International Association of Oil & Gas Producers

REPORT 696 | NOVEMBER 2023

Remotely Piloted Aircraft Systems

Acknowledgements

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About

Report 696 – *Remotely Piloted Aircraft Systems* (RPAS) provides recommended practices that will assist in the safe and effective management of RPAS operations that are either operated directly or subcontracted by IOGP Member Companies.

This Report is part of IOGP's Oil and Gas Aviation Recommended Practices (OGARP, also called the 69- series). The series provides recommended practices that will assist in the safe, effective, and efficient management of aviation transport operations in the oil and gas and energy industries.

Feedback

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Revision history

VERSION	DATE	AMENDMENTS
1.0	November 2023	First release

Contents

Introduction

This Report forms part of IOGP's Oil and Gas Aviation Recommended Practices (OGARP, also called the 69- series). The OGARP, developed in collaboration between oil and gas companies, aviation industry associations and aircraft operators, provides a framework for effective management of a key material risk to the safety of personnel. Please see IOGP Report 69x – *Oil and Gas Aviation Recommended Practices* overview for a full description of the OGARP series and its implementation in the industry.

This Report on RPAS operations covers four subject areas:

- General – including regulatory compliance and concept of operations
- Safety Management Systems
- Operations
- Engineering

These areas are further divided into sections, covering the main activities associated with the delivery of RPAS services, to include technical elements. Each element is presented with a title, purpose, expectations, and recommended processes and practices. A 'responsible party' for each element is identified either as the 'Company', meaning the entity which engages the services of an RPAS operator, or the RPAS operator.

The purpose of this document is to provide guidance on RPAS operations when operated and/or subcontracted by IOGP Member Companies. The use of RPAS to enhance the safety as well as the effectiveness of IOGP Member Company operations has greatly increased, with the scope constantly expanding due to technology, cost, and the global regulatory environment.

RPAS have four subsystems:

- Aircraft
- Data links – control and downlink (sensor)
- Ground control equipment
- Remote pilot/operator/visual observer

RPAS can vary in size, from those weighing less than 250 g to some the size of a commercial jet. Regardless of size, the basic guidelines outlined in this Report are to be considered.

RPAS can be controlled manually by a pilot or autonomously through the use of programming and autopilot. Semi-autonomous operation is also common, where the RPAS flight paths are programmed, but the remote pilot in command (RPIC) manually controls some phases of the flight, such as take-off and landing.

In general, RPAS operations can occur:

- Within visual line of sight (VLOS)
- Within extended visual line of sight (EVLOS) – yet still within radio line of sight of the ground control station (GCS)
- Beyond visual line of sight (BVLOS)
- Internally within vessel tanks and structures

The internal inspection RPAS operation is not regulated by any NAA and is controlled through normal HSSE processes at the site. The other three types of operation that need further explanation are discussed in this Report.

Please note that as the terms for RPAS and Unmanned Aircraft System (UAS) are often used synonymously, this Report has standardized on the use of RPAS to mean both. Similarly, since remotely piloted aircraft (RPA), Unmanned Aerial Vehicle (UAV) and Unmanned Aircraft (UA) are also often used synonymously, this Report uses RPA for standardization.

Key terms and definitions

The following key terms and definitions are used in this Report.

Aircraft

A device used or intended to be used for flight in the air, including remotely piloted aircraft (RPA).

Airworthiness

A condition in which Remotely Piloted Aircraft Systems (RPAS), including the aircraft, airframe, engine, propeller, accessories, appliances, and control station, conform to a type certificate (if applicable), and are in a condition for safe operation.

American Society for Testing and Materials (ASTM)

Based in the USA, a group of member organizations established to address issues related to design, performance, quality acceptance tests, and safety monitoring.

Aviation Advisor

A Company's appointed competent person, typically responsible for developing aviation policy, conducting assurance activities, providing technical expertise and general aviation advice, and an oversight to the business, ensuring the delivery of safe and efficient aviation services.

Beyond Visual Line of Sight (BVLOS)

A type of RPA operation in which the remote crew, including the remote pilot in command and possible visual observers, is unable to maintain continuous unobstructed and unaided visual contact with the RPA.

Category A operations

These include the use of uncertified RPAS of less than 25 kg/55 lbs maximum take-off weight (MTOW), subject to proportionate operational limitations and requirements, in which the National Aviation Authority (NAA) is involved only for the registration process, such as the "open" category in UK CAA.

Category B operations

These include the use of RPAS, subject to a process of either a declaration or NAA authorization, based on a risk assessment. These include RPAS in the "specific" category in UK CAA.

Concept of Operations (CONOPS)

A user-oriented document that describes systems characteristics for a proposed system from a user's perspective, and also describes the user organization, mission, and objectives from an integrated systems point of view and is used to communicate overall quantitative and qualitative system characteristics to stakeholders.

Crew member (RPAS)

An RPAS crew member, which includes pilots, sensor/payload operators, and visual observers (VOs), but may include other persons as appropriate or required, to ensure the safe operation of the aircraft.

Crew Resource Management (CRM)

The effective use of all available resources, including human, hardware, and information resources.

Dangerous goods (DG)

Articles or substances which are capable of posing a risk to health, safety, property, or the environment, and which are listed within the ICAO Technical Instructions (ICAO Doc 9284), or which are classified according to those instructions.

Extended Visual Line of Sight (EVLOS)

A type of operation in which the remote pilot does not maintain continuous unobstructed and unaided visual contact with the RPA. One or more VOs maintain visual contact, allowing monitoring the flight path of the RPA in relation to other aircraft, persons, and obstacles, for the purpose of maintaining separation from them and avoiding collisions.

External pilot

An RPAS pilot who flies from outside a control station with direct visual contact with the aircraft.

Flight termination

The intentional and deliberate process of performing controlled flight into terrain (CFIT). Flight termination is executed if all other contingencies have been exhausted and further flight of the aircraft cannot be safely achieved, or other potential hazards exist that require immediate discontinuation of the flight.

Focused/sterile cockpit procedures

These set a requirement that during critical phases of flight, only activities required for the safe operation of the RPAS may be carried out by the flight crew/operators, and all non-essential activities are forbidden.

Joint Authorities for Rulemaking of Unmanned Systems (JARUS)

Based in Europe, a group of experts from various NAA authorities, collaborating to recommend technical, safety and operational requirements for the certification and safe integration of RPAS into airspace and at aerodromes. While not European-based, FAA and NASA are also member organizations.

Lost link

The loss of command and control link contact with the RPA, such that the remote pilot can no longer manage the aircraft's flight.

Method statement

A method statement is a document that describes specific instructions on how to safely perform a work related task, or operate a piece of plant or equipment.

National Aviation Authority (NAA)

A generic term used to refer to a country's government regulatory authority for aviation (i.e., EASA in Europe, FAA in the United States, CASA in Australia, CAA in the United Kingdom).

Note that the term Civil Aviation Authority (CAA) is often used as a generic term with the same meaning, but is also the name of specific countries' NAAs (e.g., the UK's aviation authority is called the Civil Aviation Authority). The use of NAA is standardized in this Report to avoid confusion with specific countries' CAAs.

Optionally piloted aircraft (OPA)

An OPA is a hybrid between a conventional piloted aircraft and a remotely piloted aircraft (RPA). Retaining on-board controls, the OPA can operate as a conventional aircraft during missions for which direct human control is preferred or desired as an immediate option.

Pre-Defined Risk Assessment (PDRA)

Is a risk assessment that has been completed by the NAA for a specific set of operational scenarios (e.g., UKPDRA01 for VLOS operations within 150m of residential areas operating an RPAS less than 25kg) with key limitations that an operator is to adhere to.

Pilot duty period

The period beginning when a flight crew member is required to report for duty with the intention of conducting a flight and ending when the aircraft is parked after the last flight. It includes the period before a flight, or between flights, that a pilot is working without an intervening rest period.

Pilot in Command Under Supervision (PICUS)

An RPAS pilot conducting flight tasks under the supervision of a pilot approved by the Company as a supervisory pilot, holding the appropriate qualifications and experience.

Remote pilot in command (RPIC)

The person who has the final authority and responsibility for the operation and safety of flight, has been designated as RPIC before or during the flight, and holds the appropriate category, class, and type rating, if applicable, for the conduct of the flight. The RPIC position may rotate duties, as necessary, with equally qualified pilots. The individual designated as RPIC may change during the flight. Note that the RPIC can only be the RPIC for one aircraft at a time. For an Optionally Piloted Aircraft (OPA), the RPIC meets RPAS guidance requirements for training, pilot licensing, and medical requirements when operating OPAs as RPAS.

Remotely piloted aircraft (RPA)

Devices used or intended to be used for flights in the air that have no onboard pilot. This excludes missiles, weapons, or exploding warheads, but includes all classes of airplanes, helicopters, airships, and powered-lift aircraft without an onboard pilot. RPA do not include traditional balloons, rockets, and unpowered gliders. This term is used synonymously with UAV. ICAO's definition of RPA is 'an aircraft where the flying pilot is not on board the aircraft'.

Remotely piloted aircraft systems (RPAS)

RPAS and their associated elements related to safe operations, which may include control stations (ground-, ship-, or air-based), control links, support equipment, payloads, flight termination systems, and launch/recovery equipment. This term is used synonymously with UAS, and its usage is becoming more common. It highlights the fact that a person is piloting the aircraft, albeit remotely, in contrast to a fully autonomous flight. ICAO's definition of RPAS is 'a set of configurable elements consisting of an RPA, its associated control stations, the required command and control links, and any other system elements as may be required, at any point during flight operation'.

Safety case

An explanation of why an operation is safe. Exceptions to regulations or standards often require approval of a safety case by the regulatory authority and/or the aviation advisor.

The level of complexity of the safety case is commensurate with the risk and complexity of the operation. A safety case for allowing a minor exception to a standard in a low-risk operation only requires a page or two, laying out why the exception does not add any notable risk. Other exceptions require a more rigorous formal approach, a CONOPS and an operational risk assessment (ORA). Standards for ORAs include:

JARUS Guidelines on Specific Operations Risk Assessment (SORA)

ASTM Standard Practice for Operational Risk Assessment of Small Unmanned Aircraft Systems (SUAS)

Safety risk management (SRM)

A formalized, proactive approach to system safety. SRM is a methodology in which hazards are identified; risks are analysed, assessed, and prioritized; and results are documented for decision-makers to transfer, eliminate, accept, or mitigate risk.

Specific operations risk assessment (SORA)

A JARUS-recommended risk assessment methodology to establish a sufficient level of confidence that a specific operation can be conducted safely.

Standard scenarios

These are a set of operational scenarios that have been developed by some NAAs for specific BVLOS operational scenarios (e.g., AU-STS 6 below 400 feet AGL in remote Australian airspace, defined as locations with very low population density and low risk of aircraft encounters) with key requirements that an operator is to adhere to.

Supplemental pilot

Pilots assigned RPAS flight duties to augment the RPIC. It is common for operators to have both an internal and an external RPAS pilot. The supplemental pilot can assume either of these positions and may also assume duties of the RPIC if the specified qualifications are met.

Traffic Information Service - Broadcast (TIS-B)

TIS-B allows pilots to view other aircraft that are not emitting ADS-B data but do have a transponder.

Visual line of sight (VLOS)

Unaided (corrective lenses and/or sunglasses exempted) visual contact between an RPIC or a VO and an RPA that is sufficient to maintain safe operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating, to see and avoid other air traffic or objects aloft or on the ground.

Visual observer (VO)

A trained person who assists an RPAS pilot in the duties associated with collision avoidance and navigational awareness through electronic or visual means. Collision avoidance includes, but is not limited to, avoidance of other traffic, clouds, obstructions, terrain, and navigational awareness. A VO includes the OPA pilot when operating the OPAs as RPAS.

1. Regulatory compliance

1A. Purpose

Ensuring that RPAS are operated in a manner that meets all NAA requirements

1B. Expectations

Companies and their subcontractors operate RPAS in accordance with NAA requirements

1C. Processes and practices

1C.1 RPAS are operated in accordance with all applicable regulatory requirements, including:

- 1C.1.1 The aviation regulations of the country in which operations are taking place
- 1C.1.2 Any conditions or limitations of NAA-issued operating certificates, certificates of waiver or authorization, etc., when operating under such certificates
- 1C.1.3 Environmental laws
- 1C.1.4 Fire safety regulations and guidance
- 1C.1.5 Privacy laws – note that these vary significantly between different government regions
- 1C.1.6 Noise annoyance regulations
- 1C.1.7 Other countries' regulatory or security agency permission requirements
- 1C.1.8 Any permissions or restrictions on the use of images outside of some countries.

1C.2 Requirements to obtain permission for flights over first nations/traditional/indigenous land areas, which are not covered by legislation but are culturally sensitive, are identified.

1C.3 Helideck landing officer checklists address RPAS coordination – where energy companies use RPAS offshore.

1C.4 Offshore RPAS operations outside a country's territorial waters (i.e., beyond the 12 nautical miles limit) are compliant with the required Company standard as well as with ICAO's manual on RPAS (Doc 10019).

1C.5 Operators maintain documentation of system operating certification, where applicable, including flight operations manuals, maintenance manuals/logs, aircraft flight manuals, and remote pilot certifications issued by the NAA, as required for each operation. These documents are available for reference at the point of control of the RPAS operation.

1C.6 Recommendations are followed – captured from a review of a number of NAA RPAS regulatory requirements and which differ between countries.

- 1C.6.1 Crewed aircraft have the right of way, and in situations where crewed aircraft pose a potential conflict with RPAS operations, the operations are terminated until any potential conflict has passed.

1C.6.2 All RPAS operations are controlled by a remote pilot in command (RPIC). Completely autonomous RPAS operations are not conducted unless permitted by an NAA and the safety case is approved by the Company.

1C.6.3 RPAS operations are conducted with anti-collision lighting on at all times if possible, but at least when operating:

1C.6.3.1 During civil twilight or night

1C.6.3.2 In a controlled airspace

1C.6.3.3 Within three nautical miles of an aerodrome

1C.6.4 Operations are not conducted (or are ceased) when visibility is less than 5 km from the control station unless the operation safety case allows.

1C.6.5 RPAS are flown in Visual Meteorological Conditions, unless the operation safety case allows, or as required by local NAA regulations.

1C.6.6 VLOS operations are not conducted when more than 400 feet above ground level or, when flying within 400 feet of a structure, not more than 400 feet above that structure. Where the success of the operation requires flight at higher altitudes, a waiver from the applicable regulation is obtained and a safety case is presented for approval to the NAA.

1C.6.7 RPAS speed does not exceed any original equipment manufacturer (OEM) and/or regulatory specified limits.

1C.6.8 RPAS are not flown over anyone who is not directly participating in the operation, unless the NAA regulations permit the activity, any personnel are under a covered structure or inside a covered stationary vehicle, or additional safeguards are in place and NAA regulatory requirements are complied with.

1C.6.9 RPAS with redundant propulsion and power, with the ability to maintain control of the aircraft in the event of a power loss, are to be considered for offshore as well as hazardous site locations.

1C.6.10 RPAS are not operated from a moving vehicle unless the operation is over a sparsely populated area and a risk assessment is approved by the Company. This type of mission requires inclusion of a VO.

1C.6.11 Hazardous materials are never carried aboard RPAS unless approved in the safety case and the crew is appropriately qualified.

1C.6.12 The appropriate air traffic control (ATC) is immediately notified in the event of any emergency, loss of command and control link, loss of visual contact, or any other malfunction that would impact safety or the operations.

1C.6.13 Any data/imagery from the RPAS operation is managed by the Company's appropriate data management/security procedures, including the protection of privacy.

1C.6.14 The cybersecurity risk of operating RPAS is considered as part of the risk management process and follows the guidelines established in JARUS SORA.

Guidance documents

- CAO Document 10019
- JARUS SORA
- FAA Advisory Circular AC 107-2A
- CASA Manual of Standards (MOS) Part 101 (Unmanned Aircraft and Rockets)
- CAA CAP 722: Unmanned Aircraft System Operations in UK Airspace
- EASA – Easy Access Rules for Unmanned Aircraft Systems (Regulations (EU) 2019/947 and 2019/945)

2. Concept of operations

2A. Purpose

Ensuring high-level operational details are documented

2B. Expectations

The RPAS operator develops a concept of operations (CONOPS)

2C. Processes and practices

2C.1 A CONOPS or Method Statement is developed, which includes but is not limited to:

- 2C.1.1 Operating site details – at a new site or a site which has changed significantly since a previous CONOPS was developed
- 2C.1.2 Details of all RPAS being operated and the sensors used – using significantly different RPAS or sensors
- 2C.1.3 Details of RPAS crews

2C.2 The level of complexity of the CONOPS is commensurate with the risk and complexity of the operation as assessed by the Aviation Advisor.

2C.3 The CONOPS is amended whenever there are significant changes to the sites, RPAS, etc.

Guidance documents

- Annex A of the JARUS SORA process
- ASTM sUAS

3. Safety Management System and quality assurance

3A. Purpose

Ensuring safe operation with all necessary approvals and with an effective system of documented safety management procedures

3B. Expectations

An effective Safety Management System (SMS) applicable to RPAS operations is in place, appropriate to the size and complexity of the operator so that significant safety risks are managed to as low as reasonably practicable levels

3C. Processes and practices

3C.1 The SMS is compliant with NAA regulatory requirements and the latest IOGP Aviation Management Guidelines, and meets the intent of ICAO Annex 19, Appendix 2 – Framework for an SMS, and ICAO Doc 9859, Safety Management Manual (SMM), including in those countries where national regulations for SMS are not in place for the class of operation or activity.

3C.2 The SMS interlinks all the elements listed in this document, to allow safety information to circulate freely and continuous improvements to be made.

3C.3 The SMS includes guidance in the following areas:

- 3C.3.1 Management commitment and leadership
- 3C.3.2 Safety accountabilities and responsibilities
- 3C.3.3 Key safety personnel
- 3C.3.4 Emergency response planning
- 3C.3.5 SMS documentation
- 3C.3.6 Safety risk assessment and hazard identification
- 3C.3.7 Incident reporting, investigation, and learning
- 3C.3.8 Safety performance monitoring
- 3C.3.9 Management of change
- 3C.3.10 Continuous improvement – assurance
- 3C.3.11 Training and education
- 3C.3.12 Safety communication
- 3C.3.13 Environmental management

3C.4 The RPAS pilot selection process is embedded in the SMS (or referenced in the SMS if it is in a separate document).

3C.5 A quality assurance (compliance monitoring) programme is in place as a part of the overall SMS, appropriate for the size and complexity of the organization.

Guidance documents

- ICAO Annex 19
- ICAO Doc 9859: Safety Management Manual
- IOGP Report 690-1 – Offshore Helicopter Recommended Practices – Safety Management Systems
- IOGP Report 510 – Operating Management System Framework

4. Hazard identification and risk assessment

4A. Purpose

Ensuring that the SMS is effective at gathering and analysing safety information, managing risk, providing assurance, and ensuring continuous improvement

4B. Expectations

The RPAS operator has established a hazard and risk management (HRM) system

4C. Processes and practices

4C.1 The RPAS operator has an established hazard register and hazard identification/risk assessment process (pre-flight, in-flight and post-flight).

4C.2 The RPAS operator has a hazard reporting system allowing personnel to report any type of hazard, anonymously.

4C.3 A hazard analysis/risk assessment is completed prior to beginning flight operations in a new location, when the work environment changes (e.g., new structures, simultaneous operations, external stakeholder interaction), or when a new RPAS is employed at an existing location.

- 4C.3.1 The RPAS operations team, assisted by the site manager, obtains full and detailed information about the site/installation/mobile offshore drilling unit/vessel to familiarize themselves with the layout, topography, processes, and hazardous areas.
- 4C.3.2 The main risks of the overall operation, as well as those of each specific task (considering the ongoing activity at/on the installation), are identified, documented, and mitigated, as appropriate.
- 4C.3.3 Personnel readiness (fitness-for-work), encompassing fatigue, drug and alcohol, and mental health are considered in the risk assessment.

4C.4 All risks are evaluated according to a risk assessment matrix and the results of any risk controls are evaluated through a gap analysis process.

4C.5 All identified hazards are addressed through processes defined in the SMS.

Guidance documents

- IOGP 690-1, Section 7
- JARUS SORA
- ASTM UAS

5. Incident reporting and investigation

5A. Purpose

Ensuring that the SMS is effective at gathering and analysing safety information, managing risk, providing assurance, and ensuring continuous improvement

5B. Expectations

The RPAS operator has safety reporting procedures in place

5C. Processes and practices

5C.1 The RPAS operator has an incident reporting system that tracks and reports all mishaps, potential mishaps, command and control link events, and near misses. This system provides for analysis and improvements made as a part of the operator's SMS.

5C.2 All mishaps, incidents, and anomalies are tracked and reported to the respective customer's Aviation Advisor and NAA or other relevant government regulatory bodies , as necessary. The results of any incident investigation are linked to the RPAS operator's hazard register.

Guidance documents

- IOGP 690-1, Section 8
- ICAO Annex 19 Appendix 2
- ICAO Doc 9859: Safety Management Manual
- UK CAA CAP722: Unmanned Aircraft System Operations in UK Airspace – Guidance

6. Management of change

6A. Purpose

Ensuring that SMSs are effective at gathering and analysing safety information, managing risk, providing assurance, and ensuring continuous improvement

6B. Expectations

The RPAS operator has an effective management of change (MOC) process in place

6C. Processes and practices

6C.1 A defined MOC procedure is in place to manage the risks associated with significant changes related to aircraft operations, including key personnel.

6C.2 The MOC identifies changes that introduce new hazards, or impact the effectiveness of the existing barriers or controls in the HRM process and includes a process to track the effectiveness of the actions to mitigate such changes.

Guidance documents

- ICAO Annex 19 Appendix 2
- ICAO Doc 9859: Safety Management Manual

7. Audits

7A. Purpose

Ensuring safe operation of the RPAS by undertaking examination and verification processes

7B. Expectations

A programme of internal and external audits of RPAS operators is in place

7C. Processes and practices

7C.1 The Aviation Advisor checks and confirms that internal and subcontracted operators have passed aviation safety audits.

7C.2 Initial audits are performed prior to commencement of operations and at least once per year thereafter, or as appropriate for the organization.

7C.3 Audits are carried out by qualified and competent in-house or third-party auditors using, as a basis, the processes set out in IOGP Report 690-1.

7C.4 Audits include verification that the operations group complies with the recommendations detailed in this document.

7C.5 Each IOGP Member Company-approved RPAS operator has an internal audit programme suitable for the size and complexity of the operation.

Guidance documents

- ISO 9001:2015, Quality Management Systems
- ICAO Doc 9859: Safety Management Manual
- IOGP Report 690-1 – Offshore Helicopter Recommended Practices – Safety Management Systems

RPAS OPERATIONS

8. Operations manual

8A. Purpose

Ensuring that RPAS operations are documented and approved

8B. Expectations

RPAS operators maintain a flight operations manual (OM), approved by the NAA where applicable

8C. Processes and practices

8C.1 The flight OM provides detailed operating procedures, including as a minimum:

- 8C.1.1 Procedures and checklist information for pre-flight, in-flight, post-flight, and emergency procedures
- 8C.1.2 A process to maintain accurate flight logs including, areas covered, flight hours flown and equipment used
- 8C.1.3 Limitations for the RPAS types operated
- 8C.1.4 Information on aircraft systems and performance
- 8C.1.5 Detailed RPAS-type training and recurrent training policies, and adequate systems in place for undertaking periodic competency checks for each RPAS operative grade/team member
- 8C.1.6 A fatigue management programme for flight crew (see Section 11, Fatigue management)
- 8C.1.7 A process where, when required, an RPAS operating area Notice to Airmen (NOTAM) and, if required, a request for temporary airspace restriction, is filed through the applicable NAA system at least 24 hours prior to the operation
- 8C.1.8 Instructions for the operation of multiple aircraft by a single RPIC, where permitted by the NAA and a safety case is approved by the Company.

Guidance documents

- FAA Advisory Circular AC 107-2A

9. Offshore/helideck operations

9A. Purpose

Ensuring that RPAS operations from offshore helidecks are coordinated with helicopter operations

9B. Expectations

The RPAS operator liaises with the helideck operator and external agencies

9C. Processes and practices

9C.1 The RPAS operating team is responsible for ensuring that operations cease with the RPAS 'on-deck' and the helideck cleared at least 30 minutes prior to any scheduled helicopter arrival.

9C.2 For offshore operations in the Gulf of Mexico:

9C.2.1. The Bureau of Safety and Environmental Enforcement (BSEE) and U.S. Coast Guard (USCG) are notified if the helideck is closed or open during RPAS operations. Notifying BSEE directly of RPAS operations allows the scheduling/rescheduling of inspections, to avoid facilities with ongoing RPAS operations.

9C.2.2 The Helicopter Safety Advisory Conference (HSAC) NOTAM guidance and NAA recommended practices/legislation are adhered to for RPAS operations that could pose a potential hazard to manned aircraft operations.

Guidance documents

- HSAC Recommended Practices RP 15-1 UAS Guidelines
- OEUK Aviation Guidelines

10. Explosive atmospheres

10A. Purpose

Ensuring that RPAS operations that are near to explosive vapours are risk assessed and managed safely

10B. Expectations

Hazards are mitigated by assessing the design and operation of the RPAS and by matching this to the environment

10C. Processes and practices

10C.1 As there are currently no known intrinsically safe RPAS:

- 10C.1.1 When RPAS are operated in the vicinity of facilities where explosive vapours could be present, the RPAS operator considers the hazardous area classification. This is included in the risk assessment (See Section 4 – Hazard identification and risk assessment).
- 10C.1.2 Hazards associated with the design and operation of the RPAS airframe and payload are identified and mitigated, as appropriate. For example, RPAS motors, and electrical and electronic equipment are not intrinsically safe.
- 10C.1.3 RPAS operations are incorporated into the relevant Company permit to work systems.
- 10C.1.4 Portable and personal gas detection/alarms are considered for use around the area of operation of RPAS and the control station.

11. Fatigue management

11A. Purpose

Ensuring RPAS operating personnel are alert and fit for work

11B. Expectations

The RPAS operator has established limits for duty times

11C. Processes and practices

11C.1 RPAS service providers maintain a comprehensive aircrew fatigue management programme as a part of their SMS or OM, applicable to all aircrew, including the visual observer (VO), which meets the most restrictive of any NAA regulatory limits or the following:

11C.1.1 No RPICs or reserve remote pilots are at the controls of RPAS for more than 8 hours in one day, including no longer than 3 hours at a time.

11C.1.2 RPAS crews are given the opportunity of no less than 10 hours of uninterrupted rest prior to flight operations.

11C.1.3 The crew mission day does not exceed 14 hours.

Guidance documents

- ICAO Doc 9966 – Manual for the Oversight of Fatigue Management Approaches

12. Crew – qualifications and experience

12A. Purpose

Ensuring that RPAS crews are competent to fulfil their duties by having appropriate training, qualifications, knowledge, skill, and experience

12B. Expectations

The RPAS operator demonstrates that its RPAS crews meet the required experience and qualification levels

12C. Processes and practices

12C.1 The RPIC holds:

- 12C.1.1 An NAA-recognized remote pilot licence (RPL) or a private pilot certificate (or higher) when RPAS operations are conducted:
  - 12C.1.1.1 In controlled airspace, which also requires approval from ATC
  - 12C.1.1.2 Within 3 nautical miles of any active aerodrome or heliport
- 12C.1.2 An NAA-recognized beyond visual line of sight (BVLOS) RPL, an appropriate NAA-recognized flight crew licence, a military equivalent qualification, or, in lieu, a commercial pilot licence with an instrument rating (or higher) when operations are conducted:
  - 12C.1.2.1 BVLOS
  - 12C.1.2.2 Above 400 feet AGL or more than 400 feet above a structure
  - 12C.1.2.3 If determined necessary/appropriate for the operation's level of risk
- 12C.1.3 For countries where the NAA does not issue the credentials in 12C.1.1 and 12C.1.2, remote pilots are trained and evaluated to a standard that meets or exceeds the requirements of the JARUS remote pilot competency (RPC) guidelines, or that of an ICAO Member State where RPAS licences or certificates are issued

12C.2 Remote pilot experience required depends on the risk level of the operation. The minimum requirements are stated in Table 12-1:

Table 12-1: RPAS pilots' minimum experience requirements

Conditions	Total RPAS time (hours)	Time on type (hours)
1. Within VLOS 2. Daytime 3. No higher than 400 feet AGL 4. 100 feet or more from people not involved in the operation 5. Not over a populated area or critical infrastructure 6. Not in controlled airspace 7. 3 nautical miles or more from any aerodrome or heliport	5	5
Outside of conditions 1–7	20	10
EVLOS, BVLOS, or above 25 kg/55 lbs	100	20

Note: The required experience increases with the risk and complexity of the operation.

12C.3 Additional consideration is given to the requirement that for higher risk or specialized operations the RPIC holds a private or commercial pilot licence/certificate, and, where required, an instrument rating.

12C.4 RPAS pilots who do not meet the experience requirements stated in Table 12-1 conduct the task while under the supervision of a pilot approved by the Company as a supervisory pilot holding the appropriate qualifications and experience. They are considered as an RPAS Pilot in Command Under Supervision (PICUS).

12C.5 All RPAS crew members:

12C.5.1 Meet the necessary mobility requirements

12C.5.2 Are in possession of valid and up-to-date certificates required for access to the area of operations, where applicable (e.g., TWIC, BOSIET, HUET, offshore medical)

12C.6 Exceptions to the qualifications required in this section are approved by the Aviation Advisor after reviewing a safety case submitted by the RPAS operator. The safety case considers the following issues as a minimum:

12C.6.1 Applicable NAA regulations and other legal requirements

12C.6.2 The potential for the RPAS to interact with manned aircraft

12C.6.3 The size and capability of the RPAS

12C.6.4 The risk of the overall operation

12C.6.5 Company policies (e.g., regarding mobility and non-aviation qualifications)

12C.6.6 A commercial/instrument pilot's assessment of the airspace, risks, and recommended mitigations is included in the safety case when airspace and/or traffic separation are of concern.

Guidance documents

- HSAC Recommended Practices RP 15-1 UAS Guidelines
- CASA MOS Part 101

13. Crew – medical certification

13A. Purpose

Ensuring that RPAS crews are medically fit to fulfil their duties required for safe operations

13B. Expectations

RPAS crews hold valid medical certificates appropriate to their age and licence and the operational requirements

13C. Processes and practices

13C.1 Operations are only permitted if all crew members (remote pilots, VOs, and payload operators, if applicable) confirm that they are in a physical and mental condition that is sufficient to perform their duties in the environment in which the operation is to be conducted.

13C.2 As required by the applicable NAA, RPAS crews hold an aviation medical certificate appropriate for the licence held.

14. Crew – recency

14A. Purpose

Ensuring RPAS crews are competent to fulfil their duties by having appropriate training, qualifications, knowledge, skills, and experience

14B. Expectations

The RPAS operator has established a recency requirement for crews

14C. Processes and practices

14C.1 RPAS operators provide documentation showing that the RPAS pilots maintain an appropriate level of recent pilot experience in the RPAS being operated, or through appropriate flight simulation software or an appropriate flight simulation training device.

14C.2 As a minimum, RPAS pilots conduct three take-offs (launch) and three landings (recovery) in the specific RPAS make and model within the previous 90 days, or as prescribed by the operator/applicant's recurrent training and recency programme.

15. Crew – training

15A. Purpose

Ensuring RPAS crews are competent to fulfil their duties by having appropriate training, qualifications, knowledge, skills, and experience

15B. Expectations

The RPAS operator has established a training programme for RPAS crews

15C. Processes and practices

15C.1 RPAS pilots meet applicable NAA training and testing requirements for each class or type of RPAS they operate. The licensing is appropriate and as required by the RPAS operational category type certification, or determination of airworthiness.

15C.2 The training required to qualify VOs depends on the environment and type of operation; for example, there may not be a need to train VOs in aviation terminology in situations where aviation-band radios are not necessary.

15C.3 All operators develop and follow a training programme that verifies the RPAS pilot and VOs meet the applicable NAA requirements. If there are no NAA requirements, use of the JARUS RPC guideline is recommended.

15C.4 The training programme is appropriate for the type of RPAS, each aircrew role, the environment, and mission the operator is expected to perform and consider.

- 15C.4.1 The RPAS operator structures their training and competence assessment policies to embrace both modular fixed experience (hours-based) and approved integrated ab-initio training (competency-based).
- 15C.4.2 The RPAS operator maintains an up-to-date record of qualifications, training, and competence assessments for each individual RPAS pilot/crew member assigned to RPAS duties.
- 15C.4.3 The training programme covers recency evaluation, emergency procedure proficiency, systems knowledge, and specialized tasks, such as flights requiring intentionally degraded modes of automation during industrial inspection in a high magnetic interference environment, as a minimum.
- 15C.4.4 Training requirements exist for the specific type of RPAS over 25 kg/55 lbs maximum take-off weight (MTOW). Training programmes on RPAS under 25 kg/55 lbs MTOW are designed for similar types of system (i.e., quadcopters under 5 lbs).
- 15C.4.5 Training programmes comply or are consistent with the OEM's recommended training programmes.

15C.5 RPAS RPIC's training programme includes the following (or an NAA-recognized equivalent), which is in addition to the training required for a remote pilot certificate:

- 15C.5.1 Crew Resource Management (CRM)
- 15C.5.2 Dangerous goods (DG) training, if applicable
- 15C.5.3 Normal, abnormal, and emergency procedures in all specific details of the RPAS being operated
- 15C.5.4 OEM-specific training (or a NAA accepted equivalent)
- 15C.5.5 Demonstrated proficiency
- 15C.5.6 Defined interval testing on the RPAS being operated (i.e., semi-annually, quarterly)

15C.6 VOs are trained in areas that include but are not restricted to:

- 15C.6.1 CRM
- 15C.6.2 DG training, if applicable
- 15C.6.3 Aviation terminology
- 15C.6.4 Visual flight rules (VFR)
- 15C.6.6 Airspace requirements
- 15C.6.7 Applicable aviation regulatory requirements

15C.7 If applicable, a member of the RPAS operations team attends a formal permit to work training course (e.g., OPITO VO training)

Guidance documents

- JARUS RPC guideline

16. Drug and alcohol policy

16A. Purpose

Ensuring that safety critical personnel are competent to fulfil their duties by having appropriate training, qualifications, knowledge, skill, and experience

16B. Expectations

The RPAS operator has a documented policy on the use/abuse of drugs and alcohol

16C. Processes and practices

16C.1 The policy establishes a pre-hire, post-accident, for cause, and random testing policy, and is compliant with national legislation.

16C.2 The policy defines an acceptable level of alcohol consumption for staff in safety critical roles, including an alcohol-free period before duty.

16C.3 The policy provides guidance on which over-the-counter and prescribed medication can impair an individual's ability to perform their required duties in the cockpit or workplace.

17. Human factors

17A. Purpose

Ensuring safe operation of the RPAS

17B. Expectations

The RPAS operator considers human factors when planning operations

17C. Processes and practices

17C.1 Consideration is given to human factors during planning and in operation. Examples include, but are not limited to:

- 17C.1.1 Personnel readiness (fitness-for-work)
- 17C.1.2 Loss of natural sensing
- 17C.1.3 Unique flight characteristics of the RPA
- 17C.1.4 Overreliance on automation
- 17C.1.5 Lack of equipment standardization

18. Operations – visual line of sight and extended visual line of sight

18A. Purpose

Ensuring that separation from other airspace users is maintained to avoid collisions

18B. Expectations

Operations are conducted while maintaining visual contact with the RPAS

18C. Processes and practices

18C.1 Operations are generally conducted within VLOS and normally accepted at a maximum distance of 500 m (one-quarter of a nautical mile) horizontally and 400 feet vertically from the RPAS pilot, depending on the visual conditions that are due to environmental factors, and the size and visibility of the aircraft.

18C.2 Operations within EVLOS require the RPIC to comply with their collision avoidance responsibilities. The need for the RPIC to maintain direct visual contact with the RPAS is achieved through visual observation by the RPIC and/or VOs.

18C.3 All RPAS operations (including night operations), utilize one or more trained VOs to assist the RPIC with see and avoid responsibilities, by scanning the area around the aircraft for intruder traffic and assisting the RPIC with navigational awareness.

18C.4 The RPIC and VOs together maintain a view of the area that is sufficient to allow enough time for the RPIC to de-conflict as required.

18C.5 The RPIC knows which VOs are in direct visual contact with the aircraft when multiple VOs are being used.

18C.6 VOs:

- 18C.6.1 Maintain a reliable method of continuous and instantaneous communications with the RPIC, such as by two-way radios.
- 18C.6.2 Be designated as such and not share in any other duties associated with the flight.
- 18C.6.3 Establish an observation position having a clear view of the RPAS operating area.
- 18C.6.4 Are briefed on the hazards specific to the flight, their duties as VO, lost link procedures, and procedures for lost communications with the RPIC (when radios are used) prior to the flight.
- 18C.6.5 Continuously scan the airspace for, and keep the RPIC informed of, possible collision hazards, such as aircraft, power lines, crane/venting booms, birds, approaching workboats (when working underneath an offshore facility), and weather conditions.
- 18C.6.6 Are only responsible for observing one aircraft at a time.

18C.7 The operator produces a safety case, including a risk assessment for the EVLOS operation. Factors taken into consideration include:

- 18C.7.1 Procedures for avoiding collisions
- 18C.7.2 Operating range limits – suitable radio equipment is fitted to maintain positive control over the RPA at all times
- 18C.7.3 Contingency plans for a loss of link event
- 18C.7.4 Aircraft size and configuration
- 18C.7.5 Aircraft colour, markings, and lighting
- 18C.7.6 Aircraft aids to observation
- 18C.7.7 Meteorological conditions and visibility, including background conditions (cloud/blue sky)
- 18C.7.8 The positions of deployed VOs and their ability to maintain visual contact with the aircraft from these positions

19. Operations – beyond visual line of sight

19A. Purpose

Ensuring that separation from other airspace users is maintained to avoid collisions

19B. Expectations

The RPAS operator has established a method of aerial separation and collision avoidance that has been approved by the NAA

19C. Processes and practices

19C.1 The standards applicable to the development of the documentation required for requesting BVLOS operations include:

- 19C.1.1 Appropriate NAA BVLOS regulations and/or guidelines
- 19C.1.2 Other regulatory requirements, dependant on the area of operations, such as radio spectrum approvals and security authorizations
- 19C.1.3 JARUS SORA guidelines
- 19C.1.4 ASTM Standard Practice for Seeking Approval for BVLOS Small Unmanned Aircraft System (sUAS) Operations

19C.2 RPAS operators consult the NAA to verify what documentation is required for a BVLOS approval.

19C.3 RPAS that are flown BVLOS use detect and avoid (DAA) technology on the aircraft, where available. This includes, but is not exclusive:

- 19C.3.1 Electronic conspicuity capability (e.g., automatic dependent surveillance – broadcast (ADS-B) in/out, traffic information system -broadcast (TIS-B))
- 19C.3.2 Onboard visual and/or acoustic DAA systems
- 19C.3.3 Ground Control Station (GCS) with a pilot's eye view video stream
- 19C.3.4 NAA requirements for any remote identification
- 19C.3.5 A system that receives ADS-B and/or TIS-B information at the ground station and integrates it into the ground station's display to give an airspace situational awareness picture to the RPAS pilot
- 19C.3.6 Unmanned traffic management systems that become commercially available are considered to aid in traffic separation

19C.4 The operator submits a safety case, including a risk assessment for the BVLOS operation. Factors taken into consideration include:

- 19C.4.1 Procedures for avoiding collisions, including DAA technologies
- 19C.4.2 Operating range limits – suitable radio equipment is fitted to effect positive control over the RPA at all times
- 19C.4.3 Contingency plans for a loss of link event

19C.4.4 Ground risks of the operational area, avoid flights over residential areas

19C.4.5 Bird strike mitigation

19C.4.6 Aircraft size and configuration

19C.4.7 Aircraft colour, markings, and lighting

19C.4.8 Aircraft aids to observation

19C.4.9 Meteorological conditions and visibility (to manned aircraft), including background conditions (cloud/blue sky)

19C.4.10 The use of deployed VOs to view the aircraft during defined periods of its flight or at checkpoints

19C.5 BVLOS operations that require a supplemental remote pilot to augment the RPIC hold the same certification as the RPIC.

20. Weather

20A. Purpose

Ensuring the RPAS is safely operated in weather conditions that are consistent with the applicable limitations

20B. Expectations

The RPAS operator uses a reliable method of determining wind speed, ceiling, and visibility is used to inform operating decisions

20C. Processes and practices

20C.1 Weather observations are taken close enough to the operation so that it is certain that they are valid; for example, an aerodrome's observations can be used if the aerodrome is within several miles of the RPAS operation and the conditions appear to be uniform.

20C.2 The cloud ceiling may be determined from the temperature/dew point spread.

20C.3 Consideration is given to adverse weather and environmental conditions (e.g., OEM specified maximum/minimum temperatures and maximum wind speeds) that might impact the safety of the operation and/or performance of the RPAS.

21. Focused/sterile cockpit – cell phones and personal electronic devices

21A. Purpose

Ensuring the safety of RPAS operations during critical phases of flight

21B. Expectations

The RPAS operator has established a sterile cockpit policy

21C. Processes and practices

21C.1 RPAS operations are conducted with focused/sterile cockpit procedures that are active during critical phases of the flight.

21C.2 Sterile cockpit procedures include taxi and ground operations involving aircraft movement, take-off, and landing, as well as all other flight operations in which safety or mission accomplishment might be compromised by distractions.

21C.3 The use of cell phones and other personal electronic devices (PEDs) during flight operations is restricted to any required communications with ATC and other communications pertinent to the operational control of the RPAS.

21C.4 Cell phones are not to be used as the primary means of communication between VOs and remote pilots.

22. Night operations

22A. Purpose

Ensuring safe operation of the RPAS at night

22B. Expectations

Night operations are conducted with an enhanced mitigation of risks in place

22C. Processes and practices

22C.1 For night operations, the operator provides:

- 22C.1.1 A safety case
- 22C.1.2 Sufficient mitigation to avoid collision hazards

22C.2 RPAS pilots follow night-specific training in accordance with the NAA requirements or, if there are none, the JARUS RPC guideline.

22C.3 Night operations are authorized by the NAA, where required.

22C.4 External remote pilots and VOs are in place 30 minutes prior to night operations to allow for dark adaptation.

22C.5 An enhanced weather monitoring process is considered, as night operations will typically mean a loss of visual information from the sensors used for weather monitoring.

Guidance documents

- JARUS RPC guideline

23. Pre-flight procedures – pre-flight planning

23A. Purpose

Ensuring safe operation of the RPAS

23B. Expectations

The RPAS operator develops pre-flight procedures that are carried out before each flight

23C. Processes and practices

23C.1 As a minimum, pre-flight planning includes the following:

- 23C.1.1 Determine the airspace type and restrictions (i.e., VFR corridors, Temporary Flight Restrictions, Military Operations Areas).
- 23C.1.2 Determine the distance and direction to the nearest aerodromes/heliports and associated restrictions.
- 23C.1.3 Determine the approaches, departures, traffic patterns, expected traffic, and the precautions to be taken, If within five nautical miles of an aerodrome.
- 23C.1.4 Determine and verify the method of communications with ATC for required notifications such as a lost link and, if required, pre-launch and post-landing (i.e., verify that the ATC phone number and/or VHF frequency is available and that the crew has a communications method that is reliable and effective from the operations site).

Note: Hand-held VHF radios typically transmit at very low powers and cannot be used effectively to transmit ground-to-ground or over any significant distance.

- 23C.1.5 Determine the method of contacting emergency personnel in the area (e.g., fire, ambulance).
- 23C.1.6 Identify other hazards unique to the mission and their mitigations, including at least:
  - 23C.1.6.1 Potential sources of radio interference
  - 23C.1.6.2 Obstacles
  - 23C.1.6.3 Expected wildlife (e.g., birds)
- 23C.1.7 Identify any environmental or privacy laws applicable to the mission and plan accordingly.
- 23C.1.8 Identify public or residential areas near the flight path and the mitigations for potential hazards, noise abatement, and/or privacy issues.
- 23C.1.9 Determine the likelihood of people who are not associated with the mission passing under or near the flight path and determine the mitigations.
- 23C.1.10 Estimate flight durations and fuel/battery requirements.

23C.1.11 Verify that weight and balance is within limits specified by the manufacturer and that the weight is within OEM/regulatory limits.

23C.1.12 Check and confirm that procedures are established for:

23C.1.12.1 Lost link/return to home (RTH), ensuring that the RPA's flight path does not create a hazard

23C.1.12.2 GPS failure/degrade

23C.1.12.3 Control station failure, including power, transceivers, cables, and antennas

23C.1.12.4 Early termination of the flight

23C.1.12.5 Aircraft failure in-flight

23C.1.12.6 Fly-away

23C.1.12.7 Wildlife interference

23C.1.13 Determine launch, landing, and alternative landing sites, including a method of ensuring that the landing sites remain free of people, vehicles, etc., during the flight.

23C.1.14 Check of weather conditions

23C.1.15 Check and file of NOTAMs

23C.2 The information above, other than weather and current NOTAMS, if required, is documented in a CONOPS (see Section 2, Concept of operations).

24. Pre-flight procedures – pre-flight brief

24A. Purpose

Ensuring safe operation of the RPAS

24B. Expectations

The RPAS operator develops pre-flight procedures that are carried out before each flight

24C. Processes and practices

24C.1 All RPAS operations include a pre-flight brief. At a minimum, the brief includes:

- 24C.1.1 Mission overview, including, as a minimum, the mission altitude, flight path and risk assessment that includes site specific safety requirements
- 24C.1.2 Role designations and duties (RPIC, VOs, etc.)
- 24C.1.3 Permit to work (if applicable)
- 24C.1.4 Airspace and restrictions, including for nearby aerodrome s and expected traffic
- 24C.1.5 NAA waivers and associated requirements or limitations (if applicable)
- 24C.1.6 Applicable NOTAMs, both for the current operation and those filed by other users of the airspace
- 24C.1.7 ATC notifications, as required
- 24C.1.8 De-confliction plans for intruding aircraft
- 24C.1.9 Aviation-band frequencies to be used
- 24C.1.10 If VOs are communicating with the RPIC by radio, the frequencies to be used for those radios
- 24C.1.11 Hazards unique to the mission
- 24C.1.12 Environmental, noise and/or privacy issues
- 24C.1.13 Weather (current and forecast ceiling, visibility, and winds)
- 24C.1.14 Lost link, divert and flight termination procedures
- 24C.1.15 Flight time and fuel/battery requirements
- 24C.1.16 Fuel reserves/minimum voltage requirements
- 24C.1.17 Location of any emergency equipment

25. Pre-flight procedures – pre-flight actions

25A. Purpose

Ensuring safe operation of the RPAS

25B. Expectations

The RPAS operator develops pre-flight procedures that are carried out before each flight

25C. Processes and practices

25C.1 Immediately prior to each launch, the RPIC takes the following actions:

- 25C.1.1 Perform a pre-flight inspection/checklist, including an independent check if there is two or more RPAS crew
- 25C.1.2 Validate the firmware
- 25C.1.3 Visually inspect the airframe condition
- 25C.1.4 Run the system diagnostics
- 25C.1.5 Conduct an engine run test
- 25C.1.6 Check the battery, sensors, GPS signal strength, command and control link, etc.
- 25C.1.7 Verify the positions of, and communications with, the VOs
- 25C.1.8 Announce the intention to launch on the appropriate aviation-band frequency, if applicable
- 25C.1.9 Confirm that no persons, vehicles, or obstacles enter the launch/landing areas
- 25C.1.10 Confirm that there is no conflicting air traffic

26. Communications – RPAS/ground control station link

26A. Purpose

Ensuring positive communications between all elements of the RPAS

26B. Expectations

The RPAS operator is to make all efforts to maintain positive control/communications of the RPAS at all times

26C. Processes and practices

26C.1 RPAS are operated in a reliable radio frequency (RF) environment that minimizes the probability of lost link and RF interference with nearby systems.

26C.2 All frequencies used are licensed by the appropriate authority and coordinated with other nearby users through working with that authority and others as appropriate; for example, the staff responsible for communications at a site.

26C.3 The RPAS are operated in strict compliance with all provisions and conditions contained within the frequency band assigned and authorized.

26C.4 RPAS operators maintain and follow a valid communications plan that considers the following:

- 26C.4.1 A spectrum analysis to determine frequency strength and integrity, and areas of possible interference prior to RPAS operations
- 26C.4.2 Checks for predicted GPS outages, using systems such as a GPS receiver autonomous integrity monitor
- 26C.4.3 As a minimum, the identification and assessment of possible sources of RF interference, such as microwave antennas and high-voltage lines, prior to commencing operations
- 26C.4.4 The encryption of all command and return links when possible, or when sensitive information is being collected
- 26C.4.5 The immediate availability of secondary power supplies for the control station and all transceivers and antennas (see Section 31, Standby and emergency equipment)

27. Communications – on-site personnel communications

27A. Purpose

Ensuring positive communications between all elements of the RPAS

27B. Expectations

Communications are established and maintained between critical members of the RPAS team

27C. Processes and practices

27C.1 Sufficient communications capabilities between all crew members and other personnel associated with the operation are in place to cease operations ('stop-work') in the event of an inbound aircraft or other event that is not planned and that requires an emergency termination of the RPAS flight.

27C.2 A formal means of communication is in place between:

- 27C.2.1 The RPAS pilot and payload operator
- 27C.2.2 The RPIC/RPAS pilot and VOs
- 27C.2.3 The RPAS operation and the installation (i.e., radio room and/or central control room)

27C.3 There is a verified reliable and effective means of communications with ATC for required notifications, such as pre-launch, post-landing, or loss of link.

28. Communications – aviation-band radio

28A. Purpose

Ensuring that RPAS crews can communicate with ATC services when required

28B. Expectations

Aviation-band VHF radios are available when required

28C. Processes and practices

28C.1 Where communications over an aircraft-band VHF radio are required, this is undertaken by a licensed aeronautical radio operator.

28C.2 Only an NAA issued frequency may be used, which may be specific to the site/area.

28C.3 When flying in controlled airspace near an aerodrome, the agency issuing the authorization to fly specifies the requirement and includes any procedures, or restrictions for use.

29. Communications – cell phones

29A. Purpose

Ensuring positive communications between all elements of the RPAS

29B. Expectations

The use of cell phones in RPAS operations is restricted

29C. Processes and practices

29C.1 The use of cell phones and other PEDs during flight operations is restricted to any required communications with ATC and other communications pertinent to the operational control of the RPAS.

29C.2 Cell phones are not used as the primary means of communication between VOs and remote pilots.

30. Communications – lost link procedures

30A. Purpose

Ensuring that airborne operations remain predictable

30B. Expectations

The aircraft is safely recovered in the event of a lost link between RPIC and the aircraft, with no impact on other airspace users or those on the ground

30C. Processes and practices

30C.1 RPAS are fitted with RTH functionality.

30C.2 Lost link procedures comply with NAA requirements.

30C.3 The lost link solution complies with the last ATC clearance, if applicable.

30C.4 The appropriate ATC facility is notified of the lost link immediately, if applicable.

30C.5 Lost link procedures avoid flight over any populated areas and hazards, as well as any frequently travelled flight paths.

30C.6 Lost link procedures include the safe recovery of the aircraft.

30C.7 The time and duration of each lost link event is recorded by the operator and reported through the incident reporting process.

30C.8 The designated return site is clear of personnel and hazards in the event of an immediate lost link RTH and landing.

31. Standby and emergency equipment

31A. Purpose

Ensuring safe operations of the RPAS

31B. Expectations

Equipment is readily available to manage failures and emergencies

31C. Processes and practices

31C.1 Standby equipment is held at the control station for operations other than at very low risk levels, including but not limited to:

- 31C.1.1 Backup GCS
- 31C.1.2 Backup communications equipment for the GCS-RPA link, including transmitters, cables, and antennas
- 31C.1.3 Backup power systems

31C.2 RPAS operators are equipped with any specialized equipment, determined by the activity, that may be required in the event of an emergency. This equipment, such as, fire extinguishers and first-aid kits, is managed so that it is serviceable and in date.

- 31C.2.1 This includes composite material handling equipment and personal protective equipment for use if the integrity of the composite material is compromised.

RPAS ENGINEERING

32. Airworthiness

32A. Purpose

Ensuring RPAS are operated in a safe manner that meets NAA requirements

32B. Expectations

RPAS are accepted as being airworthy by the NAA

32C. Processes and practices

32C.1. RPAS are maintained in an airworthy condition under a continuing airworthiness programme.

32C.2 For operations using RPAS without airworthiness certificates, the RPAS operator provides an alternative acceptable means of compliance, for example, an airworthiness report from the OEM that aligns with the JARUS recommendations for certification specification, or an accepted NAA process, such as a manufacturer's declaration. The use of a third-party design verification process, as detailed by the JARUS process, is recommended.

32C.3 RPAS with an airworthiness certificate issued by the NAA are used, where available.

- 32C.3.1 Operators using RPAS with airworthiness certificates demonstrate to the Aviation Advisor in the Company operating/chartering the RPAS that:
  - 32C.3.1.1 The RPAS manufacturer's instructions for continued airworthiness are complied with.
  - 32C.3.1.2 Any limitations on the airworthiness certificate are complied with during the operation.

32C.4 RPAS that are not compliant with 32C.2 or 32C.3 but are available or practical to utilize for a given operation are considered if they can demonstrate a strong track record for high reliability and that have been safety-established over time in military or commercial service.

32C.5 RPAS are, in all cases, used only if they are:

- 32C.5.1 Designed to minimize the potential for a failure of any component that prevents continued safe flight and/or recovery of the vehicle
- 32C.5.2 In accordance with the manufacturer's technical design specifications
- 32C.5.3 In an airworthy condition and be maintained under a continuing airworthiness programme that follows the manufacturer's maintenance instructions, including any service bulletins
- 32C.5.4 Designed and manufactured according to appropriate regulatory and/or industry standards

32C.6 RPAS are fitted with automatic flight termination and/or flight recovery systems.

32C.7 RPAS provides the operator with a status of the aircraft, to include as a minimum:

- 32C.7.1 An indication of the remaining power/fuel (this can be indirect, such as the throttle required to maintain altitude, etc.)

32C.7.2 An indication of the command and control link quality

32C.7.3 An indication of the quality of the GPS signal (if GPS is used)

32C.7.4 When any of requirements of 32C.7.1 through 32C.7.3 are in states that could adversely affect the flight, the system alerts the operator

32C.7.5 An indication of whether the RPAS are in a normal or other state (i.e., executing an RTH) – if the system leaves the normal state other than by operator command, the system alerts the operator

32C.7.6 Position and altitude of the RPAS

32C.8 RPAS are painted, marked, and/or lit to be highly visible.

32C.9 The fitting of DAA systems is considered for some operating environments (see Section 19, Operations – BVLOS).

Guidance documents

- ASTM Standard Specification for Design and Construction of a Small Unmanned Aircraft System (for all types of RPAS under 25 kg/55 lbs)
- JARUS Certification Specification for Light Unmanned Rotorcraft Systems (for conventional helicopter RPAS up to 750 kg/1653 lbs)
- JARUS Recommendations for Certification Specification for Light Unmanned Aeroplane Systems (for fixed-wing RPAS up to 750 kg/1653 lbs)

33. Maintenance

33A. Purpose

Ensuring maintenance of RPAS for safe operations

33B. Expectations

The RPAS operator has a maintenance programme in place

33C. Processes and practices

33C.1 A maintenance programme is in place for each RPAS type in order that the OEM's maintenance manuals, instructions for continued airworthiness, service bulletins, recommended inspection procedures and intervals, and other procedures and recommendations are adhered to.

33C.2 The maintenance programme complies with applicable NAA regulations.

33C.3 Maintenance is only performed by properly trained and certified personnel.

33C.4 As a minimum, the programme includes:

- 33C.4.1 A maintenance policy and a procedures manual, approved by a relevant authority within the RPAS operator's organization
- 33C.4.2 A pre-flight and post-flight inspection of the entire RPAS, and there is an associated logbook to track inspections
- 33C.4.3 A maintenance release/release to service process
- 33C.4.4 A record of malfunctions (i.e., loss of link), anomalies, and damaged parts
- 33C.4.5 A maintenance training and evaluation programme for each operated system
- 33C.4.6 Both field and depot level maintenance intervals
- 33C.4.7 A process for reporting unusual discrepancies or potentially dangerous anomalies to the manufacturer
- 33C.4.8 A log book (either hard copy or electronic) used to track and record all maintenance activities, including pre and post flight inspections, inspection/replacement of components and to track flight hours and life limited items (eg. Batteries, rotors)

33C.5 If the manufacturer offers certification of customer maintenance programmes, this certification is obtained.

33C.6 When software or hardware changes are made, the RPAS operator:

- 33C.6.1 Checks and confirms that the changes do not result in a negative effect on operations, via:
  - 33C.6.1.1 A thorough review of the manufacturer's documentation in respect of the changes made/provided by them (e.g., software/hardware upgrades, modifications, service bulletin instructions)

33C.6.1.2 Test flights exercising all flight regimes

33C.6.2 Documents all hardware and software changes in the aircraft maintenance logbooks

33C.7 A minimum essential subsystem list (MESL), or similar list, is established for the entire system.

33C.8 The MESL includes the required equipment necessary for the specific mission and can include items such as GCSs, sensors, backup power supplies, aircraft lighting systems, transponders, and backup antennas.

33C.9 The MESL or similar list is complied with when provided by the OEM.

34. Battery/fuel management

34A. Purpose

Ensuring the safe and continuous operation of RPAS

34B. Expectations

The RPAS operator produces a battery and/or fuel management programme

34C. Processes and practices

34C.1 The battery and/or fuel management programme includes:

- 34C.1.1 Readily available material safety data sheets and other documentation, such as manufacturer's recommended charging procedures, storage, operating temperatures, and firefighting procedures
- 34C.1.2 Recommended procedures for the safe handling and transportation of the batteries/fuels that are compliant with applicable regulations and worksite requirements
- 34C.1.3 Equipment classified as dangerous is transported in accordance with NAA, IATA regulations for air cargo, and international maritime dangerous goods regulations for marine cargo transfers
- 34C.1.4 Battery/fuel storage plans that include storage in fireproof containers
- 34C.1.5 Battery/fuel inspection procedures and requirements
- 34C.1.6 Battery charging/refuelling procedures that ensure safety in the event of a fire (e.g., in fireproof containers, or when in the field, away from people, equipment, brush/trees)
- 34C.1.7 Methods to determine battery charge/fuel quantity
- 34C.1.8 Low battery power/fuel quantity indications and procedures
- 34C.1.9 Emergency procedures to manage thermal runaway

34C.2 RPAS operators maintain a battery maintenance programme that logs information about each battery by serial number, including:

- 34C.2.1 When charging; date, and the initial and final charge state
- 34C.2.2 When flying, date, the initial and final charge state
- 34C.2.3 When draining (e.g., for long-term storage or transport); method used to drain, date, initial and final charge states
- 34C.2.4 Number of charging cycles
- 34C.2.5 Monitoring of the battery performance

34C.3 If the RPAS is powered by hydrocarbons, hydrogen, etc., the above management programme addresses applicable regulatory requirements as well as relevant Company fuel management procedures.

Guidance documents

- IATA Dangerous Good Regulations

International Association of Oil & Gas Producers

Report 696 – *Remotely Piloted Aircraft Systems* (RPAS) provides recommended practices that will assist in the safe and effective management of RPAS operations that are either operated directly or subcontracted by IOGP Member Companies.

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