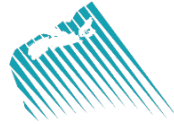




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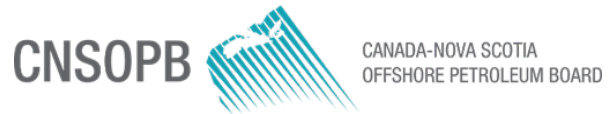


CANADA-NOVA SCOTIA
OFFSHORE PETROLEUM BOARD

REMOTELY PILOTED AIRCRAFT SYSTEMS

Guidance for the Atlantic Canada Offshore Area

Responsible Department					
Safety Department					
Document No:	Total # of Pages:	Review Cycle:	Revision No.:		
2019-GL-004	46	3 years			
Comments:					
NA	NA				
Revision Number	Date Revised	Date Created	Prepared By Dan Chicoyne	Checked By	Approved



REMOTELY PILOTED AIRCRAFT SYSTEMS (RPAS)

GUIDELINES

December 2020

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DEFINITIONS

Unless otherwise defined, terms used in this Guideline have the same meaning as the definition in the *Accord Acts*.

Accord Act(s): Refers to:

- Canada Nova Scotia Offshore Petroleum Resources Accord Implementation Act [NS Accord Act]
- Canada Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act
- Canada-Newfoundland and Labrador Atlantic Accord Implementation Act [NL Accord Act]
- Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act

For the purposes of these guidelines, references will be to the federal versions of the Acts.

Advanced Operations Pilot Certificate: Certificate required for advanced operations, in accordance with criteria defined by Transport Canada.

Aircraft: Any machine capable of deriving support in the atmosphere from reactions of the air, and includes a rocket.

Airworthiness: A condition in which the Remotely Piloted Aircraft Systems System (including the aircraft, airframe, engine, propeller, accessories, appliances, and control station) conforms to its type certificate (design) if applicable, and is in condition for safe operation.

Airworthiness Certification: A repeatable process that results in a documented decision that an aircraft system has been judged to be airworthy. It is intended to verify that the aircraft system can be safely maintained and safely operated by fleet pilots within its described and documented operational envelope.

Atlantic Canada Offshore Petroleum Area: The Atlantic Canada Offshore Petroleum Area refers to the Offshore Area(s) as defined by the Accord Act(s).

Automated Aircraft: An aircraft with the means of executing a pre-defined process or event that requires pilot initiation and/or intervention.

Autonomous Aircraft: An aircraft with the ability to execute processes or missions using onboard decision-making capabilities. The aircraft is not designed to allow pilot intervention in the management of the flight.

Autonomous Operation: An operation during which an aircraft is operating without pilot intervention in the management of flight.

Barrier: Means the technical/physical, human or organizational safeguard that is put in place to avoid, prevent, reduce or manage health, safety or environmental risks.

Board: Canada-Newfoundland and Labrador Offshore Petroleum Board and/or the Canada-Nova Scotia Offshore Petroleum Board.

Canadian Aviation Documents: means any license, permit accreditation, certificate or other document issued by the Minister under Part 1 of the *Aeronautics Act* to or with respect to any person, or in respect of any aeronautical product, aerodrome, facility or service.

Canadian Aviation Regulations: Regulations respecting aviation and activities relating to aeronautics.

Certificate of Fitness: A certificate issued by a certifying authority.

Certifying Authority: approved third party organizations that issue a certificate of fitness to facilities and verify that they comply with regulatory requirements and are fit for purpose.

Command and Control Link: The data link between the Remotely Piloted Aircraft Systems and the remote pilot station for the purposes of managing the flight.

Congested Area: A congested area is usually crowded with traffic or people. In the context of on and offshore Remotely Piloted Aircraft Systems operations, working in a congested area should be determined on a case-by- case basis.

Control Station: The facilities or equipment that are remote from a Remotely Piloted Aircraft Systems and from which the aircraft is controlled and monitored.

Crew Member: A person who is assigned duties essential to the direct operation of an aircraft during all phases of the operation.

De-confliction: Reducing the risk of collision between aircraft by coordinating their movements.

Drilling and Production Regulations: refers to either the:

- *Newfoundland Offshore Petroleum Drilling and Production Regulations*
- *Nova Scotia Offshore Petroleum Drilling and Production Regulations*

Drone: Any type of Remotely Piloted Aircraft System

Experimental Flight Permit: A permit for aircraft that are engaging in research or development.

First-Person View Device: A device that generates and transmits a streaming video image to a control station display or monitor, giving the pilot of a Remotely Piloted Aircraft Systems the illusion of flying the aircraft from an on-board pilot's perspective.

Flight Duty Period: The period that begins when the earliest of the following events occurs and ends at engines off or rotors stopped at the end of a flight:

- a) the flight crew member carries out any duties assigned by the private operator or the air operator or delegated by the Minister before reporting for a flight,
- b) the member reports for a flight or, if there is more than one flight during the flight duty period, reports for the first flight,
- c) the member reports for positioning, or
- d) the member reports as a flight crew member on standby.

Flight Safety: The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.

Flight Termination System: A system that, on activation, terminates the flight of a Remotely Piloted Aircraft System. The intentional and deliberate process of performing controlled flight into terrain (or water). Flight termination should be executed in the event that 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 flight.

Fly-away: In respect of a Remotely Piloted Aircraft Systems, an interruption or loss of the command and control link such that the pilot is no longer able to control the aircraft and the aircraft no longer follows its preprogrammed procedures or operates in a predictable or planned manner.

Handover: The act of passing piloting control from one remote pilot station to or from one pilot to another.

Highly Automated: Systems that still require inputs from a pilot (e.g. confirmation of a proposed action) but which can implement the action without further human interaction once the initial input has been provided.

Human Factors: Refers to environmental, organizational and job factors, and human and individual characteristics, which influence behaviour at work in a way that can affect health and safety.

Lost Link: The loss of command and control link contact with the Remotely Piloted Aircraft Systems such that the remote pilot can no longer manage the aircraft's flight.

Major Damage: Damage that results in uncontrolled pollution, or loss of, or serious threat to life or the installation.

Marine Installation or Structure: Refers to a "Marine Installation or Structure" as defined in the Accord Act(s). It also includes an "Installation" as defined in the Accord Act(s).

NAV Canada: The company that operates Canada's civil air navigation service.

Operator: The holder of an authorization issued by either the Canada - Newfoundland and Labrador or the Canada - Nova Scotia Offshore Petroleum Board.

Payload: A system, an object or a collection of objects that is on board or is otherwise connected to a Remotely Piloted Aircraft Systems but that is not required for flight.

Petroleum Installation Regulations: refers to either the:

- *Newfoundland Offshore Petroleum Installation Regulations; or*
- *Nova Scotia Offshore Petroleum Installations Regulations*

Pilot: The person in direct control of the Remotely Piloted Aircraft Systems - See also 'Remote Pilot'.

Pilot in Command: The person who has final authority and responsibility for the operation and safety of flight, has been designated as PIC before or during the flight, and holds the appropriate category, class, and type rating, if applicable, for the conduct of the flight. The responsibility and authority of the PIC apply to the RPAS PIC. The RPAS PIC position may rotate duties as necessary with equally qualified remote pilots. The individual designated as PIC may change during flight.

NOTE: The PIC can only be the PIC for one aircraft at a time. The PIC should meet RPAS Transport Canada guidance requirements for training, pilot licensing and medical requirements.

Radio Line-Of-Sight: A direct radio link point-to-point contact between a transmitter and a receiver.

Remote Pilot: A person charged by the RPAS service provider with duties essential to the operation of a Remotely Piloted Aircraft System and who manipulates the flight controls, as appropriate, during flight time.

Remotely Piloted Aircraft: A navigable aircraft, other than a balloon, rocket or kite, that is operated by a pilot who is not onboard.

Remotely Piloted Aircraft System Visual Observer: A trained and competent person designated by the operator who, by visual observation of the Remotely Piloted Aircraft System, assists the remote pilot in the safe conduct of the flight.

Remotely Piloted Aircraft System: A set of configurable elements consisting of a remotely piloted aircraft, its control station, the command and control links and any other system elements required during flight operation. RPAS are also considered support craft.

Remotely Piloted Aircraft System Safety Assurance: The Remotely Piloted Aircraft System Safety Assurance describes for users the safety limits of the drone they are using.

Remotely Piloted Aircraft Systems Commander: A trained and competent person who is responsible for the conduct and safety of a specific flight and for supervising the person in direct control of the RPAS. Duties are equivalent to those of an Aircraft Commander.

Remote Pilot Station: The station (flight controls) at which the Remote Pilot manages the flight of an unmanned aircraft.

Safety Management System: The elements of an operator's management system dedicated to safety management, whether or not these management elements are incorporated in or separate from the overall management system.

Safety Plan: Sets out the procedures, practices, resources, sequence of key safety-related activities and monitoring measures necessary to ensure the safety of the proposed work or activity. Has the same meaning as defined in section 8 of the *Drilling and Production Regulations*.

Support Craft: Refers to a "support craft" as defined in the *Drilling and Production Regulations*.

Team Member: An individual who forms part of the RPAS team. This includes RPAS pilots, RPAS service provider and designated members of the marine installation or structure.

Transitional OHS Regulations refer to either the:

- *Canada-Newfoundland and Labrador Offshore Marine Installations and Structures Occupational Health and Safety Regulations; or*
- *Canada-Nova Scotia Offshore Marine Installations and Structures Occupational Health and Safety Regulations.*

Visual Line-of-Sight Operation: An operation in which the remote pilot or Remotely Piloted Aircraft Systems visual observer maintains direct unaided visual contact with the Remotely Piloted Aircraft Systems.

ABBREVIATIONS

ATC	Air Traffic Control
CA	Certifying Authority
CAA	Civil Aviation Authority
CCR	Central Control Room
Offshore Area	Canada-Newfoundland and Labrador Offshore Area
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CAP	Civil Aviation Publication
CARs	Canadian Aviation Regulations
C2	Command and Control
FPV	First-Person View
GBS	Gravity Based Structure
GCS	Ground Control Station
GPS	Global Positioning System
ISO	International Standards Organisation
MIS	Marine Installation or Structure
MODU	Mobile Offshore Drilling Unit
OEM	Original Equipment Manufacturer
OIM	Offshore Installation Manager
PIC	Pilot in Command
PTW	Permit to Work
RPAS	Remotely Piloted Aircraft Systems
RTH	Return to Home
SMS	Safety Management System
TC	Transport Canada
TDG	Transportation Dangerous Goods
TSB	Transportation Safety Board
TQSP	Training and Qualifications Standard Practice
VFR	Visual Flight Rules
VLOS	Visual Line-of-Sight
VMC	Visual Meteorological Conditions
VO	Visual Observer

FOREWORD

The Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) and Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) have issued this guidance to assist operators in developing and following procedures for operating a Remotely Piloted Aircraft System (RPAS). The guidance is issued with the intention of encouraging offshore operators who are planning to use this rapidly evolving technology to think about the entire operating and safety system offshore and not just the aircraft.

The onus is on the Operator to comply with the *Accord Act(s)* and Regulations and to demonstrate to the Boards the adequacy and effectiveness of the methods employed to achieve compliance. The onus is also on the Operator to comply with the Act(s) and regulations of other authorities, as applicable.

Guidelines are developed to provide assistance to those with statutory responsibilities (including Operators, providers of service, suppliers, employers, employees, etc.) under the *Accord Acts* and Regulations. Guidelines provide an understanding of how regulatory requirements can be met. In certain cases, the goals, objectives and requirements of the legislation are such that no guidance is necessary. In other instances, guidelines will identify a way in which regulatory compliance can be achieved.

Guidelines outline the C-NLOPB's and CNSOPB's reasonable expectations on how those with statutory responsibilities can achieve compliance with *Accord Acts* and Regulations.

All statutory references in this guidance will be in accordance with the federal version of the *Accord Acts*.

The authority to issue Guidelines and Interpretation Notes with respect to legislation is specified by subsection 156(1) and 210.068 of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act (NS Accord Act)*, subsection 148 and 202BQ(1) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, subsection 151.1 and 205.067 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act (NL Accord Act)* and subsection 147 and 201.064 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act*.

This Guideline itself is not a statutory instrument; in this regard, the information set out in the Guideline does not prevent the Operator from proposing alternative methods or means to demonstrate compliance with the legislation. These alternatives will be considered on a case-by-case basis by the applicable Board. It is recommended that in proposing different alternatives, the operator assess the risks and hazards associated with the activity.

1.0 PURPOSE OF GUIDELINE

The purpose of this Guideline is to provide additional information and guidance, to help ensure regulatory compliance, for Operators of offshore marine installations or structures (MIS) who are planning to use a Remotely Piloted Aircraft System (RPAS).

2.0 STATUTORY AUTHORITY

Section 138.2 of the *NL Accord Act* and Section 142.2 of the *NS Accord Act* states “The Board shall, before issuing an authorization for a work or activity ... consider the safety of the work or activity by reviewing, in consultation with the Chief Safety Officer, the system as a whole and its components, including its structures, facilities, equipment, operating procedures and personnel.”

Subsection 205.068(1) of the *NL Accord Act* and Subsection 210.069(1)(a) of the *NS Accord Act* states “...the Chief Safety Officer shall consider the potential impact of the work or activity to be authorized on the health and safety of employees engaged in the work or activity..”

In addition, refer also to Sections 19, 27 and 69 of the *Drilling and Production Regulations* which contain general provisions in relation to safety and environmental protection and operations involving support craft.

In the event of a perceived discrepancy between this Guideline and the legislation, an operator should consult with the Board and the *Accord Acts* and *Regulations* are to prevail.

3.0 APPLICATION/SCOPE

This document is applicable to the employment of Remotely Piloted Aircraft Systems (RPAS) within the Atlantic Canada Offshore Petroleum Area.

This guidance document addresses:

- Management Systems
- Operator Safety Plan
- RPAS Operational Safety Plan/Safety Case
- Emergency Response Planning and Procedures
- Auditing and Compliance Requirements
- Inspection Services
- Managing RPAS Operations on Offshore Facilities
- Permit to Work Requirements
- RPAS Service Provider Control of RPAS Operations Offshore
- Operating RPAS

- Record Keeping

4.0 REMOTELY PILOTED AIRCRAFT SYSTEMS OVERVIEW

The use of RPAS is a constantly evolving technology for assisting with survey, inspection and maintenance of MIS in the Atlantic Canada Offshore Petroleum Area. There are numerous types of RPAS operations that can be completed in an offshore environment, for example:

i. Aerial Photography/Survey/Security

These operations usually involve flying in an open space away from structures. An example would be taking overview photographs of an offshore installation.

ii. Inspection Operations

These operations account for the majority of RPAS activities offshore. These operations usually involve flying close to, inside or sometimes under structures in order to get detailed imagery or data of the asset.

Elements of marine installations or structures that can currently be accessed using RPAS include, but are not limited to:

- Flare towers, derricks and other elevated structures
- Flare booms
- Live flare tips
- Turbine generator exhausts
- Cranes
- Helideck support structures
- Under deck/splash zone
- Risers/caissons
- Vessel hulls
- Accommodations blocks
- Antenna farms
- Inside of tanks

5.0 SAFETY AND QUALITY ASSURANCE

5.1 Safety Management System/Safety Plan

The Operator's Safety Management System (SMS) and Safety Plan are key elements of ongoing offshore operations.

In order to obtain an authorization, the Operator must ensure that the statutory and regulatory requirements pertaining to the work or activity are satisfied. Required documentation must be submitted in support of the authorization application to demonstrate that the work can be carried out safely and this documentation shall be submitted in the form of a safety plan. Guidance for the content of Safety Plans is provided in the *Safety Plan Guidelines*.

The Operator's safety plan should have content with respect to (at a minimum) contractor intake, permit to work systems and reference to how they intend to ensure the safety of any activity including RPAS work on their facilities.

The Operator should have reviewed the management system of the RPAS service provider and how it interfaces with the Operator's SMS. This can be in the form of a bridging document. The RPAS' management system shall comply with the Accord Act(s) and Regulations of the Boards and, with Transport Canada (TC) requirements. It should also take into consideration internationally accepted best practices and guidelines with respect to RPAS activities for oil and gas operations.

The RPAS operational safety plan shall describe any planned activities to be conducted by the RPAS service provider and describe the hazards and associated risks. It should provide measurable commitments respecting any equipment, procedures and training and include a reference to any detailed procedures or plans associated with the activity. As part of the installation's Declaration of Fitness, the Operator must review and accept the equipment, procedures and training of personnel involved in the activity. The certifying authority would also review the RPAS from a temporary equipment perspective.

The RPAS management system and RPAS operational safety plan shall include a reference to the RPAS procedure that includes best practices, resources, sequence of key safety related activities and monitoring measures necessary to ensure the safety of the proposed work or activity. It is an essential operational document specific to offshore operations. The RPAS operational safety plan shall describe any planned activities to be conducted by the service provider and describe the hazards and associated risks. It should provide measurable commitments respecting any equipment, procedures and training and include a reference to any detailed procedures or plans associated with the activity.

A sample content list for an RPAS Operational Safety Plan is provided in Appendix A.

5.2 Emergency Response Planning and Procedures

A formal emergency response plan shall be in place for all RPAS flight operations. An approved incident response checklist, as part of the RPAS flight operations manual, should be followed in the event of an incident or accident.

Guidance for the content of Contingency Plans is provided in Section 6 of the *Drilling and Production Guidelines*. Contingency Plans shall be updated to include RPAS flight operations or a bridging document between the RPAS service provider and the Operator should be developed to capture this. It should also make reference to where more detailed emergency response procedures enacted by the RPAS team is located. An approved incident response checklist, as part of the flight operations manual, shall be followed in the event of an incident. The RPAS team shall also receive an orientation of the facility and be familiarized with the facility's emergency response plan and their associated actions in response to an emergency.

All incidents shall be reported immediately by the RPAS pilot to the Offshore Installation Manager (OIM) or delegate. A report to the appropriate regulatory authorities (e.g. C-NLOPB, CNSOPB or TC and, when applicable, to the Workplace Committee) must also be made as required by the Accord Acts and Regulations. These incidents shall be investigated to determine root cause(s). Guidance on incident reporting and investigation is provided in the *Incident Reporting and Investigation Guidelines*.

5.3 Auditing and Compliance Requirements

Operators should undertake a detailed operational/flight safety/commercial audit of a prospective RPAS service provider (including pilot and crew qualifications and experience) prior to contracting the company to undertake offshore RPAS operations.

From an aviation perspective, a RPAS is an airborne platform that is used primarily as a tool for data collection. Therefore, aviation safety audits shall be carried out by qualified and competent auditors using, as a basis, the processes set out in TC *Canadian Aviation Regulations* [CARs] *Standard 922* (CARs 901.76 for advanced operations).

RPAS used to conduct advanced operations, as per TC CARs, must be declared as able to perform certain advanced operations safely. The RPAS Safety Assurance categories are:

- Flight in controlled airspace
 - operations in which the drone will fly within the airspace controlled by air traffic control (Class A-F)
- Flight near people
 - operations in which the drone will fly within 30 meters (for basic operations) and within 5 meters or directly over (for advanced operations) of any person not associated with the operation

- Flight over people
 - operations in which the drone will fly directly over any person not associated with the operation
- Flight in the vicinity of airports

If RPAS are built or modified, a declaration to TC identifying the capabilities of the system must be made. Anyone who builds or modifies a RPAS must be able to prove that the RPAS complies with *Canadian Aviation Regulations Standard 922* and *Canadian Aviation Regulations 901.76* (or equivalent), if it is to be used for advanced operations. If a model does not have an RPAS Safety Assurance declaration, pilots cannot use that RPAS for advanced operations. For more information on how an RPAS Safety Assurance affects where and how pilots can fly an RPAS, see TC's *Choosing the Right RPAS*.¹

Pilots might also need to use RPAs outside of the rules established by TC. Therefore, a RPAS operator would need to apply for a *Special Flight Operations Certificate (SFOC)*. For information on how to request a Special Flight Operations Certificate, refer to TC's *Getting Permission to Fly a Drone Outside the Rules*.

As a minimum, compliance with the following will be required:

- RPAS pilots must comply with the rules in the CARs *Part IX- Remotely Piloted Aircraft Systems*
- RPAS pilots must hold a valid Advanced Operations Pilot Certificate and only fly RPAS that are appropriately Safety Assured, registered with TC and marked with the applicable registration number.

When Permission is Required to Fly RPAS²

If a RPAS is being used for work or research, or if it weighs over 25 kilograms, the operator must have a *Special Flight Operations Certificate (SFOC)* from Transport Canada. The certificate tells how and where it is allowed to use the RPAS. For more information on the certificate, refer to TC's *Getting Permission to Fly your RPAS*.

A Special Flight Operations Certificate (SFOC) gives you permission to operate your drone outside the rules for a specific purpose. You need this certificate if you want to fly your drone outside the rules for basic or advanced operations.

You might be eligible to get an SFOC if:³

- your drone weighs over 25 kilograms (kg)
- you want to fly your drone beyond the visual line-of-sight
- you are not a Canadian citizen, permanent resident of Canada or a corporation incorporated by or under the laws of Canada or a province

¹ tc.canada.ca/aviation/drone-safety

² *ibid*

³ *ibid*

- you want to fly your drone at higher altitudes
- you want to fly more than five drones at the same time
- you want to fly at a special aviation event or an advertised event
- you want to fly your drone carrying dangerous or hazardous payloads (e.g. chemicals)
- you want to fly closer to a military airport

6.0 INSPECTION SERVICES - ELEMENTS AND STANDARDS

6.1 RPAS Operations Documents

The RPAS service provider (company) operations manual should include⁴

- RPAS operational Safety Plan
- General procedures
- RPAS equipment and systems information
- Management system
- RPAS service provider (company) authorized operations
- Remote Pilot training and certification as per company requirements including proof of passing TC RPAS exam (or equivalent) and advanced certificate
- RPAS system servicing and maintenance as per Original Equipment Manufacturer (OEM) recommendations
- Company overview/summary
- Responsible persons
- Emergency contacts
- Operational controls
- Maintenance and flight record keeping process
- Training management process
 - Normal and Emergency procedures in addition to Loss of C2 Link
 - Loss of visual contact
 - Fly-away
 - Flight control failure
 - Flight termination process
 - Pilot incapacitation
 - Procedures specific to operating offshore including failsafe configuration
- Operational procedures for adverse weather
- Use of FPV systems
- Site survey process
- Transportation and safe handling of Lithium batteries
- RPA equipment and systems information

⁴ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

- Safety management system (or similar type of content)
- List of authorized operations
- Communications processes
- RPAS servicing and maintenance as per OEM recommendations
- Description of company policies such as, but not limited to:
 - EH&S
 - Crew duty time
 - Near miss
 - Confined space entry
 - Use of PPE
 - Fire/electrical/fall/medical/chemical/hot work/noise/ladders/vehicle operations
 - Accident/Incident investigation process
 - Drug and alcohol usage and testing
 - Hazard reporting

It is important for the Operator to review, understand and approve the safety and communications procedures that an RPAS operations team will follow during the tasking. The procedure should, as a minimum, contain the following details:

1. RPAS specifications and limits
 - i. RPAS technical specifications
 - ii. RPAS operating limitations and restrictions
 - iii. RPAS certification
2. Description of operation including the scope(s) of work to be executed
 - i. Required equipment and personnel
 - ii. Permit to work system
 - iii. Securing the airspace
 - iv. Take-off and landing sites
 - v. Airborne procedures including details of flight paths and no fly zones
 - vi. Communications protocol
 - vii. Site specific risk assessment
3. Restricted access
 - i. Restricted access to areas with hazardous atmospheres identified and appropriate mitigation measures in place
 - ii. Restricted access to areas of known or potential magnetic or radio wave interference identified and appropriate mitigation measures in place
 - iii. Overfly, security and privacy restrictions identified and mitigated for operations adjacent to assets and people on and offshore (i.e. no overflight of personnel)
4. Emergency response plan
 - i. Fire and gas alarms/release response procedures
 - ii. Blowdown/increased flare rate response procedures
 - iii. Emergency procedures for RPAS operational upset conditions
 - iv. RPAS contingency plan
5. Preventive Measures

- i. Prop/rotor failure
- ii. Loss of payload/dropped object risk
- iii. Battery failure
- iv. Loss of communications link/cyber interference
- v. Resistance to magnetic disturbances and anomaly
- vi. Log file recording

Detailed requirements for a RPAS operations manual are expanded in Appendix B of this document.

7.0 MANAGING RPAS OPERATIONS ON OFFSHORE FACILITIES

7.1 Management of RPAS Operations on a Marine Installation or Structure

7.1.1 Management Roles and Responsibilities for Offshore RPAS Operations

The OIM (or the vessel master when applicable) is responsible for all activities undertaken on a MIS. This includes ensuring that all conflicting/simultaneous RPAS operations have been properly risk assessed, robust procedures are in place and trained and competent personnel are assigned to manage the RPAS activities.

As per Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*, day to day delegated responsibilities will normally include:⁵

- The installation maintenance manager (or an alternate nominated responsible person) providing a single point of contact to manage all RPAS team activities on and around the MIS.
- Another person, such as the helicopter landing officer (HLO) (or an alternate nominated responsible person) should provide direct communications to the RPAS team regarding ongoing operations onboard the MIS and may also act as an additional visual observer for flight operations on and around the MIS. This would include communications from the control room/bridge, heli-admin and/or radio room to provide weather updates, helicopter inbound timings, updating on other work that may affect the RPAS operations (e.g. over the side work, etc.).
- The Radio operator should be responsible for ensuring de-confliction between RPAS operations and other aircraft or vessels. The radio operator is responsible for ensuring other nearby offshore units have been informed of the RPAS operations (e.g. the standby vessel) advising the areas of operation etc. on and around the MIS.

⁵ (Oil and Gas UK, *UAS Operations Manual Standards and Guidelines Issue 1, 2017*)

7.1.2 Control/Oversight of RPAS Operations in the Offshore Installation Environment⁶

Communications between the RPAS team and installation supervisory personnel onboard the MIS shall be established as part of the pre-task requirements and should be adhered to at all times throughout the RPAS operations.

The appropriate authority (e.g. OIM or vessel master) onboard the MIS will appoint a nominated person as a single point of contact to manage the permit to work (PTW) system on behalf of the RPAS team (in the event the RPAS team have not done a company specific PTW course). RPAS team shall attend shift handover meetings onboard the MIS.

The HLO (or an alternate nominated responsible person) will normally act as the RPAS team communication link to the installation control room, heli-admin and/or radio room to provide weather updates, helicopter inbound timings, and updates on other work that may affect the RPAS operations (e.g. over the side work, etc.).

The radio operator is responsible for ensuring other nearby offshore units have been informed of RPAS operations (e.g. the standby vessel) on and around the MIS.

The RPAS operating team is responsible for ensuring that RPAS operations cease with the RPAS on-deck and helideck cleared at least 30 minutes prior to any scheduled helicopter arrival. Where an installation/MODU/vessel is in close proximity (1-2NM) to other potential helipad sites, the same requirement to land and pause operations must be adhered to.⁷

Should the RPAS be operated in close proximity to radar antennas on an MIS, those antenna systems must be placed in STANDBY, with radar monitoring provided by the standby vessel(s) which should be 500 meters or more from the installation. This operational mode is critical to the flight safety of the RPAS, and failure to do so can cause significant interference between the RPAS and the ground station (C2 link). This includes navigation and weather radar, as well as radar used for tanker management.

7.1.3 RPAS Team Offshore Safety Training Requirements

Safety training for all personnel travelling offshore, (i.e. BST, HUEBA, Offshore Medical, etc.) shall be in accordance with Accord Act legislation and associated Regulations. Refer also to C-NLOPB and CNSOPB guidance and referenced standards (*Training and Qualifications Standard Practice (TQSP)*).

⁶ ibid

⁷ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

7.1.4 Permit to Work Requirements

Permit to Work (PTW) requirements for undertaking RPAS operations on an MIS will be conducted using the existing Operator's PTW procedures. These PTW procedures will be administered under the close scrutiny of the OIM or a designated alternate.

Prior to undertaking RPAS operations, at least one member of the RPAS team shall have attended a formal PTW training course. In addition, the RPAS operations team should nominate a competent person to act as the PTW focal point for the task and be responsible for ensuring that PTW compliance is maintained throughout the on-board RPAS operations.

7.2 RPAS Service Provider Control of RPAS Operations Offshore

7.2.1 RPAS Manager and Flight Team Roles and Responsibilities

All of the RPAS activities should be overseen remotely by the service provider's operations manager or project manager who supports the RPAS team with assignment preparation, operations and assignment of post operations duties and acts as the Operator liaison.

7.2.2 RPAS Pilot Operations Manual

A RPAS service provider should have a comprehensive operations manual that is routinely kept up to date and approved by the RPAS company accountable manager. When applicable, the manual should also be approved by the regulatory authority (e.g. TC) and subject to contractual requirement, by the Operator's aviation advisor. A sample contents list is provided in Appendix B.

Access to the RPAS pilot operations manual should be made available to the Operator prior to and during the contract for RPAS services.⁸

7.2.3 Communications

During RPAS operations, it is a mandatory requirement to establish a formal means of communication between the RPAS pilot and payload operator and additionally, between the RPAS operator and the MIS (e.g. radio room, central control room, bridge).

⁸ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1*, 2017)

Note: Communications between the RPAS operator and MIS may be controlled by the RPAS observer.⁹

7.2.4 Familiarization with Installation Topography and Hazardous Areas

Prior to undertaking any RPAS activities on or near a MIS, the RPAS operations team, assisted by the operator shall familiarize themselves with the layout, topography, processes, hazardous areas and the types of upsets or emergencies that may occur. Focus should be on ensuring that the planned RPAS operations can be safely managed without interference or jeopardizing other on-board operations. This familiarization shall occur prior to completing the formal hazard identification and risk assessment for the activity as risks and hazards may be identified by the RPAS crew that would not typically be identified by the operator and vice versa.¹⁰

7.2.5 De-confliction (during SIMOPS) with Offshore Flight Operations

Procedures shall be in place to ensure that adequate helicopter (and fixed wing, when applicable) de-confliction is factored into the RPAS flight program. As a minimum, the RPAS should be on deck and stowed no less than 30 minutes prior to a scheduled helicopter arrival or 30 minutes after its departure.

Prior to planned RPAS operations on a MIS, the HLO/heli-admin (or delegated responsible person) shall ensure that communications (written and during shift handover meetings) regarding RPAS operations being conducted are made and the times these operations are scheduled to take place. Helicopter (and fixed wing) Operators, air traffic control and flight crews should also be made fully aware of RPAS activities during the flight planning phase for scheduled flights to the MIS and to nearby facilities within the area of operations of the RPAS.

Updates on the status of RPAS operations shall be communicated to flight crews by the HLO/radio operator during the approach phase of the flight, with continual updates being provided throughout.¹¹

7.2.6 De-confliction with Marine Activities

Procedures shall be in place to ensure that adequate de-confliction with surface vessels servicing the MIS is effectively achieved.

Standby and other vessels working in close proximity to the MIS (e.g. supply vessels, tankers, diving vessels, etc.) shall be made aware of ongoing RPAS operations by the radio operator and a listening watch maintained. Flight routes of the RPAS shall be such that they avoid flying over

⁹ *ibid*

¹⁰ *ibid*

¹¹ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

or directly alongside any vessel in the area. Similarly, de-conflicting with installation crane activities is also critical.¹²

7.2.7 RPAS Flight Planning, Conduct and Surveillance

The RPAS flight team should conduct a pre-operations briefing for each day's activities that details, as a minimum, the planned flight schedule, the designated take off/landing area(s), location weather forecast including motion conditions for the MIS (as applicable), intended areas of RPAS activity, no-fly zones (as determined during the risk/hazard assessment) and potential installation operating effects on the RPAS program (e.g. turbulence and thermal effects from turbine exhausts, vents, areas of potential radio-frequency/magnetic interference and GPS denied areas).¹³

The RPAS crew shall verify that they have reviewed the RPAS maintenance records to ensure that pre-flight and periodic inspections are up to date and the RPAS is airworthy in all respects.

7.3 Offshore Transportation and Accommodation of RPAS Personnel and Equipment

7.3.1 Transporting and Accommodating RPAS Personnel Offshore

Authorization and arrangements for the transportation and accommodation of members of the RPAS crew on an offshore MIS is the responsibility of the Operator. Once onboard the MIS efforts should be made to keep the flight crew (typically a 2-person team) together in one room or in separate rooms if space allows. This is primarily due to crew duty times and rest requirements and also provides a space for the crew to rest during down time and weather standby days.

7.3.2 Manifesting / Transporting RPAS Equipment Offshore by Air or Sea

RPAS equipment authorized for transportation to an offshore location should be packed, manifested and dispatched in accordance with the helicopter service provider, the respective operator and RPAS company cargo handling procedures.

Equipment classified as dangerous goods shall be transported in accordance with TC *Dangerous Goods* (TDG) regulations which covers both air and marine cargo. Equipment classed as dangerous goods should be handled and stored onboard a MIS in accordance with the programs established onboard the MIS and in accordance with the requirements for hazardous substance as outlined in Part 10 of the *Transitional OHS Regulations*.

¹² ibid

¹³ ibid

7.3.3 Dangerous Goods Compliance (e.g. Batteries)

There may be a requirement to transport batteries to an offshore MIS via air freight. If so, the batteries must be packaged and transported as per the Transport Canada TDG Regulations and the Helicopter Service Provider and offshore installation requirements, relevant to the specific battery type. Appropriate information and instructions should be highlighted on a safety data sheet that is specific to the battery.¹⁴

Batteries should be handled and stored onboard a MIS in accordance with the programs established onboard the MIS and in accordance with the requirements for hazardous substance as outlined in Part 10 of the *Transitional OHS Regulations*.

8.0 OPERATING REMOTELY PILOTED AIRCRAFT SYSTEMS

8.1 RPAS Operating Requirements and Authorizations

The aim of a commercial RPAS service is to collect data on an MIS using a variety of on-board payloads, while adhering to strict flight safety principals and high standards of professionalism.

To undertake a RPAS commercial operation, the pilot is required to meet the knowledge and competency requirements for advanced operations as listed in *CARs Part IX Division V Paragraphs 901.62-901*. It is important to note that should a foreign operator (non-Canadian or permanent resident) be hired to do the work, they will not be able to apply for an Advanced Operations Pilot Certificate. Instead, they must provide a copy of a TC issued Special Flight Operations Certificate (SFOC) that clearly identifies the applicant, names, aircraft and approved locations/dates/times for their requested operation.

In the absence of more detailed operating guidelines it is recommended that RPAS operators comply with *CARs Part IX*, CAA, CAP 722, IOGP and Oil & Gas UK UAS Operations Management Standards and Guidelines, as appropriate to the operation. In particular, the RPAS pilot training and competence requirements for working offshore shall be adhered to.

RPAS operators working offshore must be qualified Advanced operators and shall use the TC rules for advanced operations as the baseline for all RPAS activities carried out in Canada.¹⁵

¹⁴ <https://www.tc.gc.ca/eng/tdg/transporting-batteries.html>

¹⁵ See CARs Part IX.

8.1.1 RPAS 'Permission to Operate' Standard

To review the requirements for gaining 'permission to operate' in Canadian airspace, see TC, *CARs Part IX, 901.54, 901.62*.

Unless permitted otherwise the following basic requirements apply for RPAS that are 25 kg or less:

- RPAS must be operated within Visual Line of Sight (VLOS) at all times during the flight
- RPAS must be Safety Assured for the type of operation based on airspace classification and lateral distance to people not associated with the operation. The three classifications are:
 - Controlled Airspace
 - Near People (5m – 30m)
 - Over People (Directly overhead – 5m)
- RPAS must be operated at an altitude of not more than 400 feet above ground level or (in the event that operations must be flown higher) within 200 feet laterally and not more than 100 feet above a building or structure
- Night operations require adequate navigation lighting onboard the RPAS
- No pilot shall operate more than one RPAS at a time
- RPAS must at all times give way to and not operate at the same time as other crewed aircraft; priority will be given to crewed aircraft (see also section 7.2.5)

8.1.2 RPAS 'Permission to Operate' Standard

CARs Part 9 prescribe the requirements for gaining 'permission to operate' in Canadian airspace.

8.1.3 Quality Management

A formal quality management system shall be in place. RPAS operating companies should hold *ISO 9001* certification. This certification scope should cover all the areas of the business that contribute to offshore activities.

The *ISO 9001: 2015* (or as updated from time to time) certificate (or equivalent) shall be issued by an authority that has been certified to ISO 17021 standards.¹⁶

Additional regulatory certifications such as Lloyd's Register (LR), DNV-GL, American Bureau of Shipping (ABS), etc. should be considered an asset.

¹⁶ *ibid*

8.2 RPAS Training and Competence

8.2.1 Introduction

Commercial RPAS operations can vary significantly in terms of the training and experience required for an operator/pilot to be considered competent for a specific task.

Currently there are numerous types of RPAS operations that are carried out in an offshore environment, such as:

- i. Aerial photography/survey/security

These operations typically involve flying in an open space away from structures. An example of this would be taking overview photographs of an offshore installation. This task requires a lower level of skill than required for close inspection flying, as the pilot will have more time and space to react to system anomalies or failures or changes in weather conditions. Nevertheless, the pilot should undertake additional training in accordance with operator directed standards and be assessed as competent against an industry approved set of criteria before being deemed competent to carry out offshore aerial photography or survey tasks.

- ii. Inspection operations

These operations account for the majority of RPAS offshore activities. This usually involves flying over water, and/or close to or under structures, in order to get detailed imagery or data of the MIS. An example would be conducting a close visual inspection of a flare boom. Flying close to structures carries a potentially higher degree of risk as the pilot has less time to react to an unplanned event. There is also a higher probability of encountering turbulent air, the presence of explosive atmospheres and systems anomalies caused by severe magnetic disturbance, loss of GPS, etc. The pilot should therefore receive additional training in accordance with operator directed standards and be assessed as competent against an industry approved set of criteria before being deemed competent to carry out offshore inspection operations. These criteria will be more rigorous than those required for aerial photography/survey activities.¹⁷

Additional guidance is provided in the Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017* & Transport Canada *CARs Part IX*

¹⁷ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*) & (Transport Canada *CARs Part IX*)

8.2.2 Managing RPAS Team Training and Competence

Commercial RPAS operating companies will generally be expected to manage and conduct their flying activities in a manner similar to established aviation industry practices. This includes promulgating the policies, practices and procedures required for RPAS pilot and support team training, recurrent training, competence and currency requirements and line checks, etc.

Processes for RPAS pilot selection, initial and recurrent type training, currency requirements, competence assessment and record keeping should be determined by the individual RPAS operating company and be embedded in the management system. To this end, the RPAS company's operations manual shall have detailed RPAS type training and recurrent training policies with adequate systems in place for undertaking periodic competency checks for each offshore RPAS pilot/team member.

With rapid advances in the deployment of RPAS, it is expected that potential offshore RPAS pilots will be drawn from a pool of pilots with previous RPAS operational pilot experience. It is important for commercial RPAS operating service providers to structure their training and competence assessment policies to ensure pilots meet the requirements for complex offshore RPAS operations.

The RPAS service provider shall also maintain up-to-date records of qualifications, training and competence assessments for each individual RPAS pilot/crew member assigned to offshore RPAS duties.

As part of the Operator's oversight, training records, along with the operations and training manual, shall be reviewed by a competent aviation auditor appointed by the Operator, prior to deploying a RPAS team offshore.

MIS Operator aviation auditors should use their company aviation auditing standards already in place for fixed and rotary wing and generally apply these to RPAS operations, with minor amendments. Airworthiness and maintenance should be performed in accordance with OEM instructions, *CARs Part 9 (901.29, 901.30, 901.31)*.

8.2.3 Remote Pilot Selections Standard

The commercial RPAS service provider selection process for employing potential RPAS pilots, engineering and support staff and contractors should follow a structured and well-defined process that is commonplace in the aviation industry for recruiting personnel for training to operate as licensed professionals.

Following a successful application, the candidate should proceed to personal and technical interviews, and a practical RPAS flight assessment. To achieve the goal of qualifying as an offshore

RPAS pilot, candidates should also be able to demonstrate an aptitude for working and flying a RPAS in a hostile environment.¹⁸

8.2.4 RPAS Pilot Initial Training and Experience

Operating a RPAS in and around offshore marine installations and structures requires experienced and specifically trained Remote Pilots. There are many variables to be considered during the planning for and execution of a RPAS survey and/or inspection. Many of these variables can be taught in a benign environment but a significant number come only from experience and competence gained by flying in and around different structures in a hostile environment.

An individual must be able to demonstrate an acceptable level of training and competence prior to flying in offshore environments.

Initially, an offshore installation RPAS pilot shall attend and pass examinations at a RPAS flight training ground school followed by practical flight assessments conducted by a TC qualified flight reviewer in accordance with *CARs Part IX*.

The initial training course should include but not necessarily be limited to:

Theory

- *Aeronautics Act*
- CARs
- Airmanship and aviation safety
- Human factors
- Meteorology
- Principles of flight
- RPAS components
- Airspace classification
- Basic map reading
- Operating procedures
- Radio communications

Practical Flight Assessment

- The student must be able to demonstrate skills including take-off, climb, descent, turning, judging distances, maintaining altitude, safe operation following the sudden loss of GPS stability and landing
- Recovery from unusual situations - lost link, fly away, etc.

¹⁸ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1*, Section 2017)

- Assessments should be carried out using all flight modes (in particular manual flight mode) if students are intending to undertake offshore operations
- Understanding how the RPAS operates in extreme weather (cold, high winds, gusts, fog, etc. is critical to the success of an offshore RPAS operation)

Regardless of prior experience, all potential remote pilots are required to obtain a TC *Remotely Piloted Aircraft Systems Pilot Certificate (Advanced Operations)* before undertaking specific offshore training and certification. Obtaining this level of training, experience and demonstrated competence is vital to ensure a RPAS is operated in a safe and professional manner at all times.

Refer to Transport Canada, *CARs Part IX, 901.64 & (additional guidance provided in Oil and Gas UK, UAS Operations Management Standards and Guidelines Issue 1, 2017)*

8.2.5 Offshore Remote Pilot and Support Crew Training, Recurrent Training, Competence and Currency Requirements

The commercial RPAS service provider training system for candidates to advance toward gaining a RPAS pilot authorization for undertaking offshore activities, shall be promulgated in the company's operations manual (COM).

The ground school and flight syllabus covering advanced offshore flight training (including RPAS flight training for camera and inspection operations) and a formal assessment of competence is required before a student is permitted to act as a remote pilot for offshore projects. These shall be in accordance with local regulations (e.g. TC). Training should include but not be limited to:

Ground Training:¹⁹

- Further systems training - GPS vulnerabilities, magnetic interference issues and flight system dependencies – Inertial Measurement Unit, Barometer, GPS and interaction with the flight control systems
- Hazard awareness and risk management in complex industrial (offshore) environments
- Data collection techniques
- Shipping Dangerous Goods by Air training
- Advanced systems knowledge - flight systems theory
 - GPS multipath
 - Accelerometer and gyro errors
 - Magnetic interference influence on flight systems
 - Electromagnetic interference effects
 - Local barometric pressure anomalies and effects
 - Autopilot control theory, Kalman filters and combination effects of sensor degradation
 - Offshore weather and sea influences

¹⁹ (Oil and Gas UK, *UAS Operator Training and Competency Section 4.2*)

- Advanced data collection techniques

Onshore Flight Training:

- Operations in magnetic interference areas
- Operations in congested areas
- Operations in potentially explosive environments
- Manual flight skills assessments in confined areas and close to structures

Once a candidate is assessed as suitable for upgrading to offshore RPAS pilot, students should undertake a further training package that includes scenarios that could be expected to be encountered onboard an offshore installation.²⁰

Flight Training:²¹

- Advanced manual flight - look-down scenarios, close to structures, all orientations
- Operations around magnetic interference inducing structures
- Operations under deck and look-down scenarios including GPS denied areas
- Close visual inspection operations at distances >50m from pilot position
- Operating in induced turbulence and rotor streaming areas
- Recovery from unexpected conditions or system failures

Less experienced offshore RPAS pilots should initially be supervised/mentored on-site by an experienced industrial survey/inspection RPAS pilot instructor. This period of supervised work should be carried out in an industrial/commercial survey/inspection environment (either onshore or offshore) before being considered for an offshore Pilot in Command (PIC) role.

Recurrent Training

RPAS pilot recurrent training and line checks shall be carried out in accordance with *CARs Part IX* and company Standard Operating Procedures (SOPs)/internal policy.

8.2.6 Minimum Crew Composition and Competence Requirements

For the purposes of offshore surveys and inspections using RPAS, the RPAS service provider should deploy, at all times, a minimum crew composition of two persons forming the 'RPAS team' plus one observer provided by the Operator. The RPAS team should be comprised of the following qualified and current individuals:

1. Remote pilot (PIC) and a payload operator or;
2. Remote pilot (PIC) and an inspection engineer

A team made up of two newly qualified pilots each with less than 10 hours supervised

²⁰ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

²¹ (Transport Canada, *CARS Part IX, 901.63, 901.64*)

industrial/commercial survey/inspection flight experience on airframe type, should not be considered safe to work in an offshore environment.²²

8.2.7 RPAS Visual Observer

To assure safe operations, the RPAS team and aircraft shall be visually observed by a responsible person familiar with the MIS and its operational safety requirements. The visual observer should also be the radio link between the RPAS team and the MIS to assure agreed processes are being followed against the predetermined safety plan and corrective actions are taken in the event of an incident (call to muster, etc.) during RPAS operations.

The visual observer must be able to observe see the RPAS without being immersed in a virtual world which precludes them from spotting other hazards (e.g. remote video terminals first-person view device operations). Therefore, the use of video goggles is not acceptable while performing visual observer duties.²³

8.3 RPAS Equipment

8.3.1 RPAS Rotorcraft Airframe/Load Platform

The choice of RPAS airframe/power plant/load platform configuration for specific tasks is the joint responsibility of the Operator and the RPAS service provider and should include the following considerations during the selection process:

- A reliable (reliability data should be available) and safe, fit-for-purpose RPAS system
- That the following criteria should be inherent in the selected RPAS system to qualify as 'fit for purpose' for offshore operations:
 - The RPAS airframe is of robust design and construction (materials and component selection should be of an acceptable standard);
 - The RPAS is capable of sustained flight by aerodynamic means;
 - The RPAS is remotely operated either manually or automatically through a ground control station controlled by the remote pilot;
 - The RPAS is reusable;
 - The RPAS has robust loss of link capability and resistance to cyber-attack;
 - The RPAS maximum operating range is accurately defined and formally recorded to ensure, as far as reasonably practicable, that under normal operating conditions a fly away event is unlikely to occur;
 - The RPAS is certified for operations in the environment in which it is being used (i.e. a potentially explosive atmosphere or a harsh environment); and

²² (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1*, 2017)

²³ *ibid.*

- The RPAS system has been reviewed and accepted by a competent authority (i.e. certifying authority).
- The RPAS has flight control and battery redundancy and is equipped with the following modes and software architecture:
 - Automatic GPS modes (unless being operated in a GPS denied environment)
 - Automatic height modes
 - Manual backup modes
 - Return to Home (RTH) capability
- The RPAS should have a mobile control station equipped with manual controls and backup capability when automatic modes are not available to the remote pilot.

The RPAS shall have the ability to be landed in a controlled manner in the event of a single motor/propulsion failure.²⁴

8.3.2 RPAS Power Plants and Rotor Systems

The power plants (e.g. electrical motors) are critical components and have a direct effect on overall RPAS performance. All power plants used in the RPAS shall be routinely and properly maintained as part of the RPAS system maintenance program.

The RPAS systems maintenance program shall be fully detailed in the operations manual.

Multi-rotor RPAS platforms shall be high reliability and possess sufficient redundancy in the propulsion/rotors system to permit continued, fully controlled flight in the event any one power plant becomes inoperative.

The RPAS service provider is required to provide performance data on the type of power plant being used and how environmental conditions in which the RPAS is being operated affects power plant output. Additionally, this performance data should extend to determination of how usage (i.e. accumulated operating time) reduces power plant performance. This is an important safety factor. (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

8.3.3 RPAS Battery Requirements

Batteries used for powering the RPAS propulsion/rotor systems (including electronic speed control), flight control systems (e.g. receivers, transmitters, servos and flight management), payload components (e.g. cameras, etc.) and ground stations vary greatly in type, capacity and operating characteristics. Invariably, the batteries used in any RPAS will be susceptible to impact damage and incorrect charging, among other things (e.g. ambient temperature and charge cycles).

²⁴ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

It is therefore imperative that the RPAS service provider's operations manual, fully details all battery types used (e.g. Lithium polymer (LiPo), NiMH, Li-ion, Alkaline) and the associated safety instructions/precautions for battery management, charging and discharging, packing, carriage by air and sea and battery disposal.²⁵ Batteries should be handled and stored onboard a MIS in accordance with the programs established onboard the MIS and in accordance with the requirements for hazardous substance as outlined in Part 10 of the *Transitional OHS Regulations*.

8.3.3.1 Battery Management

Healthy and fully functioning batteries are integral to ensuring the safe and efficient operation of a RPAS and completing the assigned tasks in a timely manner. To ensure this, RPAS service providers shall have a battery management system in place that as a minimum should include the following key areas:

- Battery Inventory - To ensure sufficient batteries are available for the assigned task and to provide accountability for all batteries transported to and used at the work site
- Battery Charging - LiPo batteries should be handled and managed with great care to ensure they remain undamaged and properly protected during charging and discharging cycles and cell testing. During charging, discharging and cell testing, LiPo batteries should be placed in a robust fire proof enclosure to contain any fire condition that may potentially arise (i.e. due to shorting between cells). There is also a requirement for the area where batteries are stored and maintained to be properly ventilated
- Battery Health Checks - Specific checks (depending on battery type) are carried out to ensure that batteries are in a suitable condition and retain the requisite charge to complete the task safely. Any battery that does not reach the minimum standards or shows signs of being faulty should be removed immediately, quarantined and properly documented

Under no circumstances should damaged or faulty batteries be used in an RPAS or transported by air.

- Battery Disposal - Damaged or underperforming batteries should be removed from the battery line, quarantined and noted on the task inventory

If a battery is damaged or is found to be faulty it should be brought to the attention of the person on the installation responsible for managing disposal of hazardous waste from the installation. The installation will have procedures in place for hazardous waste disposal and these batteries should be fully discharged and brought ashore (by sea) and disposed of by a registered waste collection company, compliant with Environmental Protection Plan and Waste Guidelines. The number of times a battery has been charged and discharged shall be recorded. If the battery cannot be safely discharged due to damage, it is recommended to submerge the battery in salt

²⁵ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)

water (ocean water) for 72 hours before disposing. In the event of a battery emergency (fire/thermal runaway, etc.) battery-specific emergency response equipment (extinguish/containment) shall be readily available on site.²⁶

8.3.4 RPAS Electronic and Data Capture Systems Requirements

Data capture should always be made in its raw format. Considerations should be given to the following:

- Metadata associated with the imagery should be available
- Maintenance of the integrity of the raw imagery during the storage process
- Alterations or amendments to the raw imagery stored separate to original raw data image and associated meta data

Data storage from Secure Digital card or origin hard drive to central server should ensure the following:

- Continuous chain of custody
- Local storage data encryption
- Central storage data encryption
- Once data centrally held, appropriate security policy and backup management

8.4 RPAS Limitations

8.4.1 Visual Conditions for Operations

The term visual meteorological conditions (VMC) does not really apply to VLOS operations because there are no specifically laid down VMC criteria for this. An RPAS can be operated safely on the exterior of an installation in weather conditions that are much lower than the VMC minima for manned aircraft.

The key element is that the RPAS is kept within the direct, unaided VLOS of the person flying it and the visual observer - in other words, the remote pilot and visual observer have to be able to see the aircraft at all times. This principle can be carried on to night operations also. If the aircraft can be seen and controlled safely at night while when flying in a floodlit area for example, there should be no major reason to prevent the flight taking place - again, the key point is whether or not the RPAS can be seen clearly by the crew. TC rules dictate that adequate positional/navigational lighting is required for night operations.

²⁶ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1, 2017*)
NS Act: **210.019(1)(h)**

When night time operations are required on the exterior of an installation, adequate lighting must be provided to ensure the pilot has visual contact with the RPAS at all times. Night time operations must be in accordance with TC/NAV Canada/operator regulations and/or guidance, as appropriate to the operation.

RPAS operations in confined spaces such as tanks and voids shall be subject to special consideration, risk assessment and rigorous work permit controls. Visual conditions in these cases will be dependent on the provision of sufficient artificial lighting to allow good visual references to be obtained, to ensure that proper RPAS control can be maintained throughout the flight duration. If the RPAS Pilot is to enter a confined space, they must have the appropriate confined space training and in accordance with Part 11 of the Transitional OHS Regulations and entry into the confined space must be performed in accordance with the established PTW process onboard the MIS and the space must be confirmed to be gas and hazard free (including maintaining a safe distance from any personnel as per *CARs Part 9*) and monitored throughout the operation.²⁷

8.4.2 Weather Considerations

8.4.2.1 Wind

The Operator's adverse weather policy (or established weather limits) is the controlling factor for all offshore installation operations, including RPAS flights.

Due to the extreme weather conditions encountered in the Atlantic Canada Offshore Petroleum Area, wind and weather are both very important considerations when performing RPAS operations. The RPAS operational envelope should specify the wind limits for the type of RPAS in use and the type of operations being conducted, and this could be below the established operating limits for the MIS.

If the weather forecast shows that wind conditions are anticipated to be outside of the RPAS operating limits at some stage during the flying task, the Remote Pilot should land the RPAS 30 minutes prior to the forecasted change. Frequent monitoring of winds during the operations is necessary and should be coordinated with personnel responsible for monitoring the weather onboard the MIS.²⁸

8.4.2.2 Precipitation

Rain and moisture can affect some exposed parts of the RPAS and its payload, additionally it can potentially degrade the quality of the imagery. This is an important consideration for the RPAS pilot when selecting the RPAS system (e.g. airframe and payload) for the specified task and shall be fully considered in the Risk Assessment.²⁹

²⁷ (Oil and Gas UK, *UAS Operations Management Standards and Guidelines Issue 1*, 2017)

²⁸ *ibid*

²⁹ *ibid*

8.5 Record Keeping

Full formal and detailed records of RPAS flights, flight hours, tasking and maintenance shall be maintained by the RPAS service provider and these requirements should be prescribed in the operations manual.

All RPAS crew members (e.g. pilots, observers, maintainers, etc.) should be in possession of a log book that provides a continuous personal record of individual qualifications, regulatory and company authorizations, training, recurrent training, task competencies and flights/tasking carried out.³⁰

³⁰ *ibid*

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APPENDICES

APPENDIX A

Sample Content for RPAS Operational Safety Plan

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Appendix A: Sample Content for RPAS Operational Safety Plan³¹

The safety plan is an important operational document specific to offshore MIS and shall be mandatory for all RPAS operations. The purpose of the safety plan is for the Operator to fully understand the safety and communications procedures that a RPAS operations team will follow during the tasking, prior to giving approval for the project to proceed. The safety plan should contain the following details:

1. Introduction
2. RPAS Specifications and Limits
 - a. RPAS technical specifications
 - b. Limitations and restrictions
3. Operation description
 - a. Scope of work(s) to be executed
 - b. Required equipment and personnel
 - c. Securing the airspace
 - d. Take-off and landing sites
 - e. Exclusion zones (no fly zones)
 - f. Airborne procedures including details of flight paths
 - g. Communication protocol
4. Operations Restricted Access
5. Alarms
 - a. Fire and gas release
 - b. Blowdown/increased flare rate drill
6. Preventive Matters
 - a. Prop failure
 - b. Loss of payload/dropped object risk
 - c. Battery failure
 - d. Loss of communication link
 - e. Resistance to magnetic disturbances and anomaly
 - f. Log file recording

³¹ Oil and Gas UK

APPENDIX B

Sample Content for RPAS Pilot Operations Manual

Appendix B: Sample Content for RPAS Pilot Operations Manual

Part A – General

1. Organization and Responsibility
 - a. Scope
 - b. Purpose
 - c. Company structure and accountable managers (include organogram)
 - d. RPAS services description
 - e. RPAS equipment overview
 - f. Regulations and guidance
 - i. Aviation regulatory compliance
 - ii. C-NLOPB/TC guidance
 - g. Operations and training personnel
 - i. Operations director/operations manager
 - ii. Remote pilot
 - iii. RPAS camera/payload operator
 - iv. Remote pilot instructor
2. Company Authorizations
 - a. Operation description
 - b. TC/NAV Canada Permission for Aerial Work
 - c. Other permissions (if applicable)
 - d. Company personnel training and competency requirements
 - e. Company personnel medical requirements and certification (if applicable)
3. Risk Analysis Model
 - a. Policy
 - b. Risk assessment
 - c. Method statement
 - d. Safety plan
4. Safety Management System (or equivalent)
5. Quality Control System
 - a. ISO 9001:2015
6. Rest Time Policy and Human Factors
 - a. Policy
 - b. Human factors
7. General Operating Procedures and Restrictions
 - a. Remote pilot basic requirements
 - i. Remote pilot qualification
 - ii. Conduct
 - iii. Remote pilot specific duties
 - iv. Competency
 - b. Met assessment
 - c. Pre-flight duties
 - d. Airspace management
 - e. Flight procedures

- f. VLOS
- g. RPAS system basic requirements
- h. Checklist procedures
- i. Checklist information
- j. RPAS team operations
- k. Loss of link
- l. Airworthiness
- m. Post-flight duties
- n. Tech Log
- o. Logbook
- 8. Accidents and Incidents
 - a. Incident reporting
 - b. Post-accident management
 - c. Remote pilot grounding
- 9. Types of Operations
 - a. Description
 - b. VLOS
 - c. Authorized operations

Part B – RPAS System Manual

- 1. General
- 2. Checklists
- 3. Description of the RPAS
 - a. Remotely Piloted Aircraft Systems
 - b. Mobile control station
 - c. Payloads
 - d. Batteries and chargers
 - e. Transport case
- 4. RPAS Operation
 - a. General safety
 - b. Flight modes
 - i. GPS mode
 - ii. Height mode
 - iii. Manual mode
 - c. Automated system checks
 - d. Emergency modes
 - e. RPAS setup procedures
 - f. Mission control station setup procedures
 - g. Flight phase
 - i. Launch procedure
 - ii. Mission procedure
 - iii. Recovery procedure
 - h. Visual and acoustic warnings
 - i. Limitations information

5. Status Display
 - a. Functions
 - b. Emergency modes
 - c. Display menus
6. Waypoint Navigation
 - a. Automation
 - b. Mode redundancy
 - c. Geo-reference
 - d. GPS
 - e. Payload control
 - f. RVT payload control

Part C - Authorized Operations

1. Offshore Installation Inspections
 - a. Introduction
 - i. General
 - ii. Applicable documents
 - iii. Onshore inspection
 - iv. Offshore inspection
2. Standard Operating Procedures (SOP)
 - a. Preparation
 - i. RPAS minimum serviceability
 - ii. Infrastructure study
 - iii. Equipment and inventory
 - iv. Operations assignment
 - v. Safety plan
 - vi. Risk assessment
 - vii. Method statement
 - b. Inspection types
 - i. Onshore
 - ii. Offshore

Part D - Remote Pilot Training

1. General
 - a. Policy
 - b. Objectives
 - c. Applicable documents
 - d. Approved training RPAS
 - e. Instructional staff duties and responsibility
 - f. Pilot instructor
 - g. Trainee evaluation
2. Ground School
 - a. General
 - b. Objectives

- i. Course description
 - ii. Course contents
 - iii. Supplementary training
 - c. C-NLOPB/CAPP minimum training
 - i. BST
 - ii. HUET/ HUABA
 - iii. Offshore medical
 - iv. Fall Arrest, CSE, H2S, etc. (as required)
 - 3. Camera Operation Training
 - a. RPAS team operations
 - b. Remote viewing terminal (RVT) - If required/permitted
 - c. Communications procedure
 - 4. Industry Specific RPAS Inspection Training
 - a. Payload operations
 - 5. Initial RPAS Training
 - a. General
 - b. Training RPAS familiarization
 - c. Emergency procedures
 - d. Degraded mode RPAS flight training
 - e. GPS
 - f. Height
 - g. Manual
 - h. Initial RPAS training flight test
 - 6. Advanced RPAS Training
 - a. General
 - b. Inspections training against infrastructure
 - c. Task specific flight training (e.g. surveillance, photographic, infrastructure inspection)
 - d. Advanced RPAS training flight test
 - 7. RPAS Inspection Type Training
 - a. Inspection RPAS familiarization
 - i. Payload
 - ii. Circuits
 - iii. Modes - GPS; height; manual
 - iv. Emergency
 - b. Inspection RPAS type training against structures
 - c. Type training flight test
 - d. Remote pilot consolidation training
 - e. Scope
 - f. RPAS team ops
 - g. Mentor program

Part E - RPAS Maintenance and Servicing

1. Policy

- a. RPAS maintenance policy
 - b. RPAS maintenance schedules and periodicity
2. RPAS Accountable Managers and Technicians
 - a. Independent checks
 - b. Extensions and U/S equipment red line entries
3. Technical Log
4. Minimum Equipment List
5. Spares Stores and Inventories
6. RPAS Cleaning
7. Batteries
 - a. Inspection procedures
 - b. Storage and disposal
 - c. Transport (including Dangerous Goods requirements)
 - d. Charging practices and precautions
 - e. Tracking and Inventory arrangements
8. Routine Maintenance
 - a. Mission control station
 - b. Other inspections equipment

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