

**PROCUREMENT OF A DRONE DETECTION AND PROTECTION SYSTEM FOR VILNIUS,  
KAUNAS AND PALANGA AIRPORT PERIMETERS AND NO-FLY ZONE TECHNICAL  
SPECIFICATION**

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## 1. CONCEPTS AND ABBREVIATIONS

- 1.1. **Buyer** – JSC Lithuanian Airports, Rodūnios kelias 10A, Vilnius.
- 1.2. **Supplier** – an economic entity – a natural person, a private legal entity, a public legal entity, other organizations and their subdivisions or a group of such persons with whom the Buyer enters into the Agreement.
- 1.3. **Goods** – Drone Detection Equipment and its Components.
- 1.4. **Services** – services for the mounting, installation, configuration, adjustment, testing, periodic inspections, servicing, updating and all related services necessary to ensure the full operation of the solution and performance.
- 1.5. **System/ADS** – a drone detection and monitoring system consisting of at least three passive RF sensor modules per airport site, optoelectronic day/night camera modules, dedicated software for detecting, tracking and displaying the location of drones, and technical capability for future expansion with 360-degree radar modules. The System shall support operation at Vilnius, Kaunas and Palanga Airports, where ordered by the Buyer, and shall allow central monitoring and operation from the Vilnius Operations Centre.
- 1.6. **Contract** – a contract concluded between the Supplier and the Buyer regarding the object of the Purchase.
- 1.7. **VNO** – JSC Lithuanian Airports Vilnius Branch, Rodūnios Road 10A, Vilnius.
- 1.8. **KUN** – AB Lithuanian Airports Kaunas Branch, Oro uosto g. 4, Karmėlava, Kaunas district.
- 1.9. **PLQ** – AB Lithuanian Airports Palanga Branch, Liepojos pl. 1, Palanga.
- 1.10. **UAV** – Unmanned Aerial Vehicle.
- 1.11. **DRONE-ID** – a unique identification identifier of the drone and/or its operator transmitted via Remote ID.
- 1.12. **LAN** – (Local Area Network).
- 1.13. **FPV** – First person view. First person view/perspective.
- 1.14. **CEP** – Circular Error Probable.
- 1.15. **GNSS** – Global Navigation Satellite System.
- 1.16. **SLA** – (Service level agreement) is a breakdown of the technical maintenance works of the system according to the complexity and competencies required to perform the work.
- 1.17. **SAT** – (Site Acceptance Test) an acceptance test performed at the installation site to verify that the installed system complies with the technical specification and other agreed Buyer requirements.
- 1.18. **Integration** – is the connection of two or more systems with each other through a physical and/or software interface, allowing data and coordinated actions are exchanged between the integrated systems.
- 1.19. **AOA** – (Angle of Arrival) Angle of Arrival.
- 1.20. **TDOA** – (Time Difference of Arrival) time difference.
- 1.21. **CNS** – (Communications, Navigation, and Surveillance) communications, navigation, and surveillance.
- 1.22. **DF** – (Direction Finding) direction.
- 1.23. **RF** – Radio Frequency.
- 1.24. **RF Fingerprinting** – radio-frequency fingerprinting technology used to identify a specific device based on unique characteristics of the transmitted radio signal.
- 1.25. **EO** (Electro-Optical) – Electro-optical cameras.
- 1.26. **TI** (Thermal Imaging) – Thermal imaging cameras.
- 1.27. **NUC** (Non-Uniformity Correction) – correction of unevenness.

## 2. OBJECT OF PURCHASE AND QUANTITIES

- 2.1. **Object of the Purchase** – The Buyer plans to acquire a stationary Anti-Drone Protection System (ADS) for Vilnius Airport, with the possibility to order and install the same type of equipment at Kaunas and Palanga Airports. The ADS shall be designed to automatically detect unmanned aircraft – drones and/or their operators located in the protected airport airspace, airport territory and its approaches, based on radio emissions, Remote ID / Drone ID data, telemetry data, EO/TI data and, where ordered, radar data.
- 2.2. **General requirements**
- 2.3. **The object of the purchase consists of:**
  - 2.3.1. **ADS production, delivery, installation, configuration, testing, calibration, maintenance and preparation for use at Vilnius Airport and, where ordered by the Buyer, at Kaunas and/or Palanga Airports.** The system shall be configured to allow central monitoring and operation of all ordered airport sites from the Vilnius Operations Centre. Transfer of ADS user and operating instructions, coordination with the Buyer, conducting training for users and technical personnel.

- 2.3.2. Technical maintenance and support of the ADS system and equipment for 3 years.
- 2.3.3. Development and implementation of ADS software in accordance with these technical specifications.
- 2.3.4. System integration with the Unmanned Traffic Management API used by Oro Navigacija / ON UTM (Lithuania), as described in Annex No.1.
- 2.3.5. Other services not explicitly listed in this technical specification but necessary to achieve the intended system functionality shall also be included.
- 2.3.6. Centralized multi-airport operation from the Vilnius Operations Centre, including display, monitoring, alerting, event review and user access for all airport sites ordered by the Buyer.
- 2.3.7. Secure remote access to the ADS software platform for up to 30 authorized users, subject to the cybersecurity, authentication and authorization requirements set out in this Technical Specification.
- 2.4. The Buyer purchases the goods and services specified in this Technical Specification, the scope of the object of purchase is defined in the following sections. The scope of the purchase object is shown in Table 1.
- 2.5. Delivery period for ADS:
  - 2.5.1. The system must be delivered within the period specified in Table 3 from the date of the start of the Contract.
- 2.6. Information regarding order of 360-degree radar module:
  - 2.6.1. During the Contract period, but no later than within 3 (three) months after the Contract enters into force, the Buyer reserves the right to place an additional order for the 360-degree radar module for Vilnius Airport. If the Buyer decides to purchase the 360-degree radar module for Vilnius Airport, the ADS system installed at Vilnius Airport must be technically ready for its connection and integration.
  - 2.6.2. The Buyer also reserves the right, during the Contract period, but no later than within 24 months from the entry into force of the Contract, to order equivalent ADS equipment for Kaunas Airport and/or Palanga Airport. Such additional orders shall depend on the Buyer's operational needs, budget availability and implementation priorities.
  - 2.6.3. Where ADS equipment is ordered for Kaunas Airport and/or Palanga Airport, the Buyer shall also have the right to order the relevant 360-degree radar module for that airport site either together with the ADS equipment for that site or separately at a later stage during the Contract period.
  - 2.6.4. Each ordered airport site shall be integrated into the same centralized ADS software platform and shall be capable of being monitored and operated from the Vilnius Operations Centre.
  - 2.6.5. Radar data, where a radar module is ordered for the relevant airport site, shall be automatically combined with data from passive RF sensors and EO/TI modules. With the radar connected, all relevant parts of the system at that airport site — RF, EO/TI and radar — must function as a single integrated system, complementing each other.
  - 2.6.6. The ADS software and server infrastructure must have the licenses and technical interfaces necessary to connect ADS equipment and, where ordered, radar modules for Vilnius, Kaunas and Palanga Airports without replacement of the central software platform. Any licensing conditions or limitations related to additional airport sites or radar modules must be clearly indicated in the Supplier's tender.
  - 2.6.7. The 360-degree radar module system software and server infrastructure must have all licenses and technical interfaces necessary to connect radar modules for up to three airport sites without replacement of the central software platform.
- 2.7. Objectives and scope of the project:
  - 2.7.1. The technical specification establishes the requirements for the anti-drone protection system, the remote identification and detection system of drones, which identifies the UAV in the protected airspace and determines them according to the signals emitted by them, radar and optoelectronic equipment data. The system is designed for continuous operation (24/7 principle) in outdoor conditions.
  - 2.7.2. Detect, track and classify cooperative and non-cooperative UAVs, to identify them with the functionality of all systems, to determine the location of the drone and its operator in space and to display this information in the software provided by the Supplier, on a map, with the help of optoelectronic equipment to identify objects.
  - 2.7.3. To ensure the monitoring of the airspace of the VNO territory without active interference or impact on radio communication, using passive and active elements for the identification and detection of drones.
  - 2.7.4. To collect historical data of detected drones for the investigation and reporting of events.
  - 2.7.5. A set of system modules must ensure automatic detection of UAV, correlation of sensors, determination of UAV coordinates, altitude and real-time transmission to the operator.
  - 2.7.6. The system must not interfere with civil aviation operations or disrupt air traffic management systems.

2.7.7. The scope of this procurement is limited to UAV detection, identification, tracking, localization, visual confirmation, alerting, event recording and reporting. The system shall not include active mitigation, jamming, spoofing, takeover, kinetic effectors or any other function intended to interfere with, control, disable or physically affect UAVs.

### **3. GENERAL REQUIREMENTS FOR THE OBJECT OF THE PROCUREMENT**

- 3.1. The Supplier timely must apply both to the Buyer for all the information necessary for the design of ADS system, and to the necessary institutions, regarding the issue of relevant permits and approvals. The Buyer provides only access to the objects and electricity/LAN inputs, and the entire study, calculation of visibility zones and installation project is carried out by the Supplier at its own expense as part of the Services.
- 3.2. The Supplier must design and install the equipment of the VNO ADS system within the specified period, which must meet the requirements specified in the technical specification. The proposed solution must operate continuously 24/7 and meet all the technical and functional requirements set out in the technical specification, except in cases where technical maintenance services are performed in the system, there are failures in the Supplier's infrastructure that is used to ensure the operation of the system, there is mechanical damage/damage to the components of the ADS system not due to the Supplier's fault.
- 3.3. The installation of the System, connection, configuration and testing of the ADS System hardware shall not interfere with the operation of the VNO airport.
- 3.4. This specification defines the operational, functional and technical requirements for the ADS.
- 3.5. The Supplier will be responsible for the design of the ADS, the selection and installation of the equipment provided for in accordance with these technical specifications, functionality, performance, efficiency, operational reliability and all interfaces to meet the requirements.
- 3.6. The Supplier must prepare and submit a detailed plan for the implementation of the project works and production within the deadlines set out in Table 3 and follow it during the implementation of the project.
- 3.7. All specifications submitted must be considered as minimum requirements. Where precise values are indicated, they shall mean minimum values or maximum values, depending on the context. The proposed equipment must meet the required value or provide equivalent or better performance.
- 3.8. The protection of all assets and equipment acquired within the scope of this procurement until the date of signing the final Transfer-Acceptance Deed of the ADS system for a respective airport is the responsibility of the Supplier.
- 3.9. The ADS system is accepted for use (an acceptance-transfer deed is signed) when the Supplier proves and ensures that all the system performance and quality requirements described in this document are met.
- 3.10. The final Transfer-Acceptance Deed of the ADS system may be signed after the following:
- 3.10.1. The start-up and configuration work will be completed in full.
- 3.10.2. The Buyer will verify that all technical and functional requirements are met.
- 3.10.3. The ADS system and equipment operate successfully under real operating conditions without interruptions during a trial period of 14 calendar days.
- 3.11. If, during the testing of ADS and their equipment, it turns out that the Supplier has specified an insufficient amount of equipment for the proper operation of ADS and it requires additional equipment not specified by the Supplier, the Supplier shall additionally install it at its own expense.
- 3.12. The price of the Supplier's offer shall include all necessary machinery and equipment, installation, work of the Supplier's personnel, materials, control and maintenance of the works, commissioning, adjustment, testing, team accommodation, delivery/transportation, tools necessary for the work, indirect costs, taxes paid by the Supplier, profits together with the Supplier's reasonably foreseeable risk, obligations and liabilities defined in the Contract or arising in the performance thereof.
- 3.13. The Supplier must clearly indicate in the tender and substantiate with documents the characteristics of the future equipment necessary to recognise conformity with the requirements of the technical specification.
- 3.14. In case of doubts while assessing compliance of the equipment offered by the Supplier with the requirements of the Technical specification and if Buyer requests to prove the compliance of certain parameters, only the documentation provided by the manufacturer of the Goods will be accepted and considered as suitable proof.
- 3.15. All technical equipment provided by the Supplier must be sturdy, durable, functional, it or its components are suitable for use many times and/or are easily repaired and/or replaced.

3.16. The Supplier must implement appropriate environmental measures to reduce the amount of waste generated during the provision of the Services and deliver these wastes for recycling. All used parts must be collected, sorted, and transferred to a waste management company.

3.17. All technical equipment supplied by the Supplier must be new, unused, of high quality and comply with the requirements of the European Union standards or the country's legislation. Hardware must have certificates of conformity, certificates and manufacturer's declarations (CE).

3.18. If there are discrepancies between the English version of this technical specification and the Lithuanian version, the correct wording will be deemed to be provided in the English version.

3.19. The Supplier's personnel must have valid permanent permits for the provision of installation services described in the technical specifications during the term of the Contract. During the term of the Contract, the Buyer will not provide escort services to the Supplier's personnel in the controlled area, unless separately agreed. Information on the procedure and prices for the issuance of permits to work in the territory of the airport, as well as on the prices of fees required for obtaining permits, is available on the Buyer's website at <https://www.ltou.lt/lt/galimybes-verslui/leidimai> and <https://www.ltou.lt/lt/apie-lietuvos-orouostus/mokymai> . Airport fees for permitting and training shall be paid by the Supplier.

3.20. The Buyer shall allow the Supplier to use the existing underground perimeter cable infrastructure, where such underground communications are available, technically suitable and approved by the Buyer. Where such infrastructure is unavailable, insufficient or unsuitable, the Supplier shall be responsible, at its own expense, for providing and installing all necessary cable routes, conduits, cabling and related infrastructure required for the full operation of the System, without disrupting or adversely affecting existing airport infrastructure and operations.

3.21. The Supplier shall install and ensure the installation of all System equipment in accordance with applicable rules and requirements, including the determination of permitted installation heights where required, and shall assess and comply with all applicable height restrictions, aviation safety requirements, obstacle limitation requirements and other regulatory conditions affecting the installation locations.

#### 4. QUANTITY OF GOODS AND SERVICES

*Table 1. Table of purchased goods and services for VNO airport*

No.	Description of goods/services*	Quantity/Maximum quantity	Unit of goods/services
1.	Passive Radio Sensor Modules	3	Set
2.	Camera module (optoelectronic day/night pair)	3	Set
3.	Software for ADS system (Centralized Threat Management Module), supporting connection of ADS equipment at up to three airports	1	Set
4.	Server infrastructure for VNOairport	1	Set
5.	Operator's workplace	1	Set
6.	Other goods and/or services that are not listed in this table, but are necessary to ensure the full operation of the ADS system	1	Set
7.	System integration with the Unmanned Traffic Management API used by Oro Navigacija / ON UTM (Lithuania)	1	Set
8.	Training	1	Set
9.	Maintenance services	3	Year
9.1.	Maintenance services (1st year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
9.2.	Maintenance services (2nd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year

No.	Description of goods/services*	Quantity/Maximum quantity	Unit of goods/services
9.3.	Maintenance and services (3rd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
10.	Additional services for the installation/modification/configuration of ADS systems and their equipment, including additional configuration, software adjustment, API/data export adaptation, testing, documentation or other works required for unforeseen or future needs.	1	Set
11.	360 Degree Radar Module	3	Set
12.	Additional services for the installation/modification of ADS system and their equipment (additional working hours or hours for the implementation of unforeseen, additional needs)	600	Hours

*Table 2. Table of purchased goods and services for KUN airport*

No.	Description of goods/services*	Quantity/Maximum quantity	Unit of goods/services
1.	Passive Radio Sensor Modules	1	Set
2.	Camera module (optoelectronic day/night pair)	1	Set
3.	Server infrastructure expansion for KUN airport	1	Set
4.	Other goods and/or services that are not listed in this table, but are necessary to ensure the full operation of the ADS system	1	Set
5.	Training	1	Set
6.	Maintenance services	3	Year
6.1.	Maintenance services (1st year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
6.2.	Maintenance services (2nd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
6.3.	Maintenance services (3rd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
7.	Additional services for the installation/modification/configuration of ADS systems and their equipment, including additional configuration, software adjustment, API/data export adaptation, testing, documentation or other works required for unforeseen or future needs.	1	Set
8.	360 Degree Radar Module	1	Set
9.	Additional services for the installation/modification of ADS system and their equipment (additional working hours or hours for the implementation of unforeseen, additional needs)	150	Hours

*Table 3. Table of purchased goods and services for PLQ airport*

No.	Description of goods/services*	Quantity/Maximum quantity	Unit of goods/services
1.	Passive Radio Sensor Modules	1	Set
2.	Camera module (optoelectronic day/night pair)	1	Set

No.	Description of goods/services*	Quantity/Maximum quantity	Unit of goods/services
3.	Server infrastructure expansion for PLQ airport	1	Set
4.	Other goods and/or services that are not listed in this table, but are necessary to ensure the full operation of the ADS system	1	Set
5.	Training	1	Set
6.	Maintenance services	3	Year
6.1.	Maintenance services (1st year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
6.2.	Maintenance services (2nd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
6.3.	Maintenance services (3rd year of system operation) – services designed to ensure the continuous and continuous operation of the systems	1	Year
7.	Additional services for the installation/modification/configuration of ADS systems and their equipment, including additional configuration, software adjustment, API/data export adaptation, testing, documentation or other works required for unforeseen or future needs.	1	Set
8.	360 Degree Radar Module	1	Set
9.	Additional services for the installation/modification of ADS system and their equipment (additional working hours or hours for the implementation of unforeseen, additional needs)	150	Hours

The Buyer reserves the right to order the equipment for Vilnius Airport only. During the Contract validity period the Buyer has the right to additionally order equivalent ADS equipment for Kaunas and/or Palanga Airports. The Buyer does not undertake to order equipment for all airports or all optional modules. All ordered ADS equipment ordered for specific airports shall be integrated into the same centralized ADS software platform and shall be capable of being monitored and operated from the Vilnius Operations Centre.

## 5. TECHNICAL REQUIREMENTS FOR GOODS AND SERVICES

*Table 4. Technical requirements*

Sec . No.	Parameters	Technical requirements and their meanings of the purchased ADS SYSTEM
Passive Radio Sensor Modules (RF Module)		
1.	Passive Radio Sensor System Concept	1.1. The system must be completely passive and not emit radio emissions. 1.2. The system must be modular and easy to expand. 1.3. The system must consist of at least three separated RF sensors to ensure triangulation. 1.4. The system must operate 24/7, performing automatic detection and alerting without constant operator intervention. 1.5. The system must be suitable for use in urban and airport environments without causing interference to CNS systems.



		<p>1.6. The system shall provide UAV and controller localization using AOA, TDOA, DF, protocol-based telemetry, multilateration, or equivalent methods, provided that required accuracy is achieved.</p>
2.	Frequency range	<p>2.1. The RF detection system shall cover the main frequency bands commonly used by UAV control, telemetry, video transmission and Remote ID signals</p> <p>2.2. At least the following ranges used by the UAV must be supported:</p> <p>2.2.1. 433 MHz;</p> <p>2.2.2. 868/915 MHz;</p> <p>2.2.3. 1.2–1.3 GHz;</p> <p>2.2.4. 2.4 GHz;</p> <p>2.2.5. 5.2–5.8 GHz.</p>
3.	Functional requirements for sensors	<p>3.1. Antenna system:</p> <p>3.2. At least 3 antenna complexes:</p> <p>3.2.1. 360° horizontal coverage;</p> <p>3.2.2. 0-90° vertical coverage;</p> <p>3.2.3. Direction Finding (DF) capability, including display of signal bearing and/or bearing lines on the operator map, where supported by the proposed RF architecture.</p> <p>3.3. Radio frequency analyzers:</p> <p>3.3.1. The RF sensor system shall have sufficient simultaneous receiving and processing capacity to monitor the required UAV frequency bands and detect multiple UAV/control signals in real time. The Supplier shall describe the number of RF channels, receiver architecture and simultaneous processing capacity in the technical offer;</p> <p>3.3.2. Ability to connect additional analyzers without additional system integration;</p> <p>3.3.3. The RF system shall provide sufficient instantaneous and/or effective real-time analysis bandwidth to detect UAV control, telemetry and video signals in the required frequency bands, including signals using frequency-hopping, spread-spectrum or short-duration transmission techniques.</p> <p>3.3.4. The system shall provide an aggregate effective analysis bandwidth sufficient to monitor at least three UAV frequency bands simultaneously.</p> <p>3.3.5. Sensitivity at least -110 dBm;</p> <p>3.3.6. Directional error of no more than 5° RMS (Root Mean Square) under defined reference test conditions. The Supplier shall specify the test conditions, assumptions and limitations, and performance shall be validated during SAT and/or acceptance testing.</p> <p>3.4. Technical parameters:</p> <p>3.4.1. Sensors must not have moving parts (must be passively cooled).</p>
4.	Drone Detection and Tracking Requirements	<p>4.1. Detection range:</p> <p>4.1.1. Within a radius of at least 10 km in open space;</p> <p>4.1.2. Within a radius of at least 5 km in a mixed/urban environment.</p> <p>4.1.3. The Supplier shall specify the UAV types, signal types, antenna/sensor installation assumptions, terrain conditions, RF propagation assumptions and limitations under which the declared detection ranges are achieved. Compliance with the required detection ranges shall be demonstrated by manufacturer documentation and/or during SAT and trial operation under agreed test conditions.</p> <p>4.2. The system must be capable of:</p> <p>4.2.1. Detect at least 20 UAVs at the same time, including swarm detection capability;</p>

		<p>4.2.2. Track at least 10 UAV at a time;</p> <p>4.2.3. Identify at least 5 UAVs of the same type at the same time, where supported by the relevant protocol, signal characteristics and available identification data;</p> <p>4.2.4. Detect and identify at least 5 remote controllers/control units.</p> <p>4.3. Localization accuracy:</p> <p>4.3.1. Localization accuracy targets shall be: <math>\leq 50</math> m CEP up to 2 km, <math>\leq 100</math> m CEP up to 5 km, and <math>\leq 250</math> m CEP up to 10 km. The Supplier shall specify the conditions and limitations under which these values are achieved.</p>
5.	Identification and protocol analysis	<p>5.1. The system must support three layers of detection:</p> <p>5.1.1. Remote ID/Drone ID Detection;</p> <p>5.1.2. The library shall include not less than 500 supported UAV/device/protocol profiles, or the Supplier shall demonstrate equivalent coverage of the most common UAV platforms relevant to airport security.</p> <p>5.1.3. AI-assisted classification and anomaly detection of RF signals. The system shall include an AI-assisted module that analyses RF signal data and/or spectrograms in real time and supports classification of known, unknown or anomalous RF emissions. Unknown or suspected UAV-related emissions shall be flagged for operator review and later signature/profile library update.</p> <p>5.2. The system shall be able to identify:</p> <p>5.2.1. UAV model;</p> <p>5.2.2. Serial number (when telemetry is available);</p> <p>5.2.3. The protocol used;</p> <p>5.2.4. Operating frequency.</p> <p>5.3. RF fingerprinting with a unique device ID must be supported.</p>
6.	Global Satellite Navigation System and Independent Operation	<p>6.1. Where UAV telemetry, Remote ID or protocol-based data includes GNSS-derived position, the system shall be able to process and display such position data. The ADS itself shall be capable of operating with or without GNSS, provided that sensor timing, positioning and required system performance are maintained.</p>
7.	False events and pollution	<p>7.1. False events:</p> <p>7.1.1. The system shall provide configurable filtering, background masking and threshold adjustment to minimize false alerts. The target false alert rate shall be no more than 3 false events per 24 hours after system configuration in the actual deployment environment, subject to agreed SAT/trial operation conditions.</p> <p>7.2. Non-UAV emissions filtering:</p> <p>7.2.1. The system must automatically distinguish and suppress generic non-UAV Wi-Fi traffic, while preserving detection of UAV-related Wi-Fi / Remote ID / Drone ID signals where applicable;</p> <p>7.2.2. The system must automatically distinguish and suppress generic non-UAV Bluetooth traffic, while preserving detection of UAV-related Bluetooth / Remote ID / Drone ID signals where applicable;</p> <p>7.2.3. The system must automatically distinguish and suppress other non-UAV emissions.</p>
8.	Environmental and reliability requirements	<p>8.1. Environmental resistance:</p> <p>8.1.1. Protection class at least IP66 or equivalent;</p> <p>8.1.2. Operating temperature – at least from <math>-30^{\circ}\text{C}</math> to <math>+55^{\circ}\text{C}</math>. Equipment with a lower native operating temperature limit, but not lower than <math>-25^{\circ}\text{C}</math>, shall be acceptable if installed in a dedicated heated/protected outdoor enclosure ensuring reliable operation of the equipment under Northern European climatic conditions;</p> <p>8.1.3. All outdoor equipment must be suitable for operation in Northern European climatic conditions.</p>
9.	UAV localization	<p>9.1. The UAV coordinates, altitude and, where technically possible, the operator location shall be determined:</p> <p>9.1.1. Telemetry;</p> <p>9.1.2. RF triangulation;</p> <p>9.1.3. Remote ID;</p>

		<p>9.1.4. Radar;</p> <p>9.1.5. EO/TI data or sensor fusion;</p> <p>9.1.6. TDOA and/or AOA or equivalent methods.</p> <p>9.2. The data must be displayed in real time on a GIS (Geographic Information System) map with the following information:</p> <p>9.2.1. Time;</p> <p>9.2.2. UAV coordinates;</p> <p>9.2.3. Operator coordinates;</p> <p>9.2.4. UAV altitude;</p> <p>9.2.5. UAV trajectory.</p> <p>9.3. Information must be updated at a frequency of at least 1 Hz.</p> <p>9.4. The data latency shall not exceed 2 seconds.</p>
Camera module EO and TI		
10.	Purpose of the module and system concept	<p>10.1. The camera module consists of: a controllable EO video camera and controllable thermal imaging camera.</p> <p>10.2. The camera module shall be designed for visual confirmation, tracking and classification of the RF and/or radar-detected drone.</p> <p>10.3. The module must be mounted on a gyrostabilized pan-tilt unit or similar mechanism.</p> <p>10.4. The system must ensure automatic interaction with the ADS central control module (sensor cueing).</p> <p>10.5. The module must support automatic rotation based on RF and/or radar coordinates.</p> <p>10.6. Both cameras must be calibrated so that their optical axes coincide. When switching from EO to TI, the target must remain in the center.</p> <p>10.7. The protective windows of the camera module (both EO and TI) must have an integrated automatic heating system that protects the optics from icing, fogging and condensation at negative temperatures or high humidity. This function must operate autonomously, ensuring uninterrupted image transparency over the entire operating temperature range.</p> <p>10.8. Detection capabilities:</p> <p>10.8.1. UAV detection at least 4 km under favourable visibility conditions, without precipitation, fog, heavy haze, icing or strong gusty wind, and with sufficient atmospheric transparency for optical/thermal observation;</p> <p>10.8.2. UAV classification at a distance of at least 2 km under favourable visibility conditions.</p>
11.	Mechanical functional requirements	<p>11.1. Movement limits:</p> <p>11.1.1. Pan: 360° permanent (no cable twisting);</p> <p>11.1.2. Tilt: at least +85° / -45°.</p> <p>11.1.3. Rotation speed 0.01°/s – 120°/s.</p> <p>11.1.4. Positioning accuracy not more than 0.02°.</p> <p>11.2. Stabilization:</p> <p>11.2.1. Gyroscopic stabilization of at least 2 axes;</p> <p>11.2.2. Automatic vibration compensation.</p> <p>11.3. Georeferential calibration: The software must allow the camera position on the map to be calibrated using known stationary objects/reference points (NGOs), ensuring that when the camera is rotated to a point on the map, the optical axis coincides with the actual location of the object.</p>
12.	EO (daylight) electro-optical daytime camera	<p>12.1. Sensor:</p> <p>12.1.1. Minimum light sensitivity: Color mode: no more than 0.001 Lux (measured at F1.2, AGC ON), black and white mode (B/W): no more than 0.0001 Lux (measured at F1.2, AGC ON);</p> <p>12.1.2. Sensor CMOS at least 1/1.8";</p> <p>12.1.3. Resolution at least 1920x1080 (Full HD).</p>

		<p>12.2. Optics:</p> <p>12.2.1. The EO camera shall be equipped with a motorized long-range optical zoom lens suitable for wide-area observation and narrow-field UAV confirmation;</p> <p>12.2.2. Optical zoom at least 30x;</p> <p>12.3. The camera must support the Optical Defog function (switching to the NIR – near-infrared spectrum), which ensures a transparent image in fog, smoke or high humidity.</p>
13.	TI thermal imaging camera	<p>13.1. Sensor:</p> <p>13.2. Spectral range: MWIR 3–5 <math>\mu\text{m}</math>. The thermal imaging camera shall use a Stirling cooler or equivalent cooled detector technology with cooler MTBF of at least 20,000 hours.</p> <p>13.3. The thermal imaging camera resolution shall be at least <math>1280 \times 720</math> pixels or higher;</p> <p>13.4. Pixel pitch not more than 15 <math>\mu\text{m}</math>;</p> <p>13.5. Noise equivalent temperature difference NETD not more than 35 mK at <math>+25^{\circ}\text{C}</math>.</p> <p>13.6. Optics:</p> <p>13.7. The thermal camera shall be equipped with a motorized long-range zoom lens suitable for UAV detection, tracking and visual confirmation;</p> <p>13.8. The thermal lens shall provide both wide-area observation and narrow-field long-range target confirmation.</p> <p>13.9. The wide field of view shall be at least <math>8^{\circ}</math> horizontal FOV.;</p> <p>13.10. The narrow field of view shall be not more than <math>1^{\circ}</math> horizontal FOV.;</p> <p>13.11. The thermal imaging camera shall provide at least <math>4\times</math> digital zoom or an equivalent picture-in-picture magnification function suitable for target confirmation and tracking;</p> <p>13.12. The lens must be parfocal (to maintain focus over the entire optical zoom range).</p>
14.	Image tracking algorithm	<p>14.1. AI-based visual tracking (computer vision):</p> <p>14.1.1. AI-powered video tracking;</p> <p>14.1.2. Auto-lock of the target.</p> <p>14.1.3. Lenses must be parfocal (maintain focus over the entire optical zoom range). The system must have a built-in Continuous Auto-focus function with the ability to turn it off (Manual override), i.e. take over manual control.</p> <p>14.2. Tracking must be supported under the following conditions:</p> <p>14.2.1. Dynamic target movement;</p> <p>14.2.2. Wind-induced vibration or movement;</p> <p>14.2.3. Partial target obstruction or partial loss of visual contact;</p> <p>14.3. The system must have automatic priority management (multiple target handling).</p>
15.	Environmental and reliability requirements	<p>15.1. Environmental resistance:</p> <p>15.1.1. At least IP66 or equivalent;</p> <p>15.1.2. Operating temperature – at least from <math>-30^{\circ}\text{C}</math> to <math>+55^{\circ}\text{C}</math>. Equipment with a lower native operating temperature limit, but not lower than <math>-25^{\circ}\text{C}</math>, shall be acceptable if installed in a dedicated heated/protected outdoor enclosure ensuring reliable operation of the equipment under Northern European climatic conditions;</p> <p>15.1.3. All outdoor equipment must be suitable for operation in Northern European climatic conditions.</p>
16.	Integration with ADS	<p>16.1. The module must be capable of the following:</p> <p>16.1.1. Receive coordinates from RF and/or radar modules;</p> <p>16.1.2. Automatically slew/turn towards the target;</p> <p>16.1.3. Transmit video/images to the centralized platform;</p> <p>16.1.4. Allow the operator to take manual control of the cameras.</p>

		<p>16.1.5. Video Transmission and Output Standards:</p> <p>16.1.6. Video streaming must be transmitted using H.265 (HEVC) or H.264 compression algorithms, ensuring high image quality and minimal network load.</p> <p>16.1.7. The software must support RTSP (Real Time Streaming Protocol) and ONVIF (Profile S/T) standards, ensuring the integration of video streams with third-party video management systems (VMS).</p>
Radar module		
17.	360° radar system: purpose and architecture	<p>17.1. The radar module is designed for real-time detection, tracking and classification of UAV (drones).</p> <p>17.2. The module must ensure interoperability with the ADS centralized threat management system: the radar must be able to "indicate" (specify) the exact coordinates for the RF and EO/TI modules.</p> <p>17.3. The radar module shall provide continuous or near-continuous 360° surveillance coverage of the protected airspace without mechanical rotation of the antenna system. The radar solution may be based on FMCW radar, pulse-Doppler radar, phased-array radar, sector radar, multi-panel radar architecture or equivalent non-mechanically rotating technology, provided that the required detection, tracking, classification and integration performance is achieved.</p>
18.	Detection functionality	<p>18.1. UAV detection range by target class:</p> <p>18.1.1. small UAV / low-RCS target: not less than 4 km;</p> <p>18.1.2. medium UAV target: not less than 8 km;</p> <p>18.1.3. larger UAV target: not less than 10 km.</p> <p>18.1.4. The Supplier shall specify the reference UAV type, radar cross-section, flight altitude, speed, environmental assumptions and detection probability used for each declared range. The Supplier shall also describe the radar architecture and confirm that 360° surveillance coverage is achieved without mechanically rotating antenna elements.</p> <p>18.2. The radar shall track at least 50 priority UAV / aerial targets at a time;</p> <p>18.3. The radar shall process at least 250 total detected objects/tracks at a time;</p> <p>18.4. Radar angular accuracy shall be not worse than 2° RMS in azimuth. Elevation accuracy or altitude estimation capability shall be specified by the Supplier where supported by the proposed radar architecture.</p> <p>18.5. The radar shall support UAV classification using micro-Doppler analysis, target movement characteristics, radar cross-section, track behaviour, AI-assisted classification or equivalent methods to distinguish UAVs from birds and other moving objects.</p> <p>18.6. The radar and EO/TI subsystem shall support detection, tracking and visual confirmation of non-drone aerial objects relevant to airport safety, including balloons or other slow-moving airborne objects, where technically feasible. The Supplier shall describe the system's capability, limitations and expected detection conditions for such objects.</p> <p>18.7. Environmental and reliability requirements:</p> <p>18.7.1. Protection class at least IP66 or equivalent;</p> <p>18.7.2. Operating temperature – at least from -30°C to +55°C. Equipment with a lower native operating temperature limit, but not lower than -25°C, shall be acceptable if installed in a dedicated heated/protected outdoor enclosure ensuring reliable operation of the equipment under Northern European climatic conditions;</p> <p>18.7.3. Outdoor radar equipment must be suitable for operation in Northern European climatic conditions.</p>
Operator's workplace		
19.	Operator Workplace (OWS) Requirements	19.1. Workstation:

		<p>19.1.1. Workstation-class CPU, modern Intel Core i7/i9, AMD Ryzen 7/9 or equivalent, released not earlier than 2 years before tender submission and suitable for 24/7 ADS operator workstation operation.</p> <p>19.1.2. Dedicated graphics card NVIDIA RTX 4000 series (for example, RTX 4060/4070) or equivalent with at least 8 GB of VRAM;</p> <p>19.1.3. At least 32 GB DDR5;</p> <p>19.1.4. Media – NVMe SSD;</p> <p>19.2. Monitors:</p> <p>19.2.1. At least 2 (two) monitors per workstation with mounting stand, monitors are mounted vertically above each other.</p> <p>19.2.2. Size and resolution: At least 27 inches diagonal with 4K UHD (3840 x 2160) resolution.</p> <p>19.2.3. Panel quality: IPS or OLED technology,</p> <p>19.2.4. Monitors must be adapted for 24/7 continuous work, have an anti-reflective (matte) coating that reduces reflections in the control room environment.</p> <p>19.3. Interfaces:</p> <p>19.3.1. Computer mouse and keyboard.</p> <p>19.3.2. Control Panel Manipulator (Joystick):</p> <p>19.3.3. Industrial manipulator (joystick) for camera control, 3-axis (Pan/Tilt/Zoom) proportional control, at least 10 programmable buttons for quick actions: sensor switching (EO/TI), Auto-lock activation, manual focus and thermal imager calibration (NUC).</p> <p>19.3.4. Built-in speakers for prompt notification of detected threats and alarms to the operator.</p>
20.	Server infrastructure and data processing:	<p>20.1. Server infrastructure and data processing backend server:</p> <p>20.1.1. Central system unit for radar data processing, RF triangulation calculations, sensor data fusion (Sensor Fusion) and AI image analytics.</p> <p>20.1.2. Processor (CPU): At least 2 (two) server processors (e.g., Intel Xeon Silver/Gold or equivalent) with a total of at least 32 physical cores.</p> <p>20.1.3. Image Processing (GPU): A mandatory dedicated server graphics card (such as an NVIDIA Tesla or RTX Ada L4/L40 or equivalent) for parallel computation of AI algorithms and real-time analysis of HD video streams.</p> <p>20.1.4. Memory (RAM): At least 128 GB DDR5 ECC memory to ensure system stability in 24/7 mode.</p> <p>20.1.5. Data Storage and Archiving:</p> <p>20.1.6. System memory: not less than 2 x 960 GB NVMe SSD (in RAID 1 configuration) for the operating system and critical applications.</p> <p>20.1.7. Event &amp; Video Archive: A dedicated RAID 6 or RAID 10 array for 90 days of uninterrupted data storage.</p> <p>20.1.8. Capacity: The net usable capacity (after RAID formation) must be at least 16 TB for high-resolution EO/TI records and telemetry logs.</p> <p>20.2. Reliability and communication:</p> <p>20.2.1. Power supply: Redundant, hot-swap power supplies.</p> <p>20.2.2. Network: At least 2 x 10 Gbps SFP+ interfaces for data exchange with sensor modules and 4 x 1 Gbps interfaces for local area network.</p> <p>20.2.3. Installation: The server must be adapted for installation in a standard 19-inch cabinet.</p>
21.	Uninterruptible Power Supply (UPS)	<p>21.1. The Supplier must provide and install an Online Double-Conversion type UPS device (such as APC Smart-UPS On-Line or Eaton 9PX or equivalent) that provides zero switching time (0 ms).</p> <p>21.2. The power of the UPS must be calculated in such a way that the system (server, workstation, radar, RF and cameras) is running at full capacity for at least 10 minutes in the event of a power failure.</p> <p>21.3. UPS must have an SNMP control card so that the system software can see the status of the batteries in real time and inform the operator of the power failure.</p>

		21.4. The Supplier can provide uninterruptible power by installing a single centralized UPS unit or several separate dedicated UPS modules for each component of the system (server, workstation, radar, RF sensors, and cameras), ensuring that the total power and uptime meet the above requirements.
Other requirements		
22.	Technical documentation	<p>22.1. As-built Documentation:</p> <p>22.2. Actual equipment installation project (topology) that specifies the exact locations of sensors (Radar, RF, EO/TI), server, and workstations.</p> <p>22.3. Cable laying diagrams, types of connectors and marking (marking) log.</p> <p>22.4. Operator Manual:</p> <p>22.4.1. Detailed instructions for the operator: how to operate cameras, interpret radar and RF data, set up alarm zones and export an archive of events.</p> <p>22.4.2. Description of system threat response scenarios.</p> <p>22.5. Installation &amp; Setup Guide:</p> <p>22.5.1. Detailed description of how to physically install and calibrate sensors.</p> <p>22.6. Steps for software installation, Active Directory integration, and Sensor Fusion debugging (for system administrators).</p> <p>22.7. Maintenance and prevention recommendations:</p> <p>22.7.1. Schedule of scheduled inspections (e.g., optics cleaning, UPS battery testing).</p> <p>22.8. Software update procedure and instructions for filling in RF Fingerprinting libraries.</p> <p>22.9. Login and administration data:</p> <p>22.9.1. All administrator-level passwords (server, operating system, BIOS, cameras, and radar direct control).</p> <p>22.10. License keys and certificates of their validity.</p> <p>22.11. Equipment network and communications map:</p> <p>22.12. Detailed plan of IP addresses, VLAN settings, ports and protocols used.</p> <p>22.13. Network topology diagram.</p> <p>22.14. Test and Acceptance Acts (FAT/SAT):</p> <p>22.15. Documentation confirming the successful calibration of the system, the operation of the NUC function, and the compliance of the drone's detection distances with the specification.</p>
23.	Training	<p>23.1. After delivery and installation of the system, the Supplier must, at its own expense, train the persons indicated by the Buyer at a location agreed with the Buyer no later than within one week:</p> <p>23.1.1. At least 20 system users must be trained.</p> <p>23.1.2. Service personnel to carry out maintenance and diagnostic work. At least 5 employees must be trained.</p> <p>23.1.3. During the training, a practical drone flight or simulation/replay scenario must be performed, during which operators are trained live to recognize a threat using RF Fingerprinting, point EO/TI cameras at the target and monitor the integration of radar data.</p> <p>23.2. The dates and schedules of the training must be agreed with the Buyer.</p> <p>23.3. The training is conducted in Lithuanian.</p>

\*NOTE The supplier must ensure the proper operation of the system and/or the hardware and all necessary services, whether or not they are mentioned in Table 2. Accordingly, if additional software or hardware is required for the full operation of the solution, but it is not mentioned in this Technical Specification, it must be included in the price of the offer.

## 6. PLACES OF PERFORMANCE OF CONTRACTUAL OBLIGATIONS

6.1. Vilnius Airport, Rodūnios Road 2, Vilnius.

- 6.2. Kaunas Airport, Oro uosto g. 4, Karmėlava, Kaunas district, where equipment for Kaunas Airport is ordered by the Buyer.
- 6.3. Palanga Airport, Liepojos pl. 1, Palanga, where equipment for Palanga Airport is ordered by the Buyer.
- 6.4. Vilnius Operations Centre / central operational location designated by the Buyer, from which the ADS system installed at Vilnius, Kaunas and/or Palanga Airports shall be monitored and operated.

## 7. IMPLEMENTATION PHASES AND DEADLINES

- 7.1. The provisional phases and deadlines for the delivery of the system are set out in *Table 3 below*.
- 7.2. The services provided, the installed equipment, the installed software, the works performed, etc. will be paid in accordance with the procedure provided for in the Contract.
- 7.3. The project is implemented in main stages – delivery, mounting, installation and configuration of the ADS system at Vilnius Airport, with the possibility to order equivalent ADS equipment for Kaunas and/or Palanga Airports during the Contract period, and technical maintenance and preventive service for 3 years after the date of signing of the final Transfer-Acceptance Deed of the ADS system for the respective airport.

*Table 5. Project phases and implementation deadlines*

Sec No.	Stage name	Description of the stage	Deadline for completion of the stage
1.	Preparation of a detailed project implementation plan	A project implementation plan has been prepared and agreed, which would include: the project implementation phases and their sequence, activities, dependencies, terms of their implementation (detailing of the durations of the stages), persons responsible for the activities, roles and responsibilities of subcontractors, communication management plan.	Not more than 1 month from the date of entry into force of the Contract.
2.	Project analysis and Work Project Preparation	The Supplier will have to carry out an analysis of the Buyer's needs. The Supplier will have to coordinate a specific ADS hardware and software solution with the Buyer, provide architectural, integration and fulfilment schemes/drawings of the system elements for the solutions, prepare technical and functional description documentation.	Not more than 2 months from the date of entry into force of the Contract.
3.	Production and delivery of goods	Production of components ordered by the ADS system	Within a maximum of 8 months. from the date of entry into force of the Contract.
4.	Preparatory work	All preparation – installation structures, construction, cabling infrastructure and cable laying works that are necessary to ensure the installation of the system	Within a maximum of 8 months. from the date of entry into force of the Contract.
5.	Installation of equipment	Installation of all system components and parts in the planned design locations at the airport	Within 9 months from the date of entry into force of the Contract or within shorter period indicated in the Supplier's tender.
6.	Site acceptance test (SAT)	The Supplier must demonstrate that the system works in accordance with the requirements specified in the technical specifications and is	Within 1 week. from the end of the 5th



		functional as described in the PoC (Proof of Concept) technical specification.	(Equipment Installation Stage).
7.	Staff training	Training of service personnel and users	Within 1 week. from the end of stage 6.
8.	Trial operation	Trial operation of the system, elimination of detected errors, commissioning.	After the end of stage 7.  At least 14 calendar days must be allocated for trial operation.
9.	Maintenance and service (for VNO, KUN and PLQ airports separately)	Maintenance and servicing, troubleshooting, supply of spare parts, installation of updates, etc. services are described in this Technical Specification.	3 years from the date of signing the transfer-acceptance deed of the ADS system of the respective airport with the Buyer.  The Transfer-Acceptance Deed is signed after the end of each year
10.	Additional services for the installation/modification/configuration of ADS systems and their equipment (set) (for VNO, KUN and PLQ airports separately)	These additional services include additional configuration, software adjustment, API/data export adaptation, testing documentation or other works required for unforeseen or future needs.	Within 3 months from placing an order.
11.	360 Degree Radar Module (for VNO, KUN and PLQ airports separately)	360 degree Radar Module's production, delivery, installation, configuration and integration with ADS system	If ordered separately for any airport site, the 360-degree radar module shall be delivered, installed, configured and integrated into the ADS system of the respective airport within 5 months from the Buyer's written order. If ordered together with the ADS equipment for the respective airport site, installation, configuration and integration shall be completed together with that airport site and be ready for SAT and trial operation.

12.	Additional services for the installation/modification of ADS system and their equipment (hours) (for VNO, KUN and PLQ airports separately)	These additional services include working hours for the implementation of unforeseen, additional needs to the ADS system	Within time limit priorly agreed by the parties
13.	Additional airport site equipment — Kaunas and/or Palanga Airport	The ADS equipment ordered for Kaunas and/or Palanga Airports shall be subject to the same technical, installation, testing, and training requirements and deadlines as those applicable to Vilnius Airport, with the addition that these deadlines shall also include the Factory Acceptance Test (SAT) and the trial operation period, calculated from the date of submission of the respective order.	Within 9 months from the Buyer's written order, unless a shorter period is indicated in the Supplier's tender.

## 8. FUNCTIONAL REQUIREMENTS FOR ADS SYSTEM SOFTWARE (THREAT MANAGEMENT MODULE)

### 8.1. User management and access:

8.1.1. The Supplier must provide at least 30 (twenty) individual user licenses.

8.1.2. The system must support at least 30 users connected at the same time, ensuring stable operation and real-time data updates (delay not exceeding 1 second).

8.1.3. The ADS software platform shall support secure remote access via a web-based or internet-accessible platform for up to 30 authorized users. Remote access shall be protected by role-based access control, audit logs, encrypted communication using TLS 1.2 or higher, and two-factor authentication. Public internet access shall be allowed only through secure, Buyer-approved architecture, such as VPN, secure gateway, reverse proxy or equivalent cybersecurity measures.

8.1.4. A user authentication and authorization system must be in place that allows you to assign different roles:

8.1.5. Administrator;

8.1.6. Operator;

8.1.7. Observer;

8.1.8. Individually configurable roles.

### 8.2. User authentication and integration:

8.2.1. The system shall support local user management with role-based access control, audit logs and 2FA as a minimum;

8.2.2. Active Directory/LDAP and/or SSO integration may be provided as an optional integration capability or implemented during the project if supported by the proposed platform.

### 8.3. Cybersecurity:

8.3.1. All data transmission channels must be encrypted using TLS 1.2 or higher.

8.3.2. Data storage on the server must be protected with encryption that is no weaker than AES-256.

8.3.3. The system must have an audit log function that records:

8.3.4. Logins;

8.3.5. User actions;

- 8.3.6. Configuration changes;
- 8.3.7. It must be possible to export audit data.
- 8.4. System architecture and availability:
  - 8.4.1. The system must operate in 24/7 mode and be adapted to the use of critical infrastructure.
- 8.5. The system must support:
  - 8.5.1. On-premise deployment
  - 8.5.2. Virtual environment (VMware/Hyper-V or analog)
  - 8.5.3. The system shall be scalable and shall support connection of ADS equipment installed at up to three airports: Vilnius, Kaunas and Palanga Airports. The Supplier shall ensure that all ordered airport sites can be displayed, monitored, managed and administered through one centralized ADS software platform operated from the Vilnius Operations Centre.
- 8.6. Sensor integration and data synthesis:
  - 8.6.1. All system elements and modules must be integrated and managed from a single software.
  - 8.6.2. The system must support multichannel access:
    - 8.6.2.1. Local direct access;
    - 8.6.2.2. LAN network access;
  - 8.6.3. The system must support protocol-level detection and, where technically possible, determine the location of the control panel/operator for commonly used UAV platforms.
  - 8.6.4. The centralized ADS software platform shall support separation and filtering of events by airport site, including Vilnius, Kaunas and Palanga Airports. Operators shall be able to view each airport separately or all airport sites in a combined operational view.
  - 8.6.5. Alerts, protected zones, user permissions, reporting and event archives shall be configurable separately for each airport site.
  - 8.6.6. The system must locate self-made and other types of UAV using:
    - 8.6.6.1. Radio receivers;
    - 8.6.6.2. Radar modules;
    - 8.6.6.3. Optoelectronic equipment.
  - 8.6.7. Sensor data correlation (sensor fusion) must be implemented.
  - 8.6.8. The system must automatically combine radar, RF, and optics data into a single tactical object.
  - 8.6.9. When an object is detected by a single sensor, the system must automatically initialize:
    - 8.6.9.1. Camera redirection;
    - 8.6.9.2. Thermal imager focusing;
    - 8.6.9.3. RF triangulation.
  - 8.6.10. Operational management and delays:
    - 8.6.11. Glass-to-glass video latency from the camera sensor to the operator workstation shall not exceed 500 ms under the agreed local on-premise/LAN deployment architecture and normal network operating conditions.
    - 8.6.12. The Supplier must provide a specialised control panel with an analogue controller/manipulator (DRC). PTZ Joystick Controller) for quick and intuitive positioning of the camera module and optical zoom control.
  - 8.6.13. Technical output:
  - 8.6.14. Automatic system calibration and axis alignment:
    - 8.6.14.1. The system shall provide software-assisted boresight calibration and alignment of radar, RF direction-finding and EO/TI sensors.
  - 8.6.15. Future external data interface and inter-agency integration capability:
    - 8.6.15.1. The system shall have a documented API or data export interface suitable for possible future data exchange with competent authorities' external command, control, surveillance or situational-awareness systems. The Supplier shall describe supported interfaces, data formats, authentication mechanisms, integration limitations and possible SAPIENT and/or ASTERIX support. Any additional integration shall be performed only upon separate written instruction by the Buyer and under an agreed scope..
- 8.7. The system must automatically recognize UAV when standard communication protocols are used:
  - 8.7.1. The system must determine:
    - 8.7.1.1. UAV coordinates;
    - 8.7.1.2. the location of the UAV operator (if possible);
    - 8.7.1.3. Height;
    - 8.7.1.4. Movement trajectory;
    - 8.7.1.5. Speed.

#### 8.8. Situational analysis and maps:

8.8.1. The system shall support the creation and management of protected airspace zones with horizontal boundaries and vertical/altitude limits. The system shall be able to generate alerts when a UAV enters, exits or breaches such zones, provided that UAV altitude information is available from telemetry, Remote ID, radar or other supported sensor sources. The operator interface shall display these zones on a 2D operational map as a minimum. Full 3D visualization of the map and objects shall not be mandatory and may be provided as additional functionality.

8.8.2. There must be an ability to upload offline maps.

8.8.3. The sensors' fields of view must be displayed on the map.

8.8.4. The system must allow the definition of at least 50 protected areas. The Supplier shall specify the maximum number of configurable protected areas supported by the system.

8.8.5. In the event of a breach, the operator must be informed:

8.8.5.1. Audible signal;

8.8.5.2. Visual alarm;

8.8.5.3. Intended users must be informed by SMS and/or e-mail information message.

#### 8.9. Data storage and analysis:

8.9.1. The entire history of events must be stored for at least 90 days.

8.9.2. The data stored must include:

8.9.2.1. UAV type;

8.9.2.2. Model;

8.9.2.3. Serial number;

8.9.2.4. Frequency;

8.9.2.5. Direction of flight;

8.9.2.6. Route;

8.9.2.7. Coordinates;

8.9.2.8. Altitude;

8.9.2.9. Time;

8.9.2.10. User ID.

8.9.3. The data must be exported to:

8.9.3.1. The system must support export of event/history data in open and commonly used formats, including at least CSV/XLSX for tabular data and KML/KMZ or equivalent GIS-compatible format for geospatial data..

8.9.4. The system must be able to mark UAV as "friendly".

8.9.5. The system must identify duplicate violations.

#### 8.10. Technical Condition Monitoring (Health Monitoring):

8.10.1. The software must perform self-diagnostics of all measurable system components (radar panels, RF modules, cameras) in real time.

8.10.2. For cooled MWIR thermal imaging cameras, the system shall monitor and display relevant cooler status information, including operating hours, temperature status, fault alarms and manufacturer-defined service limits. The Supplier shall provide the manufacturer's recommended preventive maintenance and replacement procedure. The system shall warn the administrator before the manufacturer-defined service limit is reached.

8.10.3. All technical condition events and critical errors must be recorded in a separate System Log.

#### 8.11. Script Management and Automation (Rules Engine):

8.11.1. The system must allow the user to configure automated action scenarios using "if-this-then-that" logic. Example: if an object is detected by radar in a protected area and RF confirmation of drone protocol is received, the system must automatically:

8.11.2. direct cameras;

8.11.3. turn on video recording;

8.11.4. activate the audible alarm at the operator's workplace;

8.11.5. inform intended users by SMS and e-mail.

#### 8.12. Configuring Exclusion Zones:

8.12.1. The software must allow the definition of exclusion zones on the operational map, including areas where radar or RF detection would be ignored (e.g. to avoid false reports regarding the legal movement of airport ground transport).

8.12.2. The system must support the creation of virtual geofence barriers. A drone flight in these zones must be automatically responded to by the system according to predefined scenarios (e.g. automatic aiming of EO/TI cameras, audible alarm or notification to other systems).

8.12.3. It must be possible to divide the zones into different danger levels (e.g. Alert Zone, Restricted Zone, Critical Zone), each assigning unique visual and audible indicators at the operator's workplace.

8.12.4. The system shall allow geofenced/protected zones to include vertical altitude limits and, where required, conical or sloped 3D zone shapes based on defined horizontal boundaries and height limitations.

8.12.5. An operator with administrator rights must be able to draw, change or temporarily disable these zones in real time directly in the map interface.

8.13. Training Mode:

8.13.1. The system shall provide operator training functionality, which may include an integrated simulation module, replay of recorded events, virtual target generation, scenario-based exercises or equivalent training tools enabling training without real UAV flight.

## **9. REQUIREMENTS FOR EQUIPMENT INSTALLATION AND COMMISSIONING SERVICES**

9.1. The Supplier must provide a fully complete, coordinated and ready-to-use system (turn-key principle):

9.1.1. All software and hardware (sensors, radars, cameras, servers, UPS, licenses, workstations).

9.1.2. All installation works: The scope of the Supplier includes the entire installation of the infrastructure from the sensor installation sites to the server room.

9.1.3. Cabling works and routes: The Supplier supplies and installs all the necessary power, data transmission (copper and optical) cables, protective pipes, brackets and cable routes between all system components at its own expense.

9.1.4. Limit of the Buyer's Liability: The Buyer's liability ends at the introduction of electricity and the provision of a LAN network access point at the Buyer's premises (server room). All other components, connections and works outside this limit up to the sensors are within the scope of the Supplier. The price of the System is final and includes all materials, equipment rental (lifts, equipment) and works necessary to ensure full functionality of the System without any additional investment from the Buyer.

9.1.5. Before installing the System, the Supplier must carry out an assessment of the planned installation sites of the hardware and consult with the Buyer on the optimal solution for the installation of the hardware. The installation location(s) of the system, the layout of the equipment, the installation solutions and the integration into the existing electricity and network infrastructure must be determined and approved by mutual agreement between the Supplier and the Buyer, taking into account the technical, operational and security requirements. Before starting any installation or configuration works, the Supplier must assess the topographical and building features of the territory, assess the possible restrictions on the propagation of radio signals, assess the technical capabilities of the existing infrastructure, and submit the proposed System installation solution to the Buyer for coordination.

9.2. The Supplier must comply with all safety and security rules of AB Lietuvos oro uostai, as well as fire safety rules.

9.3. For each airport site ordered by the Buyer, the Supplier shall perform site survey, RF coverage assessment, visibility / line-of-sight assessment, installation design, equipment installation, calibration, configuration and commissioning.

## **10. TRAINING REQUIREMENTS**

10.1. The training shall be based on the train-the-trainer principle. Relevant training materials must be provided. The Supplier shall provide certificates to trained employees confirming their right to operate the system and train other employees.

10.2. The Supplier shall instruct and train the Buyer's personnel on the ADS and the solutions used in their system.

10.3. Brief information about the operation of the system and its components, instructions for the systems used.

10.4. Instructions for operation and evaluation functions.

10.5. Explanation of technical solutions through practical exercises.

10.6. Software usage training.

10.7. Identification, evaluation and analysis of event and fault messages.

10.8. Maintenance policy, maintenance intervals.

10.9. The training will take place at the premises of the Buyer or at another location agreed with the Buyer.

10.10. Training shall be provided for at least 30 system users and at least 5 persons responsible for administration, maintenance and operation.

10.11. The duration of the training must be sufficient to enable all trained personnel to perform the assigned functions completely independently.

10.12. The Supplier must provide a detailed training program that includes training topics, schedule, profile/functions of paid personnel, training equipment used, and teaching methods.

10.13. The Supplier must prepare user manuals, maintenance manuals, as well as other materials in Lithuanian and English to ensure uninterrupted operation of the ADS system and equipment in paper color and electronic version (MS Word format in Lithuanian and PDF format in English).

10.14. The Supplier must provide all the equipment and tools necessary for the training.

10.15. The Supplier must organise training in Lithuanian.

## **11. REQUIREMENTS FOR TESTING AND TRIAL OPERATION**

### **11.1. Site Acceptance Tests (SAT):**

11.1.1. Site acceptance tests (SATs) must be carried out on-site so that the Supplier can demonstrate that the ADS system is working according to specification, the equipment and its components are new without defects and not damaged during transportation, installation.

11.1.2. According to the prepared test plans, the Supplier will have to physically participate in the testing, provide consultations on how the tested action/function/operation should be performed according to the submitted test scenarios, express its comments and suggestions on the recommended level of criticality of the error, inform the test participants about the deadline for elimination of the error, correct errors. All information about the level of criticality of errors, the deadlines for its elimination, the progress of the elimination and the assigned responsible persons will be recorded in the error register. The tool for error logging shall be provided by the Supplier at least 2 weeks before the start of testing.

11.1.3. The Supplier must demonstrate that all elements, equipment and works performed in the ADS system meet the requirements of the Buyer specified in the technical specifications.

11.1.4. During the SAT test, the Supplier must coordinate with the airport <https://ltou.lt/lt/dronai> and air navigation <https://www.ans.lt/lt/paslaugos-2/bepilociai-orlaiviai-dronai-2> and, after obtaining permission, demonstrate the actual operation of the ADS system by lifting the drone

11.1.5. The Supplier shall submit the SAT plan document for review no later than one month before the start of the SAT.

11.1.6. Upon completion of the SAT, the Supplier must submit an SAT report that records all tests performed and results achieved, as well as comparisons with the intended results to meet the specification. It should clearly summarize where the SAT was performed, or, if the test was unsuccessful in any area, it should detail the corrective work that needs to be done to achieve a successful test status.

### **11.2. Trial operation:**

11.2.1. The trial operation period shall be at least 14 calendar days, starting with the successful completion of the Local Reception Tests.

11.2.2. The purpose of the trial period is to check the performance of the solution, its functionality in real working conditions and its compliance with performance and technical requirements, and to correct the identified errors.

11.2.3. If the ADS system successfully performs a trial period of 14 calendar days under real operating conditions, without interruptions, the trial operation will be considered successful.

11.2.4. If deficiencies in the functionality and operation of the ADS system or its equipment are identified during the trial operation, it will be considered that the pilot operation has been carried out unsuccessfully – the Supplier will have to eliminate the identified deficiencies and inform the Buyer about the newly started trial operation period.

11.2.5. The Supplier shall remedy any functionality and performance deficiencies identified during the pilot operation and recorded in the test operation problem register (including safety deficiencies identified during the testing) in accordance with a harmonised timetable for the elimination of errors. The tool for error logging is provided by the Supplier.

11.2.6. SAT and 14-calendar-day trial operation shall be performed separately for each airport site where ADS equipment is installed. The relevant airport site shall be accepted only after successful SAT and trial operation, including verification of integration with the centralized ADS software platform and operation from the Vilnius Operations Centre.

## **12. MAINTENANCE REQUIREMENTS**

### **12.1. General provisions:**

12.1.1. The Supplier undertakes to provide system maintenance services for at least 36 months from the date of signing the final Transfer-Acceptance Deed of the ADS system for a respective airport.

12.1.2. The object of maintenance services is the full functionality of the ADS system: hardware (RF, Radar, EO/TI modules), server infrastructure, UPS, software and all integrations (e.g. with ON UTM) and its components.

### **12.2. Classification of errors and deadlines for elimination:**

#### **12.2.1. Critical error:**

12.2.2. Essential components, such as Radar, RF or TI, do not work and the operator does not receive information about the UAV.

12.2.3. Response time: within 12 hours from the dispatch of an error notice by the Buyer. Remote response shall be acceptable.

12.2.4. For a Critical Error, the Supplier shall restore minimum operational capability within no more than within 48 hours from the dispatch of an error notice by the Buyer by repair, remote configuration, temporary bypass, redundancy, replacement unit, or equivalent temporary measure.

12.2.5. Final repair or permanent replacement shall be completed within a reasonable period agreed with the Buyer, but not later than within 12 working days from the dispatch of an error notice by the Buyer, unless the delay is caused by manufacturer repair, logistics, customs, or other documented circumstances outside the Supplier's control. In such cases, the Supplier shall maintain minimum operational capability until final restoration.

#### **12.3. Medium-level error: Impaired side functions that do not have a decisive impact on UAV detection.**

12.3.1. Response time: within 24 hours from the dispatch of an error notice by the Buyer. Remote response shall be acceptable.

12.3.2. Resolution time or agreed workaround: no more than within 96 hours. Final correction shall be completed within a period agreed with the Buyer according to the nature of the fault.

#### **12.4. Specific Cooler (MWIR) Maintenance Requirement:**

12.4.1. Since the TI camera module uses a cooled MWIR sensor, the Supplier is required to carry out continuous monitoring of the condition of the cooler.

12.4.2. The Supplier must ensure preventive inspection or replacement of the cooler in accordance with the manufacturer's recommended service limits or if a decrease in cooling efficiency is observed.

12.4.3. If the cooler fails and this causes loss of TI camera operational capability, the failure shall be treated as a Critical Error. The Supplier shall restore minimum operational capability in accordance with Clause 12.2.4, including, where necessary, by temporarily installing a replacement TI camera module of similar parameters until the defective module is repaired by the manufacturer's service.

#### **12.5. Preventive maintenance and details:**

12.5.1. The Supplier must carry out scheduled maintenance at least every 6 months:

12.5.2. Clean the protective glass of the sensors and check the operation of the heating elements;

12.5.3. Perform radar and camera axis alignment (Boresight calibration);

12.5.4. Check the health of UPS batteries and server loads.

#### **12.6. Additional works:**

12.6.1. The Buyer reserves the right to order additional configuration or development works according to the hourly rate specified in the Supplier's offer. Additional works shall be started only upon receipt of the written approval of the Buyer.

12.6.2. Warranty, maintenance and SLA requirements shall apply to all ADS equipment and software installed at Vilnius, Kaunas and/or Palanga Airports, depending on the equipment actually ordered by the Buyer. Maintenance shall include support for the centralized software platform and all ordered airport sites.

## **13. ORDERING OF OPTIONAL GOODS AND ADDITIONAL SERVICES**

13.1.1. The Buyer shall purchase the goods and/or services listed in Points 10–12 of Table 1, Points 1-9 of Table 2, Points 1-9 of Table 3 only on demand, by placing a separate order.

13.1.2. Orders shall be submitted to the person appointed by the Supplier as responsible for the performance of the Contract.

13.1.3. An order shall be deemed received by the Supplier upon its submission by the Buyer.



13.1.4. Upon receipt of an order for Additional services for the installation/modification of ADS system and their equipment (hours) (Point 12 of Table 1, Point 9 of Table 2, Point 9 of Table 3), the Supplier shall provide (detail) and coordinate with the Buyer a description of the planned additional works, the time (hours) required for their performance together with justification of such time expenditure, and the order implementation deadline. The Supplier may commence to start implementing an order for such additional services only after the Buyer's written approval.

13.1.5. Upon completion of an order, the Transfer-Acceptance Deed for the delivered goods and/or provided services shall be signed in accordance with the procedure set forth in the Contract. In case of Good listed in Point 11 of Table 1, Point 7 of Table 2 and/or Point 7 of Table 3 is ordered together with other items specified in Points 1-8 of Table 1, Points 1-4 of Table 2 and/or Points 1-4 of Table 3 after the Contract enters into force, separate Transfer-Acceptance Deed shall not be concluded and the Good will be accepted after signing the final Transfer-Acceptance Deed of the ADS system for a respective airport.

#### **14. ADDITIONAL REQUIREMENTS**

14.1. The Supplier must be the manufacturer of the goods offered or the official distributor of the manufacturer, or the authorized representative of the manufacturer's distributor, who has the right to sell, install their equipment and provide after-sales service and maintenance services.

14.2. Together with the tender, the Supplier must provide an authorization letter, power of attorney or other equivalent document issued by the manufacturer of the proposed ADS systems or an authorized representative of the manufacturer's distributor confirming that the Supplier has the right to sell the offered equipment and system software, install it, provide after-sales and maintenance services, and conduct training related to the equipment.

14.3. The installed ADS system shall be covered by a 3-year manufacturer's warranty, calculated from the date of signing the final transfer-acceptance deed for the respective airport. If the Good specified in Point 11 of Table 1, Point 8 of Table 2 and/or Point 8 of Table 3 is ordered separately from the Goods specified in Points 1–8 of Table 1, Points 1–5 of Table 2 and/or Points 1–5 of Table 3, the 3-year warranty period for such Good shall be calculated from the date of signing its respective Transfer-Acceptance Deed. The services provided shall be covered by a 12-month warranty period.

14.4. Unless explicitly stated otherwise, references to specific technical methods, architectures, quantities or technologies shall be understood as minimum functional expectations. Equivalent or better solutions shall be accepted where the Supplier demonstrates, through technical documentation, that the proposed solution achieves the required operational performance, reliability, cybersecurity and airport safety requirements.

ATTACHED. Comparative table.