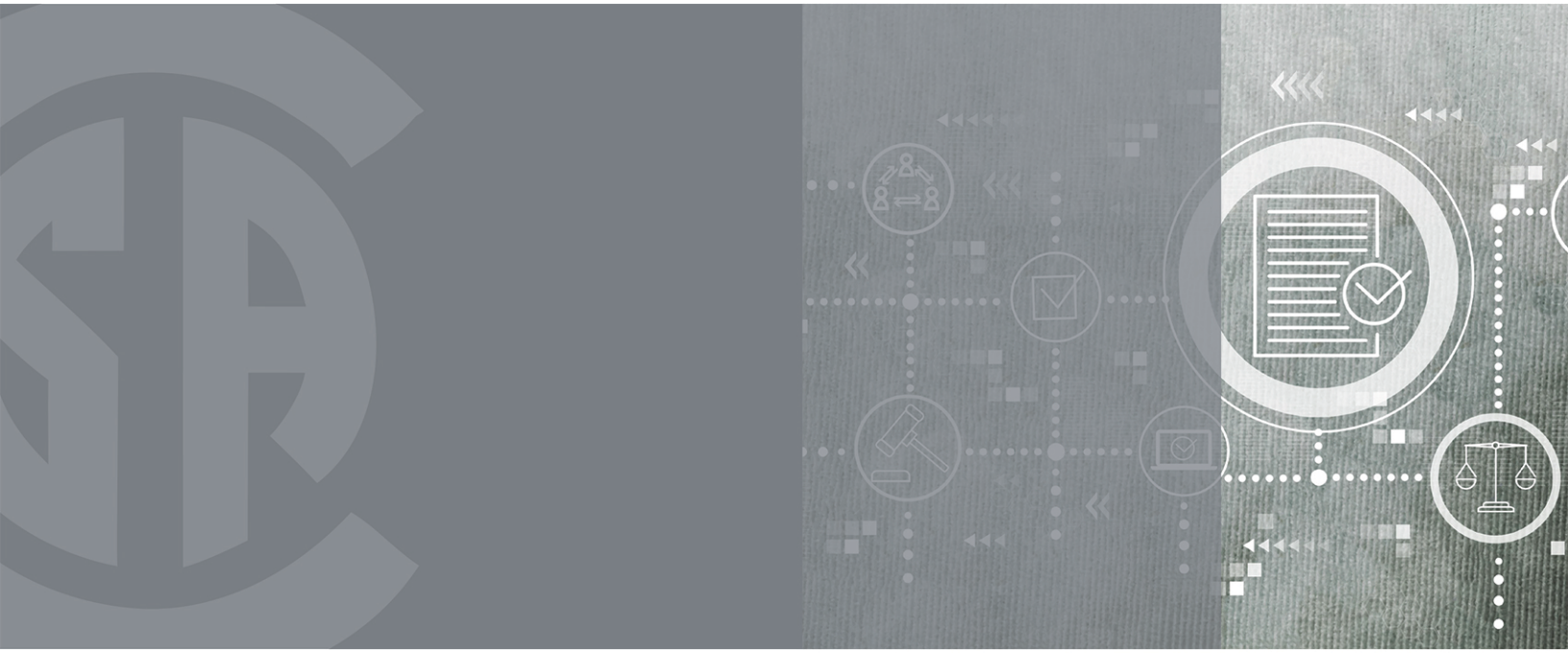
CSA EXP15:21

Remotely piloted aircraft system (RPAS) operator competency requirements for emergency services



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A. Wollbaum	Defence Research and Development Canada Centre for Security Science	
A. Holbeche	CSA Group	*Project Manager*

Preface

This is the first edition of CSA EXP15, *Remotely piloted aircraft system (RPAS) operator competency requirements for emergency services*. This Express Document is not a consensus product; that is, it is not a Standard and it has not been formally reviewed or approved by a CSA Technical Committee.

CSA Group acknowledges that the development of this Express Document was made possible, in part, by the financial support of the Canadian Safety and Security Program, which is led by Defence Research and Development Canada's Centre for Security Science (DRDC CSS), in partnership with Public Safety Canada.

This Express Document was prepared by the Development Committee on EXP15 and reviewed by the Project Review Committee on EXP15.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Express Document is stated in its Scope, it is important to note that it remains the responsibility of the users of the Express Document to judge its suitability for their particular purpose.*
3) *All enquiries regarding this Express Document should be sent to inquiries@csagroup.org.*

CSA EXP15:21
Remotely piloted aircraft system (RPAS) operator competency requirements for emergency services

0 Introduction

0.1 Background

Fire, search and rescue, police, emergency management, paramedic services, and other emergency services are increasingly using remotely piloted aircraft systems (RPAS). RPAS are used to provide enhanced situational awareness, intelligence, surveillance, reconnaissance, and emergency tasking's for various emergencies as identified in the hazardous identification risk assessment (HIRA) in Canada to protect the public and emergency services and to create efficiencies in operations. At present, there are no Canadian guidelines specifically for emergency services use of RPAS. In particular, there is a need for guidance on operator competency with a specific focus on low altitude, short range beyond visual line of sight (BVLOS) operations. The challenge is that emergency services have a mandate to develop these types of operations but are unable due to the lack of federal regulations. This limits the ability to quickly and efficiently obtain real-time situational awareness in emergency response.

RPAS vary greatly in size, flying capability, capacity, and methods of control. The emergency services/ public safety community can and will use RPAS in many different situations and these use cases will grow in complexity and scope in coming years. Each emergency service will have specific needs and requirements, but their operational objectives will be similar: to provide public safety assistance effectively and efficiently and to ensure that emergency service providers are as safe as possible.

For both the United States and Canada, public safety agencies began to implement the use of RPAS in 2013. Data from a US study showed that as of 2018, at least 910 state and local police, sheriff, fire, and emergency service agencies in the U.S. have acquired RPAS.

The use of RPAS can have a positive impact in every public safety sector. This relatively new technology will not only provide efficiency gains but enhance public safety and the safety of emergency services. With the anticipated growth in this sector, it will be important to ensure that any regulatory framework and supporting standards be flexible to allow for innovation and new opportunities.

While there are strong benefits of using RPAS in emergency services operations, current challenges exist, including

a) costs associated with implementing a program, both human and other expenses;
b) lack of knowledge and expertise in aviation by emergency services personnel;
c) time required to develop procedures, manuals, and complete training;
d) lack of standardized training and procedures for emergency services pilots;
e) potential privacy and data breaches;
f) community acceptance; and
g) management of data: how to capture accurate data and process it for decision making and analysis.

0.2 Regulatory environment

Transport Canada introduced amendments to the Canadian Aviation Regulations (CARs) for RPAS operations in 2019 for the safe integration of RPAS operations within visual line of sight in Canadian airspace and pilot certification. To support these regulations, Transport Canada published a new edition of TP 15263 in June 2019. Transport Canada written examinations for pilot certification are in accordance with the knowledge requirements outlined in TP15263. However, operators and training organizations may choose to supplement this Transport Canada guidance document with additional knowledge areas. For example, TP15263 does not address RPAS operations and competency requirements for emergency services in Canada. Emergency operations are often not planned activities because a need for them occurs suddenly and thus all procedures for enabling a safe flight of RPAS need to be carried out as quickly as possible while maintaining the appropriate level of safety.

In addition, there is little guidance to assist emergency services organizations who want to expand their use of RPAS to BVLOS and other more complex applications. Transport Canada is developing a regulatory regime for routine, lower risk BVLOS and voluntary guidelines through standards work will be an important part of this regulatory development process. Enterprise specific guidance will be necessary due to the complexity of these operations and Canada's unique environments.

Within controlled airspace, flight authorization from NAV CANADA is required prior to flight; however, exemptions exist for use of RPAS by first responders in the case of life-threatening emergencies.

0.3 Purpose

The main goal of this Express Document is to improve RPAS performance and safety by the emergency services sector in Canada. This Express Document provides guidance to help public safety or emergency services agencies establish and maintain RPAS programs, including competency requirements for operators and personnel involved with RPAS programs.

Where available, reference to existing standards and/or regulations is provided. Where no guidance is currently available, guidance has been provided.

This Express Document provides information that can be scaled to an organization's size and complexity, and that scaling would be at the discretion of the organization.

1 Scope

1.1 Purpose

This Express Document (herein referred to as "this Document") provides requirements and guidance relating to the safe operation of RPAS for the emergency services sector in Canada.

Clauses 4 and 5 provide requirements and guidance for the operator on the elements of an RPAS program and the ongoing management of an RPAS program.

Clause 6 covers competency requirements for personnel involved with emergency services RPAS programs.

This Document applies to the broad range of uses of RPAS by the emergency services organizations (herein referred to as "the operator") but does not expressly speak to procedures for specific emergency service operations.

This Document does not apply to the use of underwater unmanned vehicles.

This Document does not cover operations involving counter-drone technology, which refers to systems that are used to detect and/or intercept unmanned aircraft.

Note: *This Document is generally applicable to RPAS under the scope of TP 15263; however, this Document may be applied to smaller, sub-250g, RPAS. For any size of RPAS, the expectation is to apply existing requirements for all aircraft, as well as applicable requirements and best practices for the size of RPAS being used.*

1.2 Terminology

In this Document, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Document; "should" is used to express a recommendation or that which is advised but not required; and "may" is used to express an option or that which is permissible within the limits of the Document.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications

This Document refers to the following publications, and where such reference is made, it shall be to the edition listed below.

ASTM International

F3196-18
Standard Practice for Seeking Approval for Beyond Visual Line of Sight (BVLOS) Small Unmanned Aircraft System (sUAS) Operations

F3266-18
Standard Guide for Remote Pilot in Command of Unmanned Aircraft Systems (UAS) Endorsement

F3379-20
Standard Guide for Training for Public Safety Remote Pilot of Unmanned Aircraft Systems (UAS) Endorsement

JARUS (Joint Authorities for Rulemaking on Unmanned Systems)

JAR doc 06 SORA (package)
Available at: http://jarus-rpas.org/content/jar-doc-06-sora-package

ISO (International Standard Organization)

21384-3:2019
Unmanned aircraft systems — Part 3: Operational Procedures

23665:2020
Unmanned aircraft systems — Training for personnel involved in UAS operations

NFPA (National Fire Protection Association)
2400-2019
Small Unmanned Aircraft Systems Used for Public Safety Operations

Office of the Privacy Commissioner of Canada
Guidelines for the Use of Video Surveillance of Public Places by Police and Law Enforcement Authorities. Available at: https://www.priv.gc.ca/en/privacy-topics/surveillance/police-and-public-safety/vs_060301/

Transport Canada
Canadian Aviation Regulations (SOR/96-433)

TP 15263 (June 2019)
Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems, 250 g up to and including 25 kg, operating within visual line of sight

3 Definitions and abbreviations

3.1 Definitions

The following definitions shall apply in this Document.

Chief pilot — the individual responsible for the professional standards of a flight crew.

Operations manager — the position responsible for safe flight operations.

Operator — an organization that is responsible for all aspects of an internal RPAS program.

Payload — all elements of the aircraft that are not necessary for flight but are carried for the purpose of fulfilling specific mission objectives.
Note: *This can include sub-systems such as intelligence and surveillance assets, communication equipment, sensors, cargo, and cameras.*

Public safety/emergency service organization — the agencies charged with the prevention and protection of the public from dangers affecting safety, such as crimes, disasters, and with aiding persons seeking emergency assistance.
Note: *For example, the Search and Rescue agencies tasked by authorities.*

Pilot in command — the pilot designated by the operator, as being in command and charged with the safe conduct of a flight

Visual line of sight — the operation where unaided visual contact is maintained by the pilot or crew at all times with a remotely piloted aircraft that is sufficient to be able to maintain control of the aircraft, know its location, and be able to scan the airspace in which it is operating in order to perform this detect and avoid functions in respect of other aircraft or objects.

Visual observer — the trained person, acting as flight crew member who assists the pilot to see and avoid other air traffic or objects aloft or on the ground.
Note: *The visual observer is charged with constantly watching the RPAS and the surrounding area and alerting the pilot to potential hazards.*

3.2 Abbreviations

The following abbreviations shall apply in this Document.

AHJ — authority having jurisdiction
BVLOS — beyond visual line of sight
CFIT — controlled flight into terrain
DAA — detect and avoid
EMI — electromagnetic interference
HIRA — hazard identification risk assessment
ICS — incident command system
IMS — incident management system
MOU — memorandum of understanding
NOTAM — notice to airmen
PIC — pilot in command
PPE — personal protective equipment
ROC-A — Restricted Operators Certificate Aeronautical
RPAS — remotely piloted aircraft system
SFOC — special flight operations certificate
SMS — safety management systems
SOP — standard operating procedures
SORA — specific operations risk assessment
VHF — very high frequency
VLOS — visual line of sight

4 Program planning

4.1 General

Clause 4 provides recommendations relating to the development and management of an RPAS program for operations supporting public safety organizations. Prior to implementing an RPAS program, the operator should consider those factors that will impact the operations of the program. The key elements of an RPAS program that an operator should consider prior to implementing an RPAS program include

a) mission objectives, risk factors, and risk mitigation;
b) selection of equipment. Consider the purchase of different RPAS models for different missions. Testing and experimenting with less expensive models first can help the organization select the most appropriate RPAS models;
c) regulatory requirements;
d) stakeholder engagement;
e) availability and capability of resources;
f) privacy laws;
g) budgets for equipment and training;
h) management engagement; and
i) training.

The operator may also consider a possible implementation of the RPAS program on a trial basis with a set time for a formal evaluation process in order to provide flexibility to make changes to the scope of services and equipment needed for the program before final implementation.

4.2 Mission objectives

4.2.1

Canadian emergency service organizations use RPAS to support a wide variety of operations. Prior to selecting equipment and developing program policies and procedures, the operator should determine the types of missions that are needed to be deployed by the organization.

Note: *Each operator will have specific needs and requirements, but the objective is all the same: to safely help those in need as effectively and efficiently as possible and to ensure the lives of those responding are as safe as possible.*

The use of RPAS is expanding in public safety operations, both in number of missions and types of missions. Types of missions by operators may include, but are not limited to,

a) search and rescue missions;
b) crime scene processing;
c) cross-agency aid;
d) damage assessment (manufactured or natural event);
e) disaster response;
f) fire or explosion response;
g) infrastructure inspections;
h) investigations;
i) delivery of medical equipment and supplies;
j) pandemic response (e.g., disinfecting public spaces);
k) public relations;
l) special events or public safety assessments;
m) tactical deployment;
n) training and exercises, and

o) terrorism response.

4.2.2

In thinking about the types of missions, the environments and conditions where the RPAS will be used shall be considered to identify potential risks and determine the equipment to be selected and the type of regulatory approval required. Considerations should include

a) area of operation and applicable boundaries;
b) type of airspace, applicable regulations, and potential airspace issues;
c) mission altitudes for approach and departure from the area;
d) predominant and forecast environmental conditions;
e) proximity of manned aviation including proximal aerodromes, airports, or heliports;
f) whether the missions will be conducted with VLOS or whether they will require BVLOS (if so, is there regulatory approval?);
g) whether the missions will include low-light or night operations;
h) length of mission from take-off point;
i) location and height of potential obstacles including, but not limited to, wires, towers, or buildings;
j) distance from persons not involved in the operation and potential flight proximal to or over persons;
k) potential hazardous environments such as smoke, chemicals, or hostility;
l) mission airspace class and need to seek approval or notify the airspace owner;
m) whether other agencies in the area of operation will be using aircraft or RPAS;
n) whether the mission will be compromised by environmental conditions present or forecast; and
o) hazards in the mission area of operation that could compromise the safety of people, property, or the mission.

Note: *For more information on types of missions deployed by emergency services organizations, see Annex C.*

4.3 Stakeholder engagement

In planning for an RPAS program, operators should begin early to engage their jurisdiction's administration and other community members. Operators should work directly with internal and external stakeholder groups before implementing an RPAS program. Building strong relationships and soliciting feedback and guidance will help organizations gain widespread support for their RPAS programs.

The operator should identify potential local stakeholders and develop a stakeholder engagement plan. These stakeholders may include

a) other public safety departments or agencies;
b) elected representatives;
c) civil liberties or privacy interests groups;
d) citizen or ratepayer's groups;
e) local media outlets;
f) health care partners;
g) search and rescue volunteer associations;
h) parks authorities;
i) civil rights and social justice groups;
j) schools;
k) local businesses; and
l) aerodromes, airports, and heliports in the area of operation.

Privacy is the major public concern about RPAS operations. The operator should share information about the intent of the RPAS program, what the RPAS are going to be used for, how they are going to be

deployed, and what they are not going to be used for. Education about the benefits of an RPAS program should be shared with local stakeholders.

Note: *While the use of RPAS by emergency services in Canada is generally supported by the public and community stakeholders, there should be stakeholder outreach to build support and acceptance.*

For additional guidance on developing a stakeholder engagement plan, see Annex A.

4.4 Selection of equipment

4.4.1 General

There are different RPAS for a wide range of applications with many different sizes and features. The operator should consider the following recommendations prior to selecting equipment:

a) confirm equipment is approved in accordance with the requirements of the AHJ (e.g., on the Transport Canada approved RPAS list), if applicable;
b) consider the minimum system configuration and specifications of the products and review quantitative data demonstrating the RPAS capabilities;
c) ensure the RPAS is suitable for the expected operating environment including, but not limited to, weather conditions (e.g., operating temperature range, ingress protection);
d) assess the sustainable life cycle of the equipment; and
e) identify any funding limitations and resources available (i.e., what staff resources will need to be reassigned).

4.4.2 Technical capabilities

The operator should review the operational specifications of various models and find the best fit for their individual purposes. These include the following:

a) Durability: RPAS can crash and need to have rotor blades and belts replaced. As a program is implemented, there will likely be mishaps as pilots get used to navigating and manipulating RPAS in different environments. Having a sturdy RPAS that can withstand some common errors and has replaceable parts can help keep an RPAS program sustainable. Entire system should be weatherproof and able to operate in rain, snow, dust, and salt conditions, as applicable.
b) Battery life and maintenance requirements: Speed, weight of components, temperature, and altitude all affect battery life. Many RPAS with an infrared camera or thermal sensor that sends a live feed back to the pilot can fly for only 20 to 30 min depending upon conditions of use.
c) Distance: The distance an RPAS can travel from the pilot while maintaining a reliable signal from the controller can vary. Organizations should confirm that the distance and any protocols and requirements regarding keeping the drone within sight of the pilot are suitable to the application and expected use.
d) Payload: Organizations should consider what will be attached to the RPAS as part of its operational package. The heavier the components, the larger and stronger the RPAS is required to be. For example, search and rescue organizations use six-rotor drones that can deploy items such as blankets and life vests to those in need. Organizations should also consider if the mission requires the transportation of any hazardous materials.
e) Cameras: With rapid technology advancements, the capabilities and quality of the cameras have increased considerably. Organizations should evaluate the various options available for the mission types.
f) Software/other features.
g) Level of safety assurance (i.e., in Canada, the Transport Canada declaration).
h) Appropriate data security features.

Annex D includes a list of specialized equipment features.

Note: *Transport Canada regulations require manufacturers to provide operators with an operating manual that covers requirements for a maintenance program and operational details. The regulations set out the content that is required in the operating manual. This includes information on the technical capabilities of the system, procedures for operating the system in normal and emergency conditions, and assembly and adjustments instructions.*

4.5 Regulatory approval

Prior to implementing an RPAS program, the operator should understand the federal, provincial/territorial, and local regulations that govern the use of RPAS. Operators should research all regulations within its jurisdiction to ensure that the program will function lawfully and without legal challenges. Operators shall ensure that RPAS team personnel understand the laws and regulations to be followed.

Presently, there are no regulations or legislation specific to use by emergency services organizations. Current regulations are limited to VLOS and regulations for BVLOS are currently under development. As RPAS use becomes an essential part of emergency services operations, many organizations will require BVLOS approval. Operators should plan for this expansion of capability and maintain a watching brief on the evolving regulatory regime for RPAS in Canada, particularly for emergency services organizations.

Communication monitoring is not currently a regulatory requirement for RPAS; however, VHF air radio should be used as a best practice.

Note: *In Canada, Transport Canada establishes and enforces most regulations regarding RPAS use. There are significant regulatory differences with respect to sub-250g RPAS that will impact how an agency deals with requirements for training and SOPs. For any size of RPAS, the expectation is to apply existing requirements for all aircraft, as well as applicable requirements and best practices for the size of RPAS being used.*

5 Operations

5.1 General

Taking federal, provincial/territorial, and any local regulations into consideration, the operator should develop, maintain, and apply additional operational and program information to supplement the information contained in the operating manual. The agency, in conjunction with their stakeholders, shall develop documented standard operating procedures. This information may include

a) overall program administration, including purpose and scope;
b) relevant references (e.g., standards and regulations);
c) management structure and accountability;
d) risk assessment/safety management procedures;
e) authorized missions;
f) training and certification of personnel;
g) safety procedures (before, during, and after missions);
h) reporting procedures; and
i) data management.

Note: *CARs Part IX 901.78 sets out the information that is required to be included in an operating manual provided by the manufacturer.*

5.2 Administration

5.2.1 Authorities

The operator shall assign overall accountability for the RPAS program to an accountable executive. The operator shall establish an appropriate management structure for the program, depending on the needs of the organization and resources available. Overall responsibility for managing the program should be assigned to an operations manager. The operations manager shall be responsible for safe flight operations, including

a) control of operations and operational standards;
b) coordination of operations (maintenance, crew scheduling, payload control, updates); and
c) supervision, organization, function and manning of operations, crew scheduling, training programs, and safety and security.

The operator shall ensure that the operations manager and other designated flight crew meet the qualifications and competency requirements for program personnel outlined in Clause 6.

In the absence of an operations manager, all responsibilities for operational duties shall be delegated to another individual with the knowledge and skills to fulfil the role.

5.2.2 Management structure

Depending on the size and scope of the program, roles in program may include

a) operations manager, whose responsibilities include
    i) control of operations and operational standards of all aircraft operated;
    ii) operations coordination functions which impact on operational control;
    iii) contents of the operations manual;
    iv) supervision of, and production and amendment of, the operations manual;
    v) training qualifications and flight operations personnel;
    vi) liaison with the regulatory authority on matters concerning flight operations including any variation to the air operator certificate;
    vii) liaison with any external agencies which effect operations;
    viii) ensuring operations are conducted in accordance with current regulations and the operations manual;
    ix) ensuring crew scheduling complies with flight and duty time regulations;
    x) ensuring all crew members are kept informed of any changes to applicable regulations and standards;
    xi) receipt and actioning of any aeronautical information affecting the safety of flight;
    xii) dissemination of flight operations safety information;
    xiii) qualifications of flight crews;
    xiv) maintenance of a current operations library; and
    xv) ensuring that responsibilities for operational control functions are delegated to qualified personnel;
b) chief pilot, whose responsibilities include
    i) developing SOP;
    ii) developing or implementing all required crew member approved training programs;
    iii) issuing directives and notices to flight crews, as required;
    iv) the actioning and distribution of accident, incident, and other occurrence reports;
    v) the processing and actioning of any crew reports;
    vi) the supervision of flight crews;
    vii) assuming responsibilities delegated by the operations manager; and
    viii) ensuring that duties are delegated to qualified individuals;

c) pilots and ground crew; and
d) visual observers.

Additional roles may be included as operations become more complex.

5.3 Safety and security

5.3.1 Safety management system

5.3.1.1 General

SMS is a coordinated, comprehensive set of processes designed to manage safety. It requires proactive hazard identification, risk management, information control, auditing, and training. It also includes incident and accident investigation and analysis.

The four pillars of an SMS are
a) safety policy, which defines policies, procedures, and organizational structures to accomplish its goals;
b) safety risk management, which identifies key hazards and assesses their risk followed by implementing controls to mitigate risk;
c) safety assurance, which includes regular and ongoing analysis of the safety policies and controls to confirm that the organization's safety goals are being met. It also ensures that the system can evolve and adapt with change; and
d) safety promotion, through which the organization promotes, trains, and communicates safety with practices that support a culture of safety.

5.3.1.2 Safety risk management

A basic SMS foundation aims to eliminate preventable accidents. The SMS foundation shall include
a) appointing an accountable executive at a high level in your organization that has reviewed your RPAS program and the steps that have been taken to mitigate the risks of introducing RPAS operations into the organization;
b) tracking and circulating manufacturers maintenance and safety bulletins and auditing compliance;
c) encouraging a culture of reporting all incidents and anomalies with a focus on preventing reoccurrence, not on punitive actions;
d) investigating all reports, determining cause, and circulating the information to all RPAS personnel;
e) continually updating training and checklists to reflect lessons learned; and
f) tracking all the above.

Note: *As more complex RPAS operations are considered, there is an expectation by Transport Canada that organizations will demonstrate that they have an SMS that scales accordingly. Safety risk management is the foundational component of even the most basic SMS.*

5.3.2 Authorized missions

All operations shall be conducted in compliance with legislation, regulations, and policies.

Procedures for authorized missions and SOP should be outlined in the operations manual, following a risk assessment for each type of mission. The operator shall take into consideration the laws, regulations, and procedures of the AHJ for each mission type.

For each RPAS type, the operator should document the following information:
a) operational conditions and limitations;
b) area of operations;

c) manufacturer information;
d) special limitations and authorizations; and
e) mandatory equipment, including PPE.

5.3.3 Security

The following security precautions should be taken when operating an RPAS:
a) Operators should ensure all reasonably practicable cyber security measures in all aspects of RPAS operations.
b) Operators should ensure that all personnel with access to any part of the RPAS are suitably vetted.

5.3.4 Operational safety

Operators shall ensure physical security at flight operation sites. The operator should address the operational risks and develop mitigations to reduce the risks identified and ensure that mitigations do not create additional hazards to the operation.

Some of the potential hazards that may be addressed in the risk assessment include
a) weather – current and forecasted conditions;
b) human – likely duration of the mission and pilot fatigue;
c) equipment (limits and failures) – maximum wind speed limit that the RPAS and pilot can handle, risks with equipment failure;
d) electromagnetic interference (EMI);
e) overhead obstructions – overhead cables, building height variations, trees, and other obstacles;
f) close proximity to buildings – processes for observing and reporting proximity to buildings and other such infrastructure;
g) flying over people – risks identified with flying over crowds, including events;
h) DAA;
i) CFIT; and
j) other relevant environmental conditions (e.g., presence of predatory birds that can attack RPAS).

Note: *Further guidance on risk assessment for RPAS operations is given in the JARUS guidelines on SORA.*

See Annex B for sample safety checklists.

5.4 Training and qualifications of personnel

5.4.1 General

The operator shall establish and maintain a training program to ensure that program personnel have a detailed understanding of the RPAS they will be operating and the airspace they will be operating in. The training program should be designed to meet the specific needs of the agency, depending on the size of the program and the regulatory requirements.

The training program shall be competency based, including knowledge requirements as well as practical skills, and outline how the evaluation will be carried out to ensure competency achievement of personnel. At a minimum, the training program shall be designed to meet the competency requirements outlined in Clause 6.

The training program shall identify any prerequisites and training required to obtain necessary certification for specific roles in the RPAS program. Flight crew members shall complete a training course that covers the knowledge requirements of TP 15263 to help ensure that these members can pass the examination to be certified as advanced pilots.

The training program may be developed by the operator and delivered as an in-house program. The training program may also be developed and delivered by an external vendor, such as

a) a training organization that is in compliance with the training requirements set forth by the relevant aviation authority;
b) another public safety agency; or
c) a manufacturer.

In many situations, the training program may be a combination of in-house and external.

The organization shall ensure that personnel remain competent through training, periodic proficiency checks, and recurrent training. Continuous training should be provided to keep RPAS team members proficient in RPAS operations and up to date on applicable regulations.

5.4.2 Training records

The operator shall document and record all training of all personnel, taking into consideration local regulations. The operator should retain the training records for a period of three years. Records should be retained for as long as the personnel remain active.

Training records should include regular training flights, exercises, flight testing, and recurrent training requirements (i.e., in Canada, the requirements from Transport Canada).

5.5 Data management

5.5.1 General

Managing the use and possible storage of video and other data obtained through RPAS operations is an important challenge for emergency services organizations due to public concerns and legal requirements. The amount of data that can be collected by organizations can be extensive and organizations should factor the cost of data storage in their planning and ongoing budgeting.

When RPAS are used for law enforcement and evidentiary purposes, a clear policy on data management shall be developed by the organization. Where applicable, additional procedures shall be established for how to present RPAS collected data in court.

Items to consider, may include, but are not limited to,

a) tracking system that will show who has had custody of this data and for what purpose;
b) method of logging data into storage repository, data access, and retention policy; and
c) consult with internal partners as to what types of data are currently excepting in the courts.

5.5.2 Data management and data protection — Operator requirements

The operator should establish protocols and policies for the data collected, taking into account federal, provincial, and territorial legal requirements. These protocols should cover

a) systems to protect data gathered during RPAS operations as far as reasonably practicable;
b) procedures to securely store or dispose of all data gathered during RPAS operations;
c) vetting processes for personnel involved in the handling of sensitive data;
d) relevant security requirements (e.g., cyber security issues);
e) procedures to minimize the amount of data to record or maintain;
f) requirements for specialized personnel to process and analyze RPAS data collected (e.g., geographic mapping), and
g) information sharing with other agencies, media, or members of the public;
h) privacy and RPAS data collection requirements;

i) chain of custody and proper note-taking for evidence to be used in court proceedings;
j) consideration on how RPAS data that has been processed can be presented in court; and
k) retention periods.

Note: *The applicable best practices and regulatory requirements for management of data, such as the applicable personal health information act (PHIA) will need to be considered.*

5.6 Privacy and protection of personal information

The operator should be aware of

a) applicable federal, provincial, and territorial legislation, and/or agency requirements for protection of personal information which can be collected during RPAS operations;
b) actions to take to manage the collection, retention, and disposal of personal information; and
c) how to share information safely with other agencies.

Note: *See* Guidelines for the Use of Video Surveillance of Public Places by Police and Law Enforcement Authorities, Office of the Privacy Commissioner of Canada.

5.7 Maintenance

5.7.1 General

Taking relevant information from the operating manual into account, the operator should implement and document a maintenance program.

Note: *Transport Canada requires manufacturers to provide operators with an operating manual that includes the maintenance program required for the system. Maintenance requirements for most RPAS currently in use by emergency service organizations are not extensive and do not generally include any requirements specific to emergency services.*

5.7.2 Elements of maintenance program

The maintenance program should comply with the manufacturer's recommendations as outlined in the operating manual. The operator may amplify this information with the following procedural information:

a) routine cleaning;
b) decontamination;
c) maintenance necessary for operations;
d) maintenance necessary due to operating environment;
e) storage requirements;
f) battery storage, disposal, charging, and emergency procedures in accordance with manufacturer's recommendations;
g) firmware and software updates;
h) persons authorized to perform maintenance procedures;
i) maintenance only to be performed by the manufacturer; and
j) life cycle management of RPA and batteries.

5.7.3 Maintenance discrepancy reporting

The operator should ensure that all scheduled inspections are carried out in accordance with the maintenance program manual. Flight personnel should record all unserviceabilities in the logbook after landing and advise maintenance personnel of these issues so that repairs can be undertaken.

Note: *In addition to TC regulatory requirements, a best practice is to adopt a maintenance strategy, including logs of all actions for each aircraft, performed either by the operator or the manufacturer.*

6 Competency requirements

6.1 Overview

Clause 6 provides requirements on specific knowledge requirements and practical skills for the PIC and visual observer.

BVLOS standards are in development with different levels being evaluated. Clause 6 provides limited guidance on localized BVLOS competency requirements, where available (see Note 3).

The requirements outlined in Clause 6 are an outline of topics to be covered in a training program, not a training guide. However, these topics may be used to develop a training guide. Each organization should develop its own training guide based on relevant regulations, mission types, and equipment.

Depending on the management structure of the program and the personnel assigned to the program, the operator should identify specific competencies for these additional roles in the program. (See Clause 5.2.2 for other roles.)

Clause 6 does not address organization or management responsibility.

Notes:

1) *Clause 6 does not duplicate the knowledge requirements for remote pilots from Transport Canada. Pilot certification examinations in Canada are based on knowledge requirements outlined in Transport Canada TP 15263. The knowledge areas covered in Transport Canada TP 15263 include*
   a) *Section 1: Air law, air traffic rules and procedures;*
   b) *Section 2: RPAS airframes, power plants, propulsion and systems;*
   c) *Section 3: Human factors;*
   d) *Section 4: Meteorology;*
   e) *Section 5: Navigation;*
   f) *Section 6: Flight operations;*
   g) *Section 7: Theory of flight; and*
   h) *Section 8: Radiotelephony.*
2) *In addition to the knowledge requirements outlined in Transport Canada TP 15263, a number of voluntary standards (ISO 21384-3, ISO 23665, ASTM F3196, ASTM F3266, ASTM F3379, and NFPA 2400) provide guidance on knowledge requirements for pilots of RPAS.*
3) *Presently, there are some first responder agencies that have been authorized with exemptions (SFOCs) for localized BVLOS. It is expected this might be reflected in future regulations in Canada. An advanced certificate for the pilot is expected to be the starting point for PIC requirements for localized BVLOS. Operators planning to expand into BVLOS in the future should consider adopting the upper limits of existing requirements and best practices as they pertain to training, equipment, and policy. Requirements for a future complex BVLOS pilot license (beyond 4 nm) are being established.*

6.2 General

The operator shall define the roles and task allocations of the crew for operation of the RPAS.

The operations manual should outline policy and procedures to ensure that all pilots and other program personnel executing tasks relevant to the safety of operations are competent to carry out flight operations within the limits of their responsibility. Such procedures should meet or exceed appropriate aviation authority regulations.

The operator shall ensure the applicable equipment, PPE, and clothing are utilized to safely conduct operations.

The operator may assign responsibility for this task to a responsible individual such as an operations manager, chief pilot, or team coordinator.

Note: *Use of a secondary PIC can be considered a good practice in case the PIC becomes incapacitated or otherwise incapable of operating the RPAS; however, this is not always attainable. A spotter should have knowledge of the "go home" function to get the drone on the ground.*

6.3 Knowledge requirements for PIC

6.3.1 Prerequisites

A PIC should successfully complete ICS 100 or IMS 100 examination or equivalent as determined by the AHJ.

A PIC shall also complete any relevant training courses as required by the AHJ, such as

a) training course in compliance with TP 15263 by internal or accredited training organization or equivalent;
b) flight training in conditions that emulate the conditions the pilot is expected to operate in. The minimum flight training hours shall meet the specify appropriate level of time on type specified by the operator;
c) hazardous materials training (e.g., WHMIS, lithium-ion battery handling, and transport); and
d) relevant occupational health and safety training.

6.3.2 Recurrent training

Recurrent training requirements (12-month period) shall

a) include a minimum, annual academic training that aligns with the recurrency requirements determined by the AHJ (i.e., in Canada, the requirements from Transport Canada). This could be an "in-house" product;
b) include a minimum of two flights every four months, plus an annual evaluation mission;
c) include regular review by an individual as designated by the operator of all normal, abnormal, and emergency procedures, specific to the RPAS user manual and the agency flight operations manual. This may be accomplished during the training flights in Items a) and b). Pilot performance may be graded "Exceeds Standard", "Meets Standard", or "Requires Further Training"; and
d) satisfy recency requirements of the AHJ.

Note: *In Canada, recency requirements are stipulated in CARs 921.04 and 901.56.*

6.3.3 Program/administration

A PIC shall have an understanding of

a) content of the agency operations manual;
b) applicable SFOCs and SOP;
c) provisions of regulations and standards necessary to carry out the duties and responsibilities of the role to ensure safety (e.g., relevant checklists);
d) agency mission plans and objectives;
e) role of the regulator (e.g., Transport Canada) and applicable regulatory requirements;
f) role of the other controlling agency (e.g., NAV CANADA), as the controlled or restricted airspace administrator;
g) other relevant federal, provincial, or territorial requirements for RPAS operations;
h) roles of other agencies or organizations that coordinate, provide resources, provide services, or perform other relevant emergency services;
i) the need for insurance and issues related to liability; and
j) issues and rules about privacy of personal information and freedom of information requirements.

6.3.4 Hazard identification risk assessment (HIRA)

The PIC shall be trained to

a) understand the agency's risk assessment process or safety management system;
b) recognize visible and potential hazards or environments associated with an RPAS support to public safety operations at the planning stage;
c) recognize what PPE might be required for personnel during the mission;
d) know how to put into place appropriate mitigating safety measures prior to flight;
e) continually assess hazards and take appropriate actions during the flight;
f) understand how and where to report potential hazards;
g) use and generate risk assessments at an appropriate level of detail; and
h) use of aviation risk model (SORA, or equivalent).

6.3.5 Specialized resources

The PIC shall be trained to recognize when a hazard presents a risk that exceeds their training or PPE, or both.

The PIC shall be trained to recognize when there is a need for specialized resources at the outset of a mission. Specialized resources may include

a) search and rescue teams;
b) material support (e.g., construction, engineers, architects, medical personnel); and
c) resources from other local, provincial/territorial, or federal agencies.

6.3.6 Operations — Flight safety (pre-flight, flight, and post-flight)

The PIC shall be trained to

a) understand the phases of an RPAS operation, including pre-planning, notification, planning and strategy, tactics and techniques, suspension, and after-action review;
b) plan an RPAS operation, understanding airspace requirements, weather conditions, crew readiness, resource capabilities, ICS, risk assessment, site assessment, and regulatory requirements (see Annex B);
c) produce and communicate a mission plan;
d) understand any potential limitations for the operation (i.e., safe operating envelope);
e) know the content of the operations manual;
f) understand the capabilities of the RPAS, payload, operational controls, and environmental conditions during flight;
g) know the regulatory requirements during flight; and
h) know the capabilities of the RPAS, payload, transport mechanisms, and storage procedures and maintenance procedures post-flight.

6.3.7 Communications

The PIC shall be trained to understand

a) how to describe, identify, and communicate relevant information to response teams;
b) if the visual observer is not within speaking distance, how to establish a reliable and immediate communications link through radio or open cellphone line; and
c) radio communication procedures and protocols in accordance with AHJ rules and existing best practices (when using airband frequencies an ROC-A is required).

6.3.8 Emergency procedures

Documented emergency procedures shall be readily available to the PIC. Preflight briefings should include a summary of emergency procedures. The PIC shall have knowledge about

a) emergency procedures outlined in agency operations manual;
b) how to put emergency procedures into effect;
c) who to contact and notify in the event of an emergency;
d) pertinent information to relay to emergency contact for the type of emergency;
e) intervals for ongoing training on emergency procedures;
f) use and content of emergency pack (first aid kit, fire extinguishers, radios, etc.); and
g) the applicable regulatory emergency procedures.

Note: *In Canada, regulatory emergency procedures are specified in CARs 901.23(1)(b).*

6.3.9 Localized BVLOS

As noted in Clause 6.3.1, BVLOS regulations are currently under development while some first responder agencies are already operating with localized BVLOS authorization.

Where authorized for BVLOS operations, the PIC shall be trained to understand

a) content and purpose of agency SFOC, or any additional regulatory requirements, as required by the AHJ (e.g., Transport Canada);
b) risk assessment process for BVLOS operations and how to mitigate risks;
c) capabilities of RPAS to operate in BVLOS;
d) certification requirements, as applicable for pilots for BVLOS;
e) system for continuous improvement;
f) how to operate an RPAS in a complex environment safely;
g) advanced knowledge of situational awareness and critical thinking;
h) higher-level knowledge about airspace, human factors, equipment function, and maintenance required for BVLOS operation;
i) technical issues associated with BVLOS;
j) technology and automation system features,
k) how to interpret type of data collected in BVLOS missions; and
l) the following procedures:
    i) transit during BVLOS operations;
    ii) BVLOS search;
    iii) landing in BVLOS confined spaces;
    iv) BVLOS flight techniques; and
    v) provision of DAA.

Note: *BVLOS other than "localized" is out of scope for this Document and is being defined by Transport Canada.*

6.3.10 Security

The operator should determine

a) what security is needed and required for the operation (e.g., cyber security);
b) how to manage the security of the RPAS;
c) how to protect the security of the flight data in accordance with relevant legislation; and
d) the importance of, and how to control and manage access to the flight area and equipment.

6.4 Practical skills for PIC

6.4.1 General

The operator shall ensure that the PIC receives sufficient flight school training to be able to demonstrate competence in their ability to perform flight tasks during the following phases of operation:

a) pre-flight planning and actions;
b) in-flight procedures;
c) post-flight procedures; and
d) agency-specific flight skills or procedures.

The PIC shall demonstrate the ability to perform flight tasks in a variety of PPE, as determined by the operator.

6.4.2 Manoeuvres

6.4.2.1 PIC core skills

The PIC shall be able to demonstrate a variety of flight skills in accordance with the types of missions authorized by the agency. A core set of skills should include

a) preparation for flight;
b) take-off and landing;
c) hovering;
d) fly forward and backwards at a constant altitude;
e) fly left and right while maintaining a constant heading and altitude;
f) fly a box pattern;
g) ascend or descend to a specific altitude;
h) fly a horizontal figure of eight;
i) approach and landing;
j) low flying;
k) precautionary and forced landing;
l) simulated emergencies such as stall, lost control, and safe recovery;
m) night flying; and
n) GPS denied or “attitude” flight skills.

6.4.2.2 PIC demonstration of competency

To show competency in flight skills, the training provider/evaluator should use recognized test methods as the basis for these competency requirements. These include

a) ASTM F3379, Annex A1; and
b) NFPA 2400, Annex A.

6.5 Requirements for the visual observer

Visual observers are key members of the flight crew, providing assistance to the remote pilot in the safe conduct of the flight. A visual observer shall communicate information to the pilot in a timely manner, during the operation, whenever the visual observer detects conflicting air traffic, hazards to aviation safety, or hazards to persons on the surface. They shall have visual acuity sufficient to conduct these assistance duties. Visual observers should have a working knowledge of

a) visual scanning techniques;
b) inter-crew communication requirements;
c) hazardous in-flight weather conditions;

d) actions to be taken in the event a risk of collision develops;
e) vertical and horizontal boundaries of the operation;
f) class of airspace in which they intend to operate including the vertical and horizontal airspace boundaries and determining adjacent classes of airspace;
g) right of way rules as specified in the operations manual and SFOC;
h) RPAS limitations,
i) requirements for visual observer locations (i.e., proximity to the pilot); and
j) radiotelephony to communicate on frequencies within the protected aviation band.

Annex A (informative)
Recommendations for developing a stakeholder engagement plan

Note: *This Annex is not a mandatory part of this Document.*

A stakeholder engagement plan can help to ensure ongoing two-way communication about the RPAS program aims and objectives. Existing stakeholder forums or structures may be used for the RPAS.

A stakeholder engagement plan may include
- identification and mapping of stakeholders;
- communication policy for exchanging information and raising awareness of the proposed program;
- actions and key messages for engaging each stakeholder group;
- participation in community events to raise awareness;
- social or digital media tools and activities; and
- cultural and language diversity to meet community needs.

Note: *The organization may consider producing two versions of the engagement plan, including a detailed version and a condensed version for the benefit of the public and non-specialists.*

While each stakeholder engagement plan will be different based on the aims and activities of the RPAS program, there are some common principles and actions that should be considered when developing the plan. The following are recommendations based on best practice from public safety agencies:
- Engage with stakeholders before implementing a drone program to increase understanding and support for the program:
  - Proactively reach out to organizations that are likely to have reservations about drone use, such as civil liberties groups, prior to program implementation. Make legitimate efforts to understand their concerns and modify plans when appropriate.
  - Actively solicit feedback from stakeholders before finalizing the RPAS policy to ensure that stakeholder concerns are addressed.
  - Host outreach events on various days and times and at various locations to ensure that most stakeholders are able to participate.
- Provide specific information to the public and community partners about the purposes for which drones will be used and the purposes for which they will not be used. This can help to prevent unnecessary conflicts and ease community members' concerns about privacy and other issues:
  - Stress that the use of RPAS is to promote public safety and not for nonspecific, random surveillance purposes.
  - Work with print and broadcast news media organizations to disseminate messages.
  - Use social media accounts to inform and engage the public about plans.
  - Ensure that messages are disseminated widely (e.g., make use of existing resources such as the agency public affairs group to disseminate messages).
- Be clear and transparent about the organization's RPAS policies and practices prior to and after implementation of the program:
  - Post drafts and the final version of the RPAS policy on the organization's website.
  - After RPAS deployments have begun, release video of successful drone operations, when footage can be made public.

Annex B (informative)
Sample safety checklists

Note: *This Annex is not a mandatory part of this Annex.*

Use of a safety checklist(s) should be used for the following:

a) Risk assessment process: The operator should identify all of the risks that it has identified when using the RPAS and what steps have been taken to reduce the risk. The list should be developed and updated and reviewed on a regular basis.
b) Pre-flight: Before launching the RPAS, a full pre-defined checklist should be undertaken by the pilot.
c) Post flight: After completion of the mission, a full pre-defined checklist should be undertaken by the pilot.

The following is a sample checklist:

RPAS pre-flight general checklist

- □ Batteries charged
- □ Map imagery downloaded
- □ Mobile device with app
- □ Site survey:
  - □ Weather checks
  - □ NOTAM checks
  - □ Airspace review
  - □ Airspace authority
  - □ Flight area security
  - □ Comm/nav interference
  - □ Obstacles
  - □ Land use permission
  - □ Emergency contacts
  - □ Radio frequencies
- □ Crew human factors
- □ Mission procedures:
  - □ Pre-flight checklist
  - □ Take-off/launch
  - □ Approach
  - □ Landing and recovery
- □ Review emergency procedures:
  - □ Loss of link
  - □ Fly-away
  - □ Loss of GPS
  - □ Controller failure
  - □ Flight termination
  - □ Other equipment failure
- □ Equipment:
  - □ Fire extinguisher
  - □ First aid kit
  - □ Flashlight (night only)

- □ Binoculars
- □ Wind meter
- □ Cell phone
- □ Radio(s)

□ Documents required:

- □ Emergency procedures
- □ Site survey
- □ Flight plan
- □ Pilot licence
- □ RPAS regulation and marking
- □ RPAS manual
- □ Recency doc

RPAS post-flight general checklist

□ UAV shut down
□ Data secured
□ Controller shut down
□ Display shut down
□ UAS secured
□ Pilot log complete
□ Post flight electronic entry
□ Batteries on charge

Annex C (informative)
Examples of mission types for emergency services

Note: *This Annex is not a mandatory part of this Document.*

Law enforcement

- crime scene processing
- traffic control
- tactical operations
- incident information
- search and rescue missions
- public information/announcements
- large public events monitoring
- provide aerial mapping support to assist in crash reconstruction
- provide aerial mapping and photographing to analyze crime scenes
- enhanced non-surveillance operations that will provide officer safety during crime scene searches

Fire services

- assess thermal conditions
- situational awareness
- assess structural condition
- identification of fuel types and fuel load
- identification of evacuation routes
- search and rescue missions
- grass fires and wildfires
- hazardous materials situations
- large structural fires and collapse
- storm siren maintenance and inspections
- water rescues and drowning prevention

Public works/emergency management

- congestion
- detours
- review of traffic patterns in areas of construction
- roadway and bridge inspections
- pandemic response (e.g., disinfecting public spaces)
- other governmental or private agencies may request assistance through routine processes including MOUs or during emergency situations

Paramedic services

- delivery of medical supplies and equipment
- telemedicine
- remote consultations
- pandemic response
- situational awareness to assist with emergency response (e.g., traffic, natural disaster)

Search and rescue associations/teams

- lost or missing person searches/tracking
- rescue operations

- recovery operations
- visual beacon/temporary illumination
- delivery of supplies
- identifying routes for searchers

Damage assessment (natural or manufactured event)

- structural, flood-related, environment, transportation, pipeline breaks, and rail incidents
- enhanced search grids through onboard software

Cross-agency aid

Following official requests, the deployment of an RPAS may be authorized by a program supervisor. Requests are fully evaluated for approval in accordance with department policies, legal authority, other available resources, and community expectations. Participation in mutual aid requests should involve the establishment of a unified or joint command in accordance with common industry standards. All deployments are continually evaluated for changing situations or information that might alter reasonable participation in the incident.

Annex D (informative)
Specialized equipment features

Note: *This Annex is not a mandatory part of this Document.*

Specialized feature	**Description**
ADS-B receiver	DAA
Dual control	Allows two pilots to control RPA
Thermal imaging	SAR for heat-emitting subjects
SAR search pattern programming	Allows systematic search of area
Payload release capability	Allow release of SAR payload (e.g., first aid kit, life jacket)
Onboard AI	Onboard or ground control system (GCS) AI solutions dependent on use case (e.g., object tracking, colour anomalies, plate recognition, vehicle type identification)

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