*PORTUGUESE MINISTRY OF DEFENSE*

*NATIONAL AVIATION AUTHORITY*

# Circular Nº 1/13 – Permits to fly for UAS, with a UA of a MTOW below 20kg – Guidance Checklist

This checklist consists of two columns. Column A includes the requirements that an applicant shall comply with to get a Permit to Fly regarding the Operating Permission Process, in accordance with the Circular No 1/13 of the AAN (i.e Unmanned aircraft with Maximum Take-Off Weight (MTOW) under 20kg). The applicant shall submit one single document or several documents to show compliance with the requirements listed in column A to the National Aviation Authority (AAN). Such document (s) (ideally in electronic .pdf format) should accompany the formal application Form SGQAAN.MOD.402.REV00 (http://www.aan.pt/subPagina-AAN-001.002.002.002-forms). All document(s) submitted to the AAN shall have a title, a reference number, the date, and an amendment record.

Column B has inside [brackets] the recommended safety items, headings and content, for guidance purposes only. Column B includes all the information related with the design and development phase, as well as, the information related with the operation of the UAS. Other safety items, headings and content can be added based on the experience of the UAS operator, as well as, the UAS manufacturer. The safety items, headings and content of column B are based on the checklists in use by civilian authorities, namely the Safety Checklist enclosed in the FAA Order 8130.34C and the Operations Manual Template and Systems Template of UK CAA CAP 722 Unmanned Aircraft System Operations in UK Airspace – Guidance. It shall be noted that an answer to all items of column B contributes to a broader knowledge of the operator and of the UAS features, thus providing for a more substantiated risk/safety assessment of the UAS operation. A comprehensive list of items is provided in column B. However, some of them may be not applicable and/or unknown due to lack or unknown information. Nevertheless, all the answers, including the identification of the non applicable, as well as, a lack or unknown information, will be appreciated and , at the same time, it demonstrates that the applicant has followed a comprehensive methodology to obtain the Permit to Fly. For the items with unknown information, it will be well appreciated that the applicant identifies whether there are procedures or UAS design features in place that contribute to reducing or mitigating the associated risks of those items. The applicant should also identify all responses that contain information deemed proprietary, confidential, company-sensitive or subject to any other classification that would restrict or prevent the information from being disclosed. A list of the used acronyms is presented in the last page of this document.

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| *6.a.(2)* - Approval of the operating process for UAS by the AAN (PT MAA), regarding airworthiness issues. | The approval of the Operating Process is supported by the compliance of the requirements 6.d., 7.b.; 7.d.; 7.e.(1); 7.e.(2); 7.e.(3); 7.e.(4); 7.e.(5); 7.e.(6); 7.e.(8) and 7.e.(9), in the Circular Nº 1/2013 of the AAN: |
| *6.a.(3)* - Application for the issuance of a Permit to Fly (PtF) by filling the Form No. SGQAAN.MOD.402, and UAS detailed support detailed documentation in accordance with the requirements of this circular. | The Form No. SGQAAN.MOD.402 is available at www.aan.pt. All blocks shall be filled. |
| *6.a.(4)* - Flight Program | [**Purpose of the flights.** Detail the nature of the flight(s) e.g. Research and Development, Training, Surveillance, Tests, Demonstration, etc.<br>**Type of operation.** Detail nature of operation e.g. VLOS, flexible/dynamic tasking, day/night, weather, etc.<br>**Area of Operation.** Details of expected areas of geographic operations including operating areas e.g. congested areas, open countryside, roads, etc. Consideration of overflown population density, suitability of launch and recovery locations and required services. This should include coordinates (latitude and longitude), lateral boundaries, altitude dimensions, and the home airfield for the UAS. Appropriate chart(s) of the initial flight test area and the operation area.<br>**Flight Envelope and Test Plans.**<br>(1) Describe the conditions under which flight envelopes will be tested. How close will |

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| | operations be to any populated areas and major highways?<br>(2) Describe how you plan to meet test objectives under the proposed flight envelope and operating area. Include test plans, if possible.<br>**Flight team composition**. Composition of the flight team according to nature of operation, complexity, type of UA, etc.] |
| • *6.a.(5)* - UAS Log Book. | [Operator and UAS flight logs and records useful for the tracking and monitoring of the activity. Examples of the following items should be included, but not limited to:<br>(1) Flight time (Start hour/Shutdown hour);<br>(2) Date;<br>(3) Engine Flight Time (Start hour/Shutdown hour);<br>(4) Autopilot Flight time (Start hour/Shutdown hour);<br>(5) UAS Operator;<br>(6) UAS Pilot;<br>(7)UAS malfunctions.] |
| • *6.d.(1)* – Notification of aeronautical information and aeronautical data; | NOTAM |
| *6.d.(2)* – Operate within an approved frequency range for Command and Control Link; | Contact with the Electromagnetic Spectrum Manager.<br>[Provide the approved frequency range for the command and control link.] |
| • *6.d.(3)* – Hold adequate levels of insurance appropriate for the purposes of the UAS flights | [Details of any insurance provisions regarding third party liabilities, when applicable.<br>Applicable to UAS that are:<br>- not property of the Armed Forces; |

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| | - not under the Armed Forces custody, namely the UAS in the concept and/or development phase.] |
| • *7.b.* - UAS Development and Operation Programme | [This document shall have the contents of an airworthiness certification program, plus the specific elements of a UAS and it shall be properly adapted to the type of UAV under an operating permission process. An essential element of the "UAS Development Program and Operation" is the risk / safety assessment.<br>**Intended use of the UAS.** Identification of the design usage spectrum as the set of all the foreseen operational conditions of the UAS:<br>(1) typical design missions;<br>(2) in-flight operation conditions;<br>(3) on-ground operation conditions;<br>(4) operational modes (automatic, speed-hold, altitude hold, direct manual, etc);<br>(5) take-off / launch / ramp conditions;<br>(6) landing / recovery conditions;<br>(7) locations and platforms (e.g. land vehicle, water vessel, aircraft, building, etc) from which launch, command and control, and recovery operations will be performed (e.g., land, littoral/maritime, air);<br>(8) number of air vehicles to be operated simultaneously;<br>(9) transport conditions (define the transportation and storage environment of the UAS like bag, package, truck or whatever is required);<br>(10) operating environmental conditions;<br>(11) natural climate (altitude, temperature, pressure, humidity, wind, rainfall rate, lightning, |

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| | ice, salt fog, fungus, hail, bird strike, sand and dust, etc);<br>(12) electromagnetic environmental effects (electromagnetic environment among all sub-systems and equipment, electromagnetic effects caused by external environment, electromagnetic interference among more than one UAS operated in proximity);<br>(13) lighting conditions (e.g., day, night, dawn, dusk, mixed, etc);<br>(14) identify all the possible mass configurations (minimum and maximum flying weight, empty CG, most forward CG, most rearward CG must be identified)<br>(15) Expected lifetime.<br>Note: Usage other than herein prescribed requires another authorisation and other specific Permit(s) to Fly.<br>**Requirements and compliance checklist**. Description of the requirements and a description on how compliance will be demonstrated, means of compliance and the related compliance documents.<br>Note: Each compliance document should have a number and issue date. The various issues of a document should be controlled.<br>Compliance documents should normally contain:<br>(1) an adequate link with the corresponding UAS Development Program and Operation;<br>(2) the reference of the requirements addressed by the document;<br>(3) data demonstrating compliance;<br>(4) a statement by the applicant declaring that the document provides the proof of compliance for which it has been created;<br>(5) the appropriate authorised signature. |

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| | **Authorised Personnel**. Identification of relevant personnel making decisions affecting airworthiness, operational suitability.<br>Note: The Development and Operation Programme can be developed step by step, when the information needed is not available at the beginning of the project. The certification programme can be based on modules that can be updated independently.] |
| *7.d.* - Risk / safety assessment<br>○ Safety Checklist<br>○ Failure Modes, Effects and Criticality Analysis | [1. **Safety Checklist** of the FAA Order 8130.34 C, or later version, is a guide to develop such assessment;<br>**2. FMECA** – The Analysis of potential failure modes, failure effects and its criticality (see MILSTD-1629A, ARP SAE 4761, FAA AC 23.1309 or equivalent documentation). This analysis should address, but not limited to the following failure modes:<br>a. loss/failure of the propulsion system;<br>b. loss/failure of actuators or servo-controls;<br>c. loss of stability management system;<br>d. loss/failure of the command and control system;<br>e. loss/failure of the navigation system (localisation and/or altitude data);<br>f. loss/failure of the electrical system;<br>g. loss/failure of the data link;<br>h. loss/failure of the safeguard systems (e.g. energy absorbing system at impact, system to prevent the vehicle to leave the predefined flying zone, altitude limiting system, etc);<br>i. loss/failure of fuel system, if applicable;<br>j. Structural failure.] |
| • *7.e.(1)* - UAS Technical Operation | [**1. Aircraft Segment.** |

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| Instructions | **a. UA Flight envelope.** Description of the flight envelope including: Maximum Take-Off Mass, duration, communications range, max height and speeds to maintain safe flight and glide profile (where appropriate). Include effects on flight envelope of differing payloads<br>**b. UA Performance Characteristics and Limitations**<br>Describe the performance of the aircraft within the proposed flight envelope. Specifically, address the following items:<br>(1)Maximum altitude.<br>(2) Maximum endurance.<br>(3) Maximum range.<br>(4) Airspeed.<br>(a) Cruise.<br>(b) Maximum.<br>(5) Maximum rate of climb.<br>(6) Maximum rate of descent.<br>(7) Maximum bank angle.<br>(8) Turn rate limits.<br>(9) Identify any performance limitations due to environmental and meteorological conditions. Specifically, address the following items:<br>(a) Wind speed limitations.<br>i. Headwind.<br>ii. Crosswind.<br>iii. Gusts. |

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| | (b) Turbulence restrictions.<br>(c) Minimum visibility conditions.<br>(d) Outside air temperature (OAT) limits.<br>(e) In-flight icing.<br>i. Identify if the proposed operating environment includes operations in icing conditions.<br>ii. If yes, identify if the system has an icing detection capability. If so, describe what indications of the system are provided, if any, to the UA pilot, and how the system responds.<br>iii. Describe any icing protection capability of the UA. Include any test data that demonstrates the performance of the icing protection system.<br>**c. Propulsion System.**<br>(1) Describe the propulsion system and its ability to provide reliable and sufficient power to take-off, climb, and maintain flight at expected mission altitudes.<br>(2) Fuel-powered propulsion systems.<br>(a) How is engine performance monitored? What status indicators and warning messages are provided to the pilot?<br>(b) How is the fuel quantity measured, and how is that information provided to the pilot?<br>(c) Describe the most critical propulsion related failure modes and their impact on system operation.<br>(d) How does the system respond, and what safeguards are in place to mitigate the risk |

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| | of engine power loss for each of the following?<br>i. Fuel starvation.<br>ii. Fuel contamination.<br>iii. Failed signal input from the control station.<br>iv. Engine controller failure.<br>(d) Does the engine have in-flight restart capabilities? If so, describe the manual and/or automatic features of this capability.<br>(3) Electric-powered propulsion systems.<br>(a) Minimum value of current and voltage required for engine and electroavionic systems.<br>(b) Does the system have a separate electrical source? If not, how is UA power managed?<br>(4) For a multi propeller/multi engine system:<br>(a) Is the system able to be operated without one engine / propeller?<br>(b) If not, are there safety procedures in place or design features implemented in the platform when one engine/propeller is damaged?<br>**d. Electrical System.**<br>(1) How are electrical power status and power remaining information displayed to the pilot?<br>(2) Describe the source(s) of backup power in the event of loss of the primary power source.<br>(a) What systems are powered during backup power operation? |

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| | (b) Is there any automatic or manual load shedding?<br>(c) How much operational time does the backup power source provide? Include the assumptions used to make this determination.<br>**e. Flight Control Surfaces and Actuators.**<br>(1) Describe any potential failure modes and corresponding mitigations.<br>(2) How does the system respond to a servo failure?<br>(3) Are there any indications to alert the pilot that a servo is stuck or malfunctioning?<br><br>**f. Payloads.**<br>Describe the payload equipment that will fly onboard the aircraft. Describe all payload configurations that significantly change weight and balance, electrical loads, flight dynamics or electromagnetic interference.<br>(1) Internal. Payload volume:<br>(a) What is the maximum weight of the payload (extra basic configuration) that may be included;<br>(b) What are the maximum dimensions that the payload may have?<br>(c) What is the maximum electrical power supply that it may require from the UAS electrical system;<br>(d) Electromagnetic interference.<br>(2) External.<br>(a) What is the maximum weight of the payload (extra basic configuration) that it may have; |

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| | (b) What are the locations in the platform, where the payload is to be carried;<br>(c) How are the attachments to platform to be made?<br>(d) What are the maximum dimensions that the payload may have (for aerodynamic purposes or interference with operational aspects – propeller clearance, ground clearance, etc)<br>(e) What is the maximum electrical power supply that it may require from the UAS electrical system;<br>(f) Electromagnetic interference.<br>Note: The equipment that will fly permanently onboard of the platform is defined as basic **configuration** of the system. If the system comprises different **basic configurations** that are to be used in the scope of this application, define the weight and balance, the electrical loads, the flight dynamics and the electromagnetic interference of each basic configuration.<br>**2. Control and Communications Segment.**<br>**a. Navigation.**<br>(1) How does the pilot respond to the following directions from Air Traffic Control, a visual observer, or other crew member?<br>(a) Change of aircraft heading.<br>(b) Change of aircraft altitude.<br>(2) How does the system identify and respond to a loss of the primary means of navigation? Is there a backup means of navigation? How does the system respond to a loss of the secondary means of navigation?<br>**b. Autopilot.** |

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| | (1) Does the autopilot employ input limit parameters to keep the aircraft within structural limits? If so, provide a table of these limits. How were these limits defined and validated?<br>**c. Control Link.**<br>(1) What is the data link margin in terms of the overall link budget at the maximum anticipated distance from the control station?<br>(2) Is there a radio signal strength and/or health indicator or similar display to the pilot? How are the signal strength and the health value determined and what are the threshold values that represent a critically degraded signal?<br>(3) Does the system employ redundant and/or independent control links? If so, how dissimilar are they?<br>(4) What are the potential sources of radio frequency (RF) interference within the proposed operating area and how are they monitored, managed and/or mitigated?<br>(5) What design characteristics or procedures are in place to prevent or mitigate the loss of the control datalink due to the following:<br>(a) RF or other interference?<br>(b) Flight beyond communications range?<br>(c) Antenna masking during turns and pitch angles?<br>(d) Loss of control station functionality?<br>(e) Loss of UA functionality?<br>(f) Atmospheric attenuation including precipitation?<br>**d. Lost Link and Flight Recovery.**<br>(1) Lost link. |

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| | (a) How is it determined that the UA is experiencing lost link and how is this displayed to the pilot?<br>(b) Describe the operational procedures in the event of a lost link.<br>(c) Describe the sequence the UA will follow in the event control link is lost.<br>(d) Describe how the aircraft will react during take-off, climb, cruise, descent, and landing in the event of a lost link.<br>(e) How is it determined that the lost link functionality of the system is operational?<br>(f) How does the UA navigate when in the lost link mode?<br>(g) What parameters are used to define the lost link or return home point? How is this point selected? How is this point entered? What happens when the UA reaches this point? Can this point be changed during flight, and if so how is this done (is there a safety procedure to prevent an inadvertent actuation of this function)?<br>(h) Under what conditions is a return home mode both manually and automatically activated?<br>(i) What do the control station displays indicate during lost link? Is it clear that the data is stale or invalid?<br>(2) Flight recovery system (FRS).<br>(a) Describe the FRS or flight recovery capability of the UA.<br>(b) Under what conditions is an FRS manually and automatically activated?<br>(c) What happens to the aircraft when the FRS is activated? For example, does the engine run temporarily? Does the UA glide or become unstable?<br>(d) How do you know that the FRS is operational? |

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| | (e) Provide a fault tree diagram, starting with the initial condition of normal flight that shows the conditions which will trigger the FRS.<br>(f) If activated, can the FRS be turned off/shut down if no longer required?<br>(g) If FRS fails, is there a backup or secondary FRS to ensure that no additional hazards are introduced to the operational area?<br>**e. Control Station.**<br>(1) Describe or diagram the control station configuration. Include screen captures of the control station displays.<br>(2) Does the pilot have a standardized screen set up at the initiation of each phase of flight?<br>(3) How accurately can the pilot determine the attitude and position of the UA?<br>(4) What commands are safeguarded from inadvertent activation and how is that achieved (for example, a two step process to command "kill engine")?<br>(5) What kind of inadvertent input could the pilot enter to cause an undesirable outcome (for example, accidentally hitting the "kill engine" command in flight)?<br>(6) Are any other programs running concurrently on the ground control computer? If so, what precautionary measures are used to ensure that flight-critical processing will not be adversely affected?<br>(7) What are the possible conditions that would cause a ground control station display or interface lock-up?<br>(8) What alarms or warnings does the system provide to the pilot (for example, low fuel or battery, failure of critical systems, departure from operational boundary)?<br>(9) Describe the means of providing primary and backup power to the ground control |

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| | station.<br>(10) What procedures are in place should the control station lose primary and secondary power?<br>**3. Operations.**<br>**a. Airspace System Integration and Interaction.**<br>(1) Surveillance and aircraft visibility.<br>(a) Does the basic configuration of the UA have a transponder system included?<br>i. Is the transponder **a TSO**? If so, identify the Class of equipment, the transponder is approved for?<br>ii. In case the UA is equipped with a **non-TSO** Mode-C or Mode-S transponder:<br>▪ Describe the method used to determine that the transponder meets the performance and environment requirements of any class of TSO-C74d (Mode C) or TSO-C112 (Mode S). Highlight any TSO deviations or non-TSO functions;<br>▪ Describe the main characteristics of the transponder, model of the transponder and any standard that the transponder complies to.<br>(iii) What functions and/or settings of the transponder can be changed by the pilot?<br>(iv) Describe the transponder test procedures.<br>(b) Does the UA have a high-visibility paint scheme that enables other pilots to see and avoid the UA and enables the observer(s) to visually acquire and track the UA?<br>(c) What characteristics of the aircraft shape or structure increase its ability to be seen and tracked?<br>(d) Does the UA have anti-collision lights? Does the UA have position lights? What are |

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| | the procedures if the lights are inoperative?<br>(2) Air traffic control and crewmember communications.<br>(a) How does the pilot communicate with ATC?<br>(b) How does the pilot communicate with other users of the airspace?<br>(c) Describe the communications equipment (that is, radios), including any equipment on the aircraft.<br>(d) Is there an intercommunication system that allows for communication between the pilot(s), ground support personnel, crewmembers, and observers?<br>(e) What procedures have been established in the event of intercom failure?<br>(3) Sense and avoid.<br>(a) Describe the method(s) in place for sense and avoid, and if applicable, identify the members of the flight crew that hold this responsibility.<br>(b) What are the minimum traffic detection capabilities in azimuth and elevation?<br>(c) Describe the procedures that will be implemented should an aircraft enter the operating area.<br>**b. Flight Phases - Flight Procedures** (Start, take-off/launch, in-flight, landing/recovery, shutdown):<br>(1) Pre-flight/taxi operations.<br>(a) Describe the entire flight planning process, including how weather briefings and updates are obtained.<br>(b) Describe your coordination procedures with ATC before take-off by addressing at a minimum: |

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| | i. Notices to Airmen (NOTAM).<br>ii. Filing the flight plan.<br>iii. Transponder codes.<br>(c) Describe UAS pre-flight activities and the system and support equipment required by addressing at a minimum:<br>i. The process by which the system is prepared for flight.<br>ii. The systems required to prepare the system for flight.<br>iii. What critical process points are established, such as system configuration files needed to establish flight controls calibration?<br>(d) Describe how mapping updates are performed on the control station.<br>(e) Describe the flight line/operations safety program, if any.<br>(f) How do you ensure the area is clear for taxi?<br>(g) Describe the procedures to ensure the engine isn't started in a manner that could cause injury to ground personnel.<br>(2) Take-off/launch. Provide a description of system equipment required for this operation. Identify unique system performance and procedures.<br>(3) Flight.<br>(a) Identify the components of the system, including support equipment that is required for the UA to conduct safe flight operations. Information presented in response to this item shall address at a minimum:<br>i. The process by which the system is operated during flight.<br>ii. The systems required to operate the system during flight. |

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| | iii. Critical process points that are established.<br>(b) Describe the method for switching between pilot-controlled (manual) and autonomous flight modes. At what points during the flight will this happen?<br>(c) What indication does the pilot have that they are in control of the aircraft?<br>(d) How are changes made to the flight plan during flight?<br>(e) Describe the procedures in the event of lost communication with ATC (if applicable).<br>(4) Landing/recovery. Provide a description of system equipment required for this operation. Identify unique system performance and procedures.<br>(5) Post flight.<br>(a) This subsection intends to identify the parts of the system, including support equipment required for the UAS to conduct safe operations. Information presented in response to this item shall address at a minimum:<br>i. The process by which the system is operated post-flight.<br>ii. The systems required to operate the system post-flight.<br>iii. Critical process points that are established.<br>(b) Describe the process for a post-flight inspection.<br>**c. On site procedures:**<br>(1) Site Survey. Describe the methods of surveying the operating area, for identifying potential hazards and to perform/update the risk assessment of the operational area.<br>(2) Collision Avoidance. Describe the methods of identifying and selecting operating area and how the alternate would be kept clear. This includes:<br>(a) Notification of segregated airspace using the appropriate aeronautical notification |

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| | methods;<br>(b) Provision of an adequate form of surveillance of the operating area which allows for the detection of intruding aircraft. Assistance may be provided by an appropriate and approved Air Traffic Control unit that is capable of providing uninterrupted surveillance during the period of UAS operations;<br>(c) A method of providing the precise location of the UAS at all times<br>(d) A method of avoiding any eventual intruding aircraft in the operation area.<br>(Note: This may be accomplished with a procedure for immediate landing when an intruding aircraft is detected within the operational area, such as cut down, whilst remaining within the notified area).<br>(3) Crew briefing. Procedures to brief crew e.g. task, responsibilities, duties, emergencies, etc.<br>(4) Cordon Procedure. Adherence of separation criteria, including procedures to provide separation between 3rd parties and the proximity to the UA.<br>(5) Communication Procedures. Procedures to maintain contact with crew and adjacent air operations if appropriate. Awareness and links with other users and aircraft operators, considering a means of contacting any nearby Air Traffic Control, or local VFR traffic, in the event of the UA exiting its pre-defined operating area.<br>(6) Operating site planning and assessment. Airspace operating environment considerations and procedures e.g. controlled or restricted airspace, local avoids and hazards, electromagnetic environment, etc]<br>(7) Weather Checks. Met brief provision, limitations and operating considerations. |

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| | **d. Handover Procedures.**<br>Detail the handover procedures for simple operation or/and complex operation when applicable. Complex operation depends on the numbers and types of UAS and numbers and types of Control Stations to be operated.<br>**e. Operational procedures of multiple types and number of UAS and/or multiple types and numbers of control stations.**<br>Detail the operational procedures of multiple types and number of UAS and/or multiple types and numbers of control stations<br>Detail any limitations to the numbers and types of UAS and to the numbers and types of Ground Stations that a pilot(s) may operate if appropriate.<br>**f. Emergency Procedures and Safety Instructions on ground, and in flight.** Include lost link, autopilot, flyaway, fire (UAS and Ground Station), list of alarms and associated instructions. Preventative measures ought to also be detailed. Include emergency contacts. Examples include, but are not limited to, loss of link for short and long period with adequate warning of operators, recovery of mission profile, upon reset of datalink, return home procedure, safe landing procedure for loss of datalink.<br>**g. Checklists.**<br>Provide Operational Checklist for all phases of the operation and separate checklist items for normal, abnormal, or emergency procedures.] |
| • *7.e.(2)* - Maintenance Programme | [Provide inspection and maintenance programme for the continued airworthiness of the aircraft systems and sub-systems (propulsion system, airframe, electrical system, fuel system, lubrication system, avionics, sensors calibration, actuators, and communication |

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| | system), control station, data link equipment, payload, and support equipment. It should include the list of the items to be inspected, the inspection interval appropriate to the UAS and its operation. It should be based on the manufacturer recommendations and on the experience of the operator. ] |
| • *7.e.(3)* - Maintenance Manuals: | [It should include a general description of the UA airframe and UAS systems and a description of the maintenance tasks identified in the Maintenance Program.<br>Description of what and how maintenance is to be performed in the UA, in the command and control link, in the ground control station and on the support equipment. Examples include, but are not limited to servicing schedules, inspection schedules, special inspections (for example, hard landing and foreign object damage), life limited item replacement schedules, pre-flight inspections and tests and inspections for the transponder and altimeter, corrosion inspections, fatigue inspections, engine inspections, main structural components inspections.]<br>[**1. UAS description – Aircraft segment:**<br>**<u>a. Airframe.</u>**<br>(1) Structure. Describe in detail the physical characteristics of the UA. Include diagrams and schematics, as necessary.<br>(2) Composition. Describe the various materials and where they are used in the construction of the UA. Include details of the fabrication and construction processes and procedures.<br>(3) Describe the capability of the airframe structure to withstand expected flight loads and provide data/analysis to show that it is flutter-free throughout the flight envelope. Include any loads or stress analysis that demonstrates positive structural margins of safety during |

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| | flight.<br>(4) Identify and describe any unique design characteristic(s) such as a hydraulic system, environmental control system, parachute, or brakes.<br>(5) Measurements<br>(a) Wingspan.<br>(b) Fuselage length.<br>(c) Body diameter.<br>(6) Weight.<br>(a) Empty.<br>(b) Maximum gross take-off weight.<br>**b. Propulsion System.**<br>Detail the propulsion system(s) used, power output, type of propeller/rotor, etc.<br>Describe the propulsion system (Fuel-powered or Electric powered propulsion system), including at least the following data:<br>(1) Fuel-powered propulsion system:<br>(a) Type (make and model) of engine;<br>(b) Type and capacity of fuel.<br>(2) Electric-powered propulsion systems:<br>(a) Type of motor;<br>(b) Power output of the motor;<br>(c) Current draw range of the motor.<br>**c. Fuel System.** |

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| | Describe the fuel system and how it allows for adequate control of the fuel delivery to the engine, and provides for aircrew determination of fuel remaining. Provide a system level diagram showing the location of the system in the aircraft and the fuel flow path.<br>**d. Electrical System.**<br>(1) Describe the electrical system and how it distributes adequate power to meet the requirements of the receiving systems. Provide a system level diagram showing electrical power distribution throughout the aircraft. Specifically, address the following items:<br>(2) Describe how the power is generated onboard the aircraft (for example, generator, alternator, batteries)?<br>(3) Provide a high-level description of the electrical distribution architecture. Include items such as regulators, switches, buses, and converter, as necessary.<br>**e. Flight Control Surfaces and Actuators**<br>(1) Describe the design of the flight control surfaces and servos/actuators. Include a diagram showing the location of the control surfaces and servos/actuators.<br>**2. UAS description: Control and Communications Segment.**<br>**a. Avionics.** Provide an overall system diagram of the avionics architecture. Include the location of all air data sensors, antennas, radios, and navigation equipment.<br>**b. Navigation.**<br>(1) Describe how the UA determine where it is.<br>(2) Describe how it navigates to its intended destination.<br>(2) Describe the procedures to test the altimeter system.<br>**c. UA Flight Controls.** |

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| | (1) Describe how the control surfaces respond to commands from the flight control computer.<br>(2) Describe how the pilot provides input to the control system.<br>(3) Flight control computer.<br>(a) Does the flight control computer interface with auxiliary controls that might cause an unintended action?<br>(b) Describe the flight control computer interfaces required to determine flight status and to issue appropriate commands.<br>**d. Autopilot**<br>(1) How was the autopilot system developed? What industry or regulatory standards were used in the development process?<br>(2) Is the autopilot a commercial off-the-shelf (COTS) product? If so, name the type/manufacturer and provide the criteria that was used in selecting the system.<br>(3) Describe the procedures you use to install the autopilot. How is correct installation verified? Reference any documents or procedures provided by the manufacturer and/or developed by your company.<br>(4) Where do the autopilot commands reside once they are input by the pilot?<br>(5) What type of software-in-the-loop (SIL) and hardware-in-the-loop (HIL) simulations have been performed? What was the outcome of the simulations?<br>**e. Control Link.**<br>(1) Provide a detailed control system architecture diagram that includes informational or data flows and subsystem performance. Include values for data rates and latencies, if |

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| | known.<br>(2) Describe the control link(s) connecting the UA and the control station. Specifically address the following items:<br>(a) What spectrum will be used for the control link and how has the use of this spectrum been coordinated? If spectrum approval is not required, under what regulation is the use of the frequency authorized?<br>(b) What type of signal processing and/or link security (that is, encryption) is employed?<br>(c) Describe how it as determined the data link margin in terms of the overall link budget at the maximum anticipated distance from the control station.<br>(d) For satellite links, estimate the latencies associated with using the satellite link for aircraft control and for ATC communications.<br>**g. Control Station.**<br>Give details of the type of operating system and other technical specifications. Give detail of process for firmware and software updates, and what flight parameters, commands, and data are recorded.<br>**3. UAS description - Ground Support Equipment.**<br>Describe all the support equipment that is used on the ground. Include any launch or recovery systems, ground data terminals, generators, and power supplies.<br>**4. Transportation and handling information.**<br>Detail how the system is transported between sites. Include all carry cases, transport description, etc.<br>**UAS description - Software.** |

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| | a. Describe what software functions were developed by the applicant or the applicant's suppliers, and what functions are implemented by COTS software.<br>b. What software development process(es) have been used in the development of software components for the aircraft and the ground control station, and what software lifecycle data is available for review?<br>c. How will updates to system software (including COTS software) be implemented?<br>d. Describe how the software requirements are validated and how the software is verified.<br>e. For aspects of software development that are allocated to suppliers, describe the process of supplier oversight.<br>f. How is software load control implemented for the system to ensure that the correct software components are loaded onto the system?<br>g. What software quality assurance processes are used in the development of the system software? How are suppliers a part of the process?<br>h. Is there a system for reporting and tracking problems? How are suppliers integrated into the problem reporting system?<br>i. What programming language(s) are used?<br>j. What requirements standards, design standards, and coding standards are used in the software development process? What ensures that the standards are followed?<br>**5. UAS description - Electronic Hardware Design and Testing.**<br>a. Describe the standards and processes used to design, test, and modify electronic hardware system elements such as line replaceable units, circuit board assemblies, and COTS components. |

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| | b. How are the safety critical hardware components considered in the design, test, and modification processes described above relative to non-safety critical hardware components?<br>**6. Maintenance and inspections.**<br>(1) Provide an inspection and maintenance program for the main parts of the UAS (UA airframe, engine, control surfaces and servo actuators, landing gear, command and control link, ground station, support equipment, software, etc);<br>(2) Assembly, disassembly procedures;<br>(3) Pre-flight inspections, post-flight inspections or between flight inspections;<br>(4) Provide information on unique system maintenance activities, such as maintenance of a pneumatic launcher system;<br>(5) Repair and servicing;<br>(6) Installation and removal of equipment/payloads;<br>(7) Refuelling / Recharging. To include changing / charging of batteries.] |
| • *7.e.(4)* - List of approved parts and equipment to be installed in the UAS | [The approved Parts and Equipment List should include the parts or equipment designation, serial n umber and manufacturer. This list can be organized by UAS Sub-Systems (e.g. Structures, Propulsion, Avionics, etc). This list should include parts and equipment of UA, control and command system, remote control station and support equipment.] |
| *7.e.(5)* - Substantiation to show that the UAS is able to perform a safe flight and is operated safely | [This substantiation should include the operating history, training and qualifications of the UAS operator, type and area of operation, UAS features and the risk/safety assessment.<br>For the operating history of the UAS include details of the following items:<br>(1) Total number of flights and flight hours of the UA model; |

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| | (2) Number of known operators of this UA model;<br>(3) Number of in service units of this UA model;<br>(4) Other produced and in-service models, that are from the same manufacturer;<br>(5) Any system failures, incidents, accidents, or emergencies, and the resultant system modifications or corrective actions that are known to have happened on this UA model.<br>Using the evidence given in the documents required by the Circular No 1/13 of the AAN, conduct an assessment of the confidence of the operator to use this UAS in the intended operations; The capability assessment process from the operator should result in a claim, an argument and the respective demonstration of evidence. Ultimately, this substantiation should support that the operator is safe to operate in the proposed environment and that the system(s) to be employed can be operated safely. There should be no area of intended operations that are not covered in some way by the documentation required by the Circular No 1/13 of the AAN.<br>The following explanation is provided for clarity.<br>In this section an assertion shall be made regarding:<br>(1) Operators qualification;<br>(2) Type and area of operation;<br>(3) UAS features;<br>(4) Risk/safety assessment.<br>e.g.-1<br><br>**Claim 1**: (e.g. “The UAS operator(s) is suitably experienced and qualified to operate it in |

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| | the conditions addressed by this application.”).<br>**Argument 1**: (Here, the applicant shall evidence, how he supports the claim provided).<br>“The UAS operators have received training on this specific UAS model in accordance with the recommendations of the manufacturer of the UAS in order to operate it safely and proficiently.”<br>**Evidence 1**: This section references the evidence to support the argument. (So, to support the claim ‘the UAS operator(s) is suitably experienced and qualified for the intended operations’).<br>- “The UAS log book, training syllabus, experience records, training records; etc could be provided or referred to.”<br>It is important that any referenced evidence is either already embedded in the UAS documentation required by the Circular No 1/13 of the AAN, is attached as an enclosure to the UAS documentation required by the Circular No 1/13 of the AAN or a working hyperlink is provided that leads to the evidence.<br>e.g.-2<br><br>**Claim 2**: “The UAS model XXXX is adequate and safe for VLOS for day time operation and in open countryside area in cooperative and non-cooperative scheme.”<br>**Argument 2**: (To support the adequacy of the platform, the applicant shall report to the experience of the manufacturer in this type of products, as well as, to any operational testing or previous flights of this model.)<br>“The operator has gathered more than YYYY number of flight hours in UAS of this nature, |

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| | of which GGGG were on this particular UAS model. The UAS operators have been operating in this type of environment for XXXX years and are well acquainted with all the operational aspects inherent to this type and area of operation.<br>Visual surveillance is conducted by the operator qualified observers deployed in the area of operations to detect and track the UAS traffic in order ensure appropriate separation and effectively mitigate a potential collision."<br>**Evidence 2**: "Operating history records, UAS logbook, crew roles, responsibilities, and communication procedures, visual observers,etc."<br>e.g.-3<br><br>**Claim 3**: "The UAS model XXXX is designed for the intended use of this application using industrial design standards and approved design practices."<br>**Argument 3**: "In accordance with the requirements defined for the UAS, the system considered adequate is a small UAS system, built of composite material, and designed to operate in the conditions defined in the intended use of this application.<br>For the type of system developed and for the design and production system implemented, the standards that were followed for the design and production of this system covered, material selection, production techniques, quality control, cable design; development of tests;<br>The internal procedure XXX identifies which are the organization approved standards that are used in the design for each specific matter.<br>Specifically: |

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| | • Standard XXX was used for the composite construction of the model;<br>• Standard YYY was used for the design of cables;<br>• Standard ZZZ was used for the conduction of tests to the system;<br>• Manufacture techniques of small parts were made in accordance with design practices described in AC43-B;<br>• Material choice was based on material propertied defined in MMPDS.<br>In addition, the Quality System of the Organization is www (*e.g.*- ISO 9100), which ensures that a design quality control, and design assurance system is in place.”<br>**Evidence 3**: “Internal procedure XXX, Copy of the Quality Assurance Certificate (or equivalent evidence of a recognized/certified implemented design assurance system), design data, structural analysis, electrical load analysis, etc.”<br>e.g. -4<br><br>**Claim 4**: “The UAS model XXXX is produced in accordance with the design data, ensuring the UAS complies with the intended use of this application.”<br>**Argument 4**: “Case 1 – Certified Organization:<br>The organization is certified per *ISO 9001, ISO 9100 (*or other), which ensures that there is adequate control between the design and production of the UAS, guaranteeing that the UAS is produced in accordance with **approved design data** and that the **control of the final product** is done.<br>Case 2 – Non-Certified Organization:<br>If a certification does not exist, the applicant may argue that adequate control exists on |

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| | the quality assurance system, showing that procedures are in place to support quality control of the product throughout the production phases.<br>Additionally (and for both cases) in the argument a description and specification of the internal procedures is to be done.<br>Specifically:<br>• The procedure XXX of the handbook defines how the design data is approved; The procedure WWW defines how the approved design data (produced by others) is received, accepted and controlled;<br>• The procedure YYY defines how the different areas of the production of the UAS have access to the approved design data, and how eventual flaws are identified, managed and controlled;<br>• The procedure ZZZ defines how the final acceptance of the product is done, and how the verification that it complies with the design is performed."<br>**Evidence 4:** Copy of Certificate *ISO 9001, ISO 9100 (*or other)<br>Internal procedures:<br>• The procedure XXX;<br>• The procedure YYY<br>• The procedure ZZZ<br>, etc.<br>e.g. – 5:<br><br>**Claim 5:** "The UAS model XXXX is tested for the conditions defined in the intended use of |

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| | this application."<br>**Argument 5:** "A set of tests was developed and performed to ensure that the UAS complies with the intended use. Specifically:<br>• The test XX was designed to test the flight envelope;<br>• The test YY was defined for structural resistance;<br>• The test ZZ was defined to test the UAS endurance and range of the platform."<br>**Evidence 5:** "Test Program, Test Plan, Test Reports."<br>e.g. – 6:<br><br>**Claim 6:** "The UAS model XXXX is adequate and safe for operation, and all UAS potential hazards across all operating phases have been identified, their associated risks have been assessed and controlled for the operation conditions considered under the intended use of this application.**"**<br>**Argument 6:** "The UAS operator(s)/manufacturer has performed a safety/risk analysis of the system in order to identify potential hazards across all operating phases and classify the inherent risks.<br>A Safety analysis of the type of operation concerned in this application was also conducted, identifying the potential hazards included in the intended use of the system (*e.g. cooperative scheme)*<br>All identified risks were controlled and mitigations were incorporated in the System in order to reduce the risk of the hazards to acceptable levels. These mitigations are covered by design features and operational procedures.**"** |

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| | **Evidence 6:**<br>**"Safety analysis:**<br>FMECA, FTA;<br>**Mitigations:**<br>Procedures:<br>Fly away procedure,<br>Flight Recovery procedure<br>Communication procedure for cooperative scheme<br>Low energy level emergency procedure;<br>Design Features:<br>Fuel indicator;<br>Transponder;<br>Flight Recovery System;<br>Battery level indication**"**<br>e.g. – 7:<br><br>**Claim 7:** "The UAS model XXXX adequate and safe for operation and the operator is able to identify all potential hazards in the UAS operation across all operating phases, and that he/she is able to assess and control all risks associated with the UAS intended use.**"**<br>**Argument 7:** "The Operator has procedures in place to identify, collect, analyse and mitigate the risks of the operation, of the UAS, which is built upon an internal reporting procedure (YYY), a procedure for the internal investigation of occurrences (XXX) and a |

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| | procedure for the classification of these occurrences in accordance with their risk (ZZZ), and a procedure to report these occurrences to the authority (WWW).”<br>**Evidence 7:** “Internal procedures:<br>• The procedure XXX;<br>• The procedure YYY<br>• The procedure ZZZ<br>• The procedure WWW”<br>Note: Representation in a tabular format is recommended (but not mandatory) for the claim, argument, evidence to the substantiation to show that the UAS is able to perform a safe flight and is operated safely.<br>**Summary**<br>The applicant summarise the whole documents required by the Circular No 1/13 of the AAN drawing out key elements that outline why the operator’s intended operations are safe to be conducted.<br>The applicant shall provide a statement of intent to operate and to maintain the UAS to the principles and guidelines given in the documentation required by the Circular No 1/13 of the AAN.] |
| • *7.e.(6)* - Evidence of a UAS configuration control system | [(1) What procedures are in place to manage change configuration? Is it documented?<br>(2) Describe the procedures used for controlling drawings, test procedures, engineering changes, etc.<br>(3) Describe the quality assurance system, methods and procedures used, and structure within the organization. |

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| | (4) Describe the procedures are in place to manage the software configuration changes and how they are documented.<br>(5) Describe the procedures that are in place to manage change configuration in operation and how are documented (modifications, repairs, software, equipment/payloads installations/removals).] |
| • *7.e.(7)* - Evidence of a UAS operation historic record system | [Operator and UAS maintenance logs and records are useful for the tracking and monitoring of the activity, namely:<br>(1) UAS malfunctions/UAS change configuration;<br>(2) Date of the UAS malfunction/ UAS change configuration;<br>(3) Corrective action/ UAS change configuration;<br>(4) Date of the corrective action/ UAS change configuration;<br>(5) Maintenance personnel who performs the corrective action/change configuration.] |
| • *7.e.(8)* - Evidence of a procedure that ensures the qualification of the UAS operators personnel and UAS maintenance personnel; | [**a. Crew qualifications**.<br>Details of any qualifications, experience or training necessary for the pilot or support crew according to the types of UAS and roles employed by the operator. Details of the operator training programme, Training and checking requirements for pilots and support crew as determined by the operator to cover initial, refresher and conversion syllabi. Include any independent assessment of pilot competency and currency requirements.<br>(1) Crew. Is there a crew resource management training program? If so, describe the program.<br>(2) Pilot.<br>(a) Do the pilots have a current pilot certificate? If so, what type of pilot certificate? |

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| | (b) Do the pilots have a current medical certificate? If so, what class of medical certificate?<br>(c) Describe in detail and reference any procedures that show that the pilots are properly trained.<br>(d) Is there an established formal training curriculum for all pilots including PIC, supplemental?<br>(e) Is the pilot type rated for the aircraft being flown?<br>(3) Observer.<br>(a) Do the observers have a current pilot certificate? If so, what type of pilot certificate?<br>(b) Do the observers have a current medical certificate? If so, what class of medical certificate?<br>(c) Does the observer understand the applicable aviation regulations such as see and avoid, clear of clouds, and right of way rules?<br>(d) Is the observer a current pilot or have a training curriculum? Is there an established formal training curriculum for all observers? If so, please provide it during the site visit.<br>(e) Describe, in detail, how the observer is properly trained to be an effective member of the flight team.<br>(f) Does the observer understand:<br>i. Proper communications and phraseology?<br>ii. Proper visual scan techniques?<br>iii. Standard flight operations at non-towered airports?<br>iv. Containment areas and how to determine whether the UA is operating within that |

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| | area?<br><br>**b. Maintenance personnel qualification requirements**.<br>Details of any qualifications, experience or training necessary for the maintenance personnel according to the types of UAS and roles employed by the operator. Details of the operator training programme, Training and checking requirements for the maintenance personnel as determined by the operator to cover initial, refresher and conversion syllabi.] |
| • *7.e.(9)* - Evidence of an existing occurrence reporting process for the AAN of all accidents and incidents*:* | [Describe the process for incident/accident reporting and investigation.<br>Reportable occurrences should include, but not limited to events such as:<br>(1) loss/failure of the propulsion system;<br>(2) loss/failure of actuators or servo-controls;<br>(3) loss of stability management system;<br>(4) loss/failure of the command and control system;<br>(5) loss/failure of the navigation system (localisation and/or altitude data);<br>(6) loss/failure of the electrical system;<br>(7) loss/failure of the safeguard systems (e.g. energy absorbing system at impact, system to prevent the vehicle to leave the predefined flying zone, altitude limiting system, etc);<br>(8) loss/failure of fuel system, if applicable;<br>(9) Loss of control/datalink – where that loss resulted in an event that was potentially prejudicial to the safety of other airspace users or third parties;<br>(10) Pilot station configuration changes/errors: |

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| | (a) between Pilot Stations;<br>(b) transfer to/from launch control / mission control stations;<br>(c) display failures.<br>(11) Crew Resource Management (CRM) failures/confusion;<br>(12) Structural damage/heavy landings;<br>(13) Flight programming errors (e.g. incorrect speed programmed);<br>(14) Any incident that injures a third party.] |

**Acronyms:**

ATC – Air Traffic Control
CG – Centre of Gravity
CRM – Crew Resource Management
COTS – Commercial Off-The-Shelf
FMECA – Failure Mode, Effects and Criticality Analysis
FRS – Flight Recovery System
HIL – Hardware-In-the-Loop
MTOW – Maximum Take-Off Weight
OAT – Outside Air Temperature
PtF – Permit to Fly
RF – Radio Frequency
SIL – Software-In-the-Loop
TSO – Technical Standard Order
UA – Unmanned Aircraft
UAS – Unmanned Aerial System
UAV – Unmanned Aerial Vehicle
VLOS – Visual Line Of Sight
VFR – Visual Flight Rules