BRAMPTON FLIGHT CENTRE

Advanced RPAS Flight Operations

Brampton
Flight Centre

Overview


Introduction
Catagories
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BRAMPTON FLIGHT CENTRE

Introduction

Unless flying a microdrone (<250g) you will need a license to pilot drones (RPAS) in Canadian airspace.

The basic license is great for recreational pilots but most commercial pilots will require an advanced operations certificate as you will often be tasked with collecting data in much more complex operating environments with higher risk profiles.

BRAMPTON FLIGHT CENTRE

MAAC Exemptions

- The MAAC Exemption has been withdrawn.
- All model Aircraft are now considered RPAS, and pilots must obtain a minimum of a Basic Transport Canada Certificate.
- All operators of RC aircraft must also now register their aircraft.
- If your Club is in Controlled Airspace, you will require an Advanced Certificate as well as a flight review.

My Background

Useful terms to know

Populated area

- means an area with more than five people per square kilometer.

Sparsely populated area

- means an area with more than 5 but not more than 25 people per square kilometer.

Visual Observer (VO)

- means a crew member who is trained to assist the pilot in ensuring the safe conduct of a flight.

2025 Summary of change to Canada's drone regulations

Overview

To unlock the potential of medium-sized drones and beyond visual line-of-sight (BVLOS) operations in Canada, regulatory changes were needed. The new regulations allow medium-sized drone operations and some beyond the visual line-of-sight operations without the need for a Special Flight Operations Certificate (SFOC-RPAS).

Canada's expanded drone regulations introduce:

- New pilot and operator certification for lower-risk beyond visual line-of-sight operations
- Expanded privileges for advanced pilots to fly sheltered operations and extended visual line-of-sight (EVLOS) operations
- New rules for flying medium drones (over 25 kg up to 150 kg) within visual line-of-sight (VLOS)
- New technical standards for drones and any supporting systems flying advanced, complex or special flight operations
- New requirements for flying microdrones at advertised events
- New and updated fees for services provided by Transport Canada

Transport Canada

Canada

Advanced RPAS Flight Operations

2025 Summary of change to Canada's drone regulations

Two phases for coming into force

- The new regulations will come into force in two phases to give stakeholders time to get their appropriate training, certification, and to familiarize themselves with the new rules.
- You cannot start flying BVLOS, EVLOS, or Sheltered operations until November 4, 2025.
- However, you will be able to take the new Level 1 Complex exam and apply for an RPAS Operator Certificate (RPOC) through the Drone Management Portal starting April 1, 2025.
- This approach avoids changing operating rules during the peak summer flying season in 2025. If you want to fly these types of operations before November 4, you still need to apply for a Special Flight Operations Certificate.
- New and updated web pages and official publications (TPs, Standards, and Advisory Circulars) will be made available starting on April 1, 2025.

2025 Summary of change to Canada's drone regulations

Lower-risk beyond visual line-of-sight (BVLOS)

The new regulations introduce a new pilot certification process for lower-risk BVLOS called Level 1 Complex Operations. To conduct lower-risk BVLOS, you must:

- Be at least 18 years old
- Pass the online exam for advanced and Level 1 Complex Operations
- Complete at least ***20 hours*** of ground school and successfully pass a flight review
- Individuals, businesses, and organizations wishing to conduct BVLOS operations must have an RPAS Operator Certificate (RPOC). To obtain an RPOC, pilots, businesses, and organizations will be required to have policies and procedures in place that reflect the size and complexity of the operations they will carry out.

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2025 Summary of change to Canada's drone regulations

Where you will be able to fly BVLOS

All lower-risk BVLOS operations must

- remain in uncontrolled airspace, stay below 122 metres (400 feet), stay away from airports and aerodromes
- If you are flying a small or medium drone, you may operate at least 1 km away from a populated area.
- If you are flying a small drone, you may also operate over a sparsely populated area or less than 1 km from a populated area.

Lower-risk beyond visual line-of-sight (BVLOS) operations

For lower-risk beyond visual line-of-sight (BVLOS) operations, you can:

- fly a small or medium RPA BVLOS over unpopulated areas (more than 1 km from populated areas).
- fly a small RPA BVLOS over sparsely populated areas.
- fly in uncontrolled airspace, below 400 feet above ground level (AGL), and at least five nautical miles away from aerodromes listed in the Canadian Flight Supplement or Water Aerodrome Supplement.

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Advanced RPAS Flight Operations

2025 Summary of change to Canada's drone regulations

Expanding privileges for Advanced Pilot Certificates

As of November 4, 2025, the following drone operations will be permitted for pilots with a Pilot Certificate – Advanced Operations:

- Sheltered operations
- Extended visual line-of-sight (EVLOS) operations
- Medium drones within VLOS

If you already hold a Pilot Certificate – Advanced Operations today, you do not need to re-apply for your certificate, however you do need to familiarize yourself with the new operating rules. And make sure you keep your certificate current!

Sheltered operations

Sheltered operations are flights with a small drone that are close to a structure, such as a building. To conduct sheltered operations, you must fly the drone:

- More than 30 metres (100 feet) away from people not involved in the operation
- No greater than 30 metres (100 feet) above the structure
- Less than 61 metres (200 feet) horizontally from the structure

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Advanced RPAS Flight Operations

2025 Summary of change to Canada's drone regulations

Extended visual line-of-sight (EVLOS) operations

EVLOS operations are short-range flights with a small drone, but where the drone is far away enough from the pilot that it cannot be seen by an unaided eye. To conduct EVLOS, you must:

- Remain in uncontrolled airspace
- Fly more than 30 metres (100 feet) away from people not involved in the operation
- Receive assistance from a trained Visual Observer (VO) holding an RPA pilot certificate
- Fly the drone within 2 nautical miles (3.6 km) of yourself, the VO and the Control Station

Medium drones within VLOS

To fly your medium drone within VLOS, the drone must be declared as safe and able to perform the specific advanced operations that you want to conduct. You can fly medium drones in uncontrolled airspace or in controlled airspace with permission from air traffic control.

Transport Canada

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Advanced RPAS Flight Operations

2025 Summary of change to Canada's drone regulations

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New requirements for microdrones at advertised events

As of April 1, 2025, an SFOC will now be required to fly microdrones at advertised events.

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Advanced RPAS Flight Operations

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Advanced RPAS Flight Operations

What’s an RPAS?

What's an RPAS?

What are they calling my drone now?

Drones have had many official and unofficial names over the years

Drone	UAS (Unmanned Aircraft System)
Quad	UAV (Unmanned Aerial Vehicle)
Quadcopter	RPAS (Remotely Piloted Aircraft System)

SMS Report

Number:	20-7
Submitted:	Jan 18, 20 02:00Z
Time:	Jan 18, 20 23:00Z
Status:	Investigating
Due date:	Mar 18, 20
Type:	Occurrence
Pilot:	Ardizzi
Registration:	GBFJ
Category:	Company Flight
Location:	25+ NM away
Departments:	UAV Program
Factors:	CAR's
Description:	Potential near miss with drone over the town of Listowel, made radio calls on 126.7 to see if it was conflicting traffic but never got a response. Determined it was drone by the lights that were on it and how close there were together on the drone it self, didn't resemble another plane
Follow up:	Jan. 18th 2020: Report forwarded to Richard.

It’ll never happen to me!(?)

- You’ve passed the Advanced exam and the flight review. You know the rules and you’re a skilled RPA pilot
- The drone was part of an Operation YRP at Richmond Hill. According to the Ministry of Transport, NAV Canada, the country’s air navigation service provider, had not been notified of the YRP drone.
- When exiting the aircraft, they were shocked to see a major dent on the left underside of the engine cowling.
- The airbox was also bent. A few hours later, a police detective confirmed a York Regional Police drone had struck their aircraft.
- The aircraft suffered major damage, including a propeller strike.

The damage Shown here is of the Drone strike on the aircraft. A direct hit by a drone on critical surfaces can be devastating and lead to catastrophic outcomes.

Published Friday, August 20, 2021

A plane has major damage after a York Regional Police (YRP) drone struck the aircraft at **Toronto Buttonville Municipal Airport** earlier this month.

On Aug. 10, a Canadian Flyers International Inc. Cessna plane was on a flight to the airport in Markham at an unknown time during the day.

The small plane was about to land at the airport's runway when the pilot felt a jolt that "pushed them back on their seat", according to a report from Transport Canada issued this week.

The pilot thought the plane hit a large bird and proceeded to land the plane, the report said.

When the pilot exited the aircraft they saw a "major dent" on the left underside of the engine cowling and the airbox was also bent.

No injuries were reported but the airplane suffered significant damage, including a propeller strike.

A few hours after the incident, police confirmed that a YRP drone had struck the aircraft, according to the report.

The drone was part of a YRP operation in Richmond Hill.

NAV Canada, the country's air navigation service provider, had not been notified about the YRP drone, Transport Canada said.

The cause of the collision is not known.

https://www.cp24.com/news/plane-damaged-after-being-hit-by-york-police-drone-at-buttonville-airport-transport-canada-1.5554610#.YR-s9RwcEr4.whatsapp

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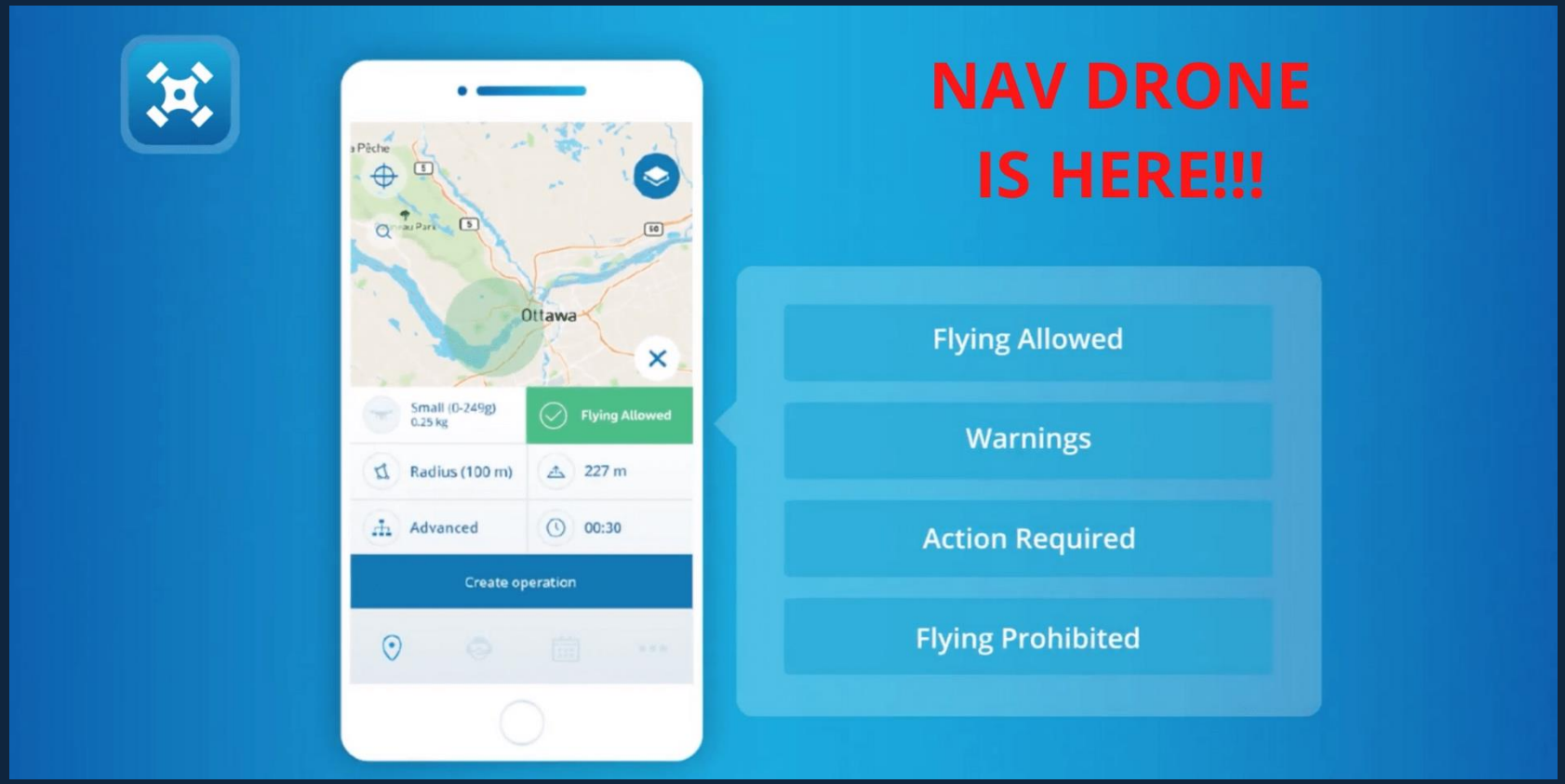


- NAV CANADA's official app for drone operators Whether you're planning a drone flight, looking for airspace information or simply want to gain a better understanding of where you can fly your drone in Canada
- NAV Drone is the only app that lets you safely and legally request permission to fly a drone in airspace controlled by NAV CANADA.

Transport Canada Now Considers your RPAS an Aircraft

=

Why? Because you share airspace with other aircraft and could pose a potential significant hazard to aviation safety.

Foreign Operators

Overview

- Foreign pilots and operators must have a valid Special Flight Operations Certificate (SFOC) for Remotely Piloted Aircraft System (RPAS) to fly a drone for any purpose (recreational, work or research).
- You are considered a foreign pilot or operator if you are not a Canadian citizen, permanent resident or a corporation incorporated by or under federal or provincial law.
- As a foreign drone pilot, you need a Canadian drone pilot certificate to operate in Canada even if you are authorized in your home country.

Drones under 250g

- Foreign drone pilots or operators **do not** need special permission to fly drones under **250g**. You still need to follow all safety guidelines for **microdrones** (under 250g).

What you need to apply?

- This will depend on your planned scenario as you may need a Basic, Advanced or Level 1 Complex operations license in addition to your SFOC-RPAS.

Foreign Operators

For Basic operations

- successfully pass the basic exam to get your Pilot Certificate - Small RPA - Basic Operations,
- apply for your SFOC-RPAS.

For Advanced operations

- successfully pass the online exam for Advanced operations (this gets your Pilot Certificate - Small RPA - Basic Operations)
- have for your SFOC-RPAS before you book your flight review (this may take up to 30 working days)
- pass the flight review
- apply for your Pilot Certificate - Advanced Operations.

Foreign Operators

For Level 1 Complex operations

- successfully pass the online exam for advanced operations (this gets your Pilot Certificate - Small RPA - Basic Operations)
- complete at least 20 hours of ground school through a flight school
- successfully pass the online exam for Level 1 Complex operations
- have for your SFOC-RPAS before you book your flight review (this may take up to 30 working days)
- pass the flight review
- apply for your Pilot Certificate - Advanced Operations.

Advanced RPAS Flight Operations

Foreign Operators

Upgrading from Basic or Advanced

- The SFOC-RPAS you received earlier is valid for your flight review and for the level of operations once your new pilot certification is obtained. There is no need to apply for a new SFOC-RPAS.

From Basic to Advanced

- If you already have an SFOC-RPAS as a foreign pilot and want to upgrade your Basic pilot certificate to Advanced, you must successfully pass the “RPAS - Advanced Operations” written exam and a flight review.

From Advanced to Complex

- If you already have an SFOC-RPAS as a foreign pilot and want to upgrade your Advanced pilot certificate to Level 1 Complex, you must successfully pass the “RPAS - Level 1 Complex Operations” written exam and a flight review.

Flying beyond basic, advanced or level 1 complex operations

- If your drone operations would normally require an SFOC-RPAS (even as a Canadian), you will need to:
- have your Canadian drone pilot certificate rated for the planned operation (see process above)
- follow the steps for applying for an SFOC-RPAS for operations in higher-risks environments or for operations in low-risk environments

Foreign Operators

Registering your drone as a foreign pilot or operator

- Foreign pilots or operators can't register drones. You need an SFOC-RPAS to comply with the CARs.

After you apply

- It may take up to 30 working days to review and issue an SFOC-RPAS. Actual processing times can vary depending on the complexity and completeness of the request. SFOCs should be issued within the 30-working day window, assuming the applicant responds to additional requests in a timely manner.
- SFOC-RPAS applications received with less than 30 working days advance notice will not be accepted.
- A foreign pilot is usually issued an SFOC-RPAS valid for one year.

Microdrones (under 250 g)

KNOW BEFORE YOU GO!

DRONES LESS THAN 250 G

DRONES THAT WEIGH **LESS THAN 250 GRAMS** ARE ALSO KNOWN AS **MICRODRONES**.

IF YOU FLY A **MICRODRONE**, YOU **MUST**:

Fly safely—don't put people or other aircraft in danger
- Avoid emergency sites and restricted airspace (forest fires, first responder perimeters)
- Follow provincial, territorial or municipal rules that may also apply, including rules about privacy and trespassing: canada.ca/safe-legal-drones

YOU **SHOULD**:
- Keep your drone below 122 metres (400 feet) in the air—approximately a 30-storey building
- Keep your drone where you can see it
- Avoid advertised events
- Avoid airports
  - Use this map to find a safe site to fly your drone: nrc.canada.ca/en/uav-site-selection

122m

YOU **DON'T** NEED TO:
- Register your drone
- Get a drone pilot certificate

MAXIMUM TAKE-OFF WEIGHT

If the take-off weight of your drone is 250 g or more, it isn't a microdrone. You must register it and get a drone pilot certificate.

The maximum take-off weight of your drone includes batteries or anything you attach to it, like:
- communications equipment
- sensors
- cameras
- lights

250g+

IF YOU BREAK THE RULES, YOU COULD BE FINED $1,000 (FOR AN INDIVIDUAL) OR $5,000 (FOR A CORPORATION)

Canada.ca/**drone-safety**

Transport Canada Transports Canada

Canada

Microdrones (under 250 g)

As a good practice, you should always:

- Microdrones are drones weighing less than 250 g. The weight of the remote control is not factored in to the weight calculation, but the weight of anything attached or carried, such as optional cameras or safety cages, will be considered part of the weight.
- Pilots of microdrones don't need to register their drone or get a drone pilot certificate to fly them. Pilots of microdrones are not bound by the same requirements as other drones. However, you must not operate your drone in a reckless or negligent manner as to endanger or be likely to endanger aviation safety or the safety of anyone.
- As a pilot of a microdrone, you have a responsibility to use good judgment, identify potential hazards, and take all necessary steps to avoid any risks associated with flying your drone.

Microdrones (under 250 g)

- You must get a Special Flight Operations Certificate for Remotely Piloted Aircraft System (SFOC-RPAS) to operate at an advertised event.
- Follow these guidelines to avoid flying in a negligent or reckless manner and being subject to fines. Enjoy a safe flight and minimize the risk of incidents. Remember: if you feel that your flight is risky, don't do it.
- Drones are considered aircraft under the Aeronautics Act and Canadian Aviation Regulations and are therefore prohibited to enter the following zones without the proper authorizations:
  - Class F Special Use Restricted Airspace
  - Over a forest fire area or any area located within five nautical miles of a forest fire area, or in any airspace for which a NOTAM for Forest Fire Aircraft Operating Restrictions has been emitted
  - Zones where a 5.1 of the Aeronautics Act restrict the use of airspace to all aircraft has been emitted

Microdrones (under 250 g)

Problems with microdrones

- As DJI has come out with a sub 250g drone and certain issues have already come up regarding the flight dynamics of this drone. Being so light there have been many reports of Blow-aways or fly-aways with the RPA.
- Winds at ground level can differ greatly from winds at higher altitudes and the mini with lower thrust capacity and weight than some of its bigger brothers such as the Mavic air and Mavic pro can be problematic in higher wind conditions.
- If you run into this problem try using sport mode with offers more power , or better yet try to get the aircraft to a lower altitude or land immediately if possible.
- The RTH function is no guarantee to a safe return if you do have a blow-away as it automatically switches to the slower P mode.
- Always check conditions before you fly any RPAS but be mindful of this problem with smaller lighter RPAS.

Regulation & Training in Canada

Transport Canada has developed new regulations to address the safety requirements, growing popularity, and economic importance of RPAS include:

- New flight rules
- Aircraft marking and registration requirements
- Knowledge testing
- Minimum age limits
- Pilot permits for RPAS operations

What do you get from this course?

- This course is designed to prepare you for the Basic or Advanced Category Transport Canada Online exam. This course meets all of Transports Knowledge requirements for the operation of RPAS in the Basic and Advance operations environments.
- You will be given the option to purchase additional study materials that will help you to prepare for the exam.
- You will also receive a certificate indicating that you have completed a TC compliant training course.

Advanced RPAS Flight Operations

How do various operations differ?

Basic

- SFOC not required if used for recreation but Transport Regulations must be followed and an online test is required.

Advanced

- An SFOC may be required if used for recreation but Transport Regulations must be followed and an online test is required.

BVLOS

- An SFOC may be required under the Level 1 Complex Operation. A 20hr ground school, online exam and flight review are required.

New regulatory structure

- RPAS will be regulated according to the CARs. Part IX of the CARs will deal with RPAS according to the divisions of mass and operating environments in the diagram on the next page. The immediate regulations will cover RPAS with an MTOW of 250 grams (0.55 lb) up to and including 150kg (330 lb) operating VLOS.
- Operating environments will be subdivided in to basic, advanced and BVLOS operations
- Other operations using RPAS that do not fall within the scope of the regulations will require a Special Flight Operations Certificate–RPAS from Transport Canada.

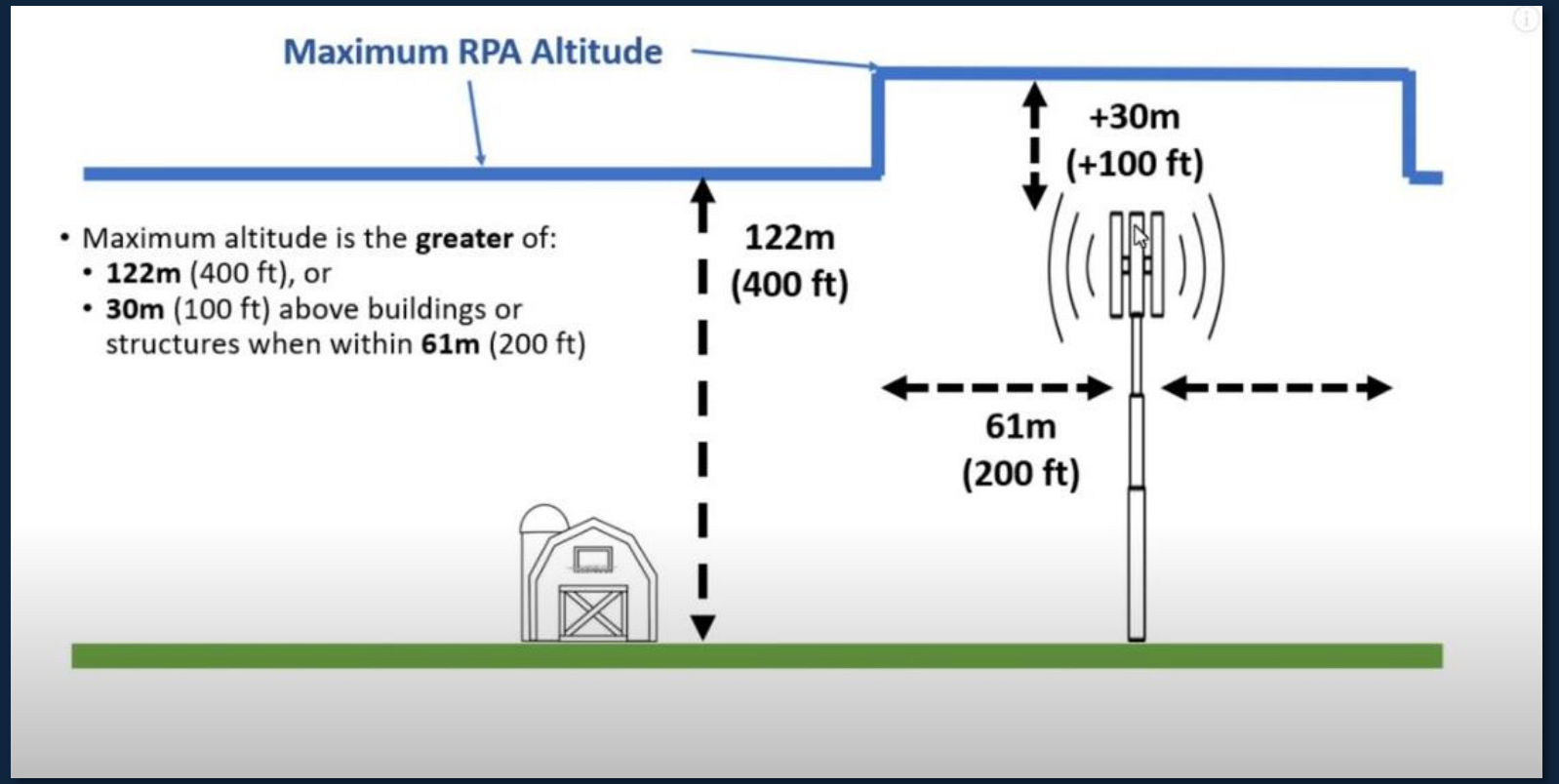
Advanced RPAS Flight Operations

How high can I fly?

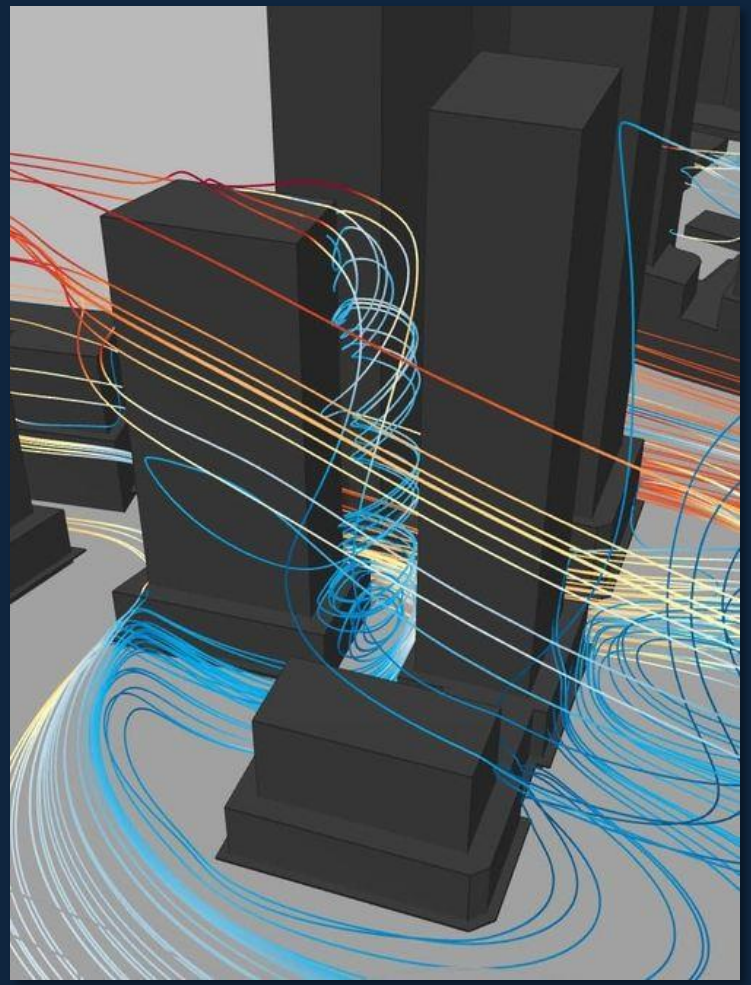
Maximum Altitude

- 901.25 (1) Subject to subsection (2), no pilot shall operate a remotely piloted aircraft at an altitude greater than
  - (a) 400 feet (122 m) AGL; or
  - (b) 100 feet (30 m) above any building or structure, if the aircraft is being operated at a distance of less than 200 feet (61 m), measured horizontally, from the building or structure.
- (2) A pilot may operate a remotely piloted aircraft at an altitude greater than those set out in subsection (1) if the operation is conducted in accordance with a special flight operations certificate — RPAS issued under section 903.03.

The “Building Bubble”



Wind Turbulence from Buildings




553m

Penalties

3 Part IX of Schedule II to Subpart 3 of Part I of the Regulations is amended by adding the following after the reference "Section 900.06":

Column I	Column II	
Designated Provision	**Maximum Amount of Penalty ($)**	
	Individual	**Corporation**
Section 900.07	3,000	15,000
Subsection 900.08(1)	1,000	5,000
Subsection 900.09(1)	5,000	25,000
Subsection 900.13(1)	5,000	25,000
Section 900.14	3,000	15,000
Subsection 900.18(1)	1,000	5,000
Section 900.19	1,000	5,000
Section 900.20	1,000	5,000

Penalties

Section 901.199	1,000	5,000
Section 901.200	3,000	15,000
Subsection 901.201(1)	3,000	15,000
Subsection 901.201(2)	3,000	15,000
Subsection 901.217(1)	1,000	5,000
Subsection 901.217(2)	1,000	5,000
Subsection 901.217(3)	1,000	5,000
Subsection 901.217(4)	1,000	5,000
Subsection 901.218(1)	1,000	5,000
Subsection 901.219(1)	1,000	5,000
Subsection 901.219(3)	1,000	5,000
Subsection 901.219(4)	1,000	5,000
Subsection 901.219(5)	1,000	5,000
Subsection 901.220(1)	1,000	5,000
Subsection 901.220(2)	1,000	5,000
Subsection 901.221(1)	1,000	5,000
Subsection 901.221(2)	1,000	5,000
Section 901.222	1,000	5,000
Subsection 901.223(1)	1,000	5,000
Subsection 901.223(2)	1,000	5,000

Types of Violations

Types of Violations

Violation	Count
CAR 901.54(1) / 901.63 (1) Pilot Certification Requirements	27
CAR 901.02 / 901.03 / 901.09 Registration / Registration Number / Access to Certificate	27
CAR 901.14 Controlled or Restricted Airspace	18
CAR 901.41(1) Special aviation events and advertised events	10
CAR 901.11(1) Visual line-of-sight	6
CAR 901.26 Horizontal distance	5
CAR 901.47 Operations at or in the Vicinity of an Aerodrome, Airport or Heliport	5
CAR 901.43(1) Payloads	4
CAR 900.06 Reckless or Negligent Operation	3
CAR 901.16 Flight safety	2
CAR 901.69(1) Manufacturer Declaration — Permitted Operations	2
CAR 901.25(1)(a) Maximum altitude	2
CAR 901.71(1) Operations in Controlled Airspace	1
CAR 901.39(1) Night flight requirements	1
CAR 901.24 Pre-flight information	1
CAR 901.73 Operations at or in the Vicinity of an Airport or Heliport — Established Procedure	1
CAR 901.12(1) Prohibition—emergency security perimeter	1

Recent Enforcement Actions

Summaries

Filter items

Showing 1 to 10 of 161 entries | Show 10 entries

Date served	Date of violation	Counts	Violation	Penalty	Location	Description of offence
2023-01	2022/03/05	5	CAR 901.02 CAR 901.14(2) CAR 901.16 CAR 901.43(1) CAR 901.54(1)	$3950	Quebec Region	A person operated a remotely piloted aircraft system (RPAS) when it was not registered, in Class F Special Use Restricted Airspace without authorization and failed to immediately cease operation when the safety of persons was endangered. A person also operated a RPAS while transporting an unauthorized payload and when the person was not the holder of a proper pilot certificate – small remotely piloted aircraft (VLOS).
2023-01	2022/03/16	3	CAR 901.02 CAR 901.12(1) CAR 901.54(1)	$1300	Quebec Region	A person operated a remotely piloted aircraft system (RPAS) when it was not registered and over or within the security perimeter established by a public authority in response to an emergency. A person also operated a RPAS when the person was not the holder of a proper pilot certificate – small remotely piloted aircraft (VLOS).
2023-01	2022/03/16	5	CAR 901.02 CAR 901.11(1) CAR 901.14(2) CAR 901.43(1) CAR 901.54(1)	$3780	Quebec Region	A person operated a remotely piloted aircraft system (RPAS) when it was not registered, in Class F Special Use Restricted Airspace without authorization and failed to operate it in visual line-of-sight at all times during flight. A person also operated a RPAS while transporting an unauthorized payload and when the person was not the holder of a proper pilot certificate – small remotely piloted aircraft (VLOS).

Recent Enforcement Actions

2024-09	2023-05-20	5	CARs 901.03 CARs 901.09 CARs 901.14(1) CARs 901.26 CARs 901.63(1)	$1,875	Quebec Region	A person operated a remotely piloted aircraft system (RPAS) without a registration number clearly visible on the remotely piloted aircraft, and without the certificate of registration being easily accessible to the pilot for the duration of the operation. A person also operated a remotely piloted aircraft in controlled airspace, at a distance of less than 100 feet from another person measured horizontally, and without the proper pilot certificate – advanced operations.
2025-03	2024-01-26	6	CARs 901.02 CARs 901.54(1) CARs 901.43(1)(d) CARs 901.14(2) CARs 901.11(1) CARs 901.29	$3,750	Quebec Region	A person operated a remotely piloted aircraft system (RPAS) without being registered. A person also operated a remotely piloted aircraft system (RPAS) when the person was not the holder of a proper pilot certificate – small remotely piloted aircraft (VLOS), and when the aircraft was transporting a payload that was attached to the aircraft by means of a line in a way that was not in accordance with the manufacturer's instructions. A person operated a RPAS in Class F Special Use Restricted Airspace without authorization. A person also failed to operate a RPAS in visual line-of-sight at all times during flight, and conducted the take-off or launch of a of a remotely piloted aircraft without ensuring, as a pilot, that the aircraft was serviceable, equipped and maintained in accordance with the regulations and the manufacturer's instructions.

General Exam Information

Where to write the examinations

- The examinations required for the operation of sRPAS may only be completed online via the Transport Canada Drone Management Portal.

Examination prerequisites

- Candidates for exams must create an account on the Transport Canada Drone Management Portal.
- Applicants must be able to read the examination questions in either English or French without assistance

Examination Rules

- 901.58 No person shall, in respect of an examination taken under this Division,
  - (a) copy or remove from any place all or any portion of the text of the examination;
  - (b) give help to or accept help from any person during the examination, unless authorized by the Minister for accommodation purposes; or
  - (c) complete all or any portion of the examination on behalf of any other person.

Drone Management Portal

Register a drone

For any drone with an operating weight of 250 g and above.

- View drones

Take an exam

Take an online exam to ensure you can operate a drone safely.

- View pilot certificate
- View exam results

Apply for a pilot certificate

Includes flying in controlled airspace, near or over people.

- Find a drone flight school near you

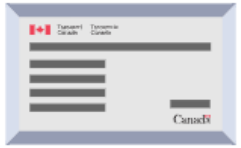
Submit flight review results

Verify the flying abilities of a pilot candidate.

- View flight review results
- Find a drone flight school near you

Apply for an RPAS operator certificate

For conducting beyond visual line-of-sight (BVLOS) operations in Canada.



Advanced RPAS Flight Operations

Taking an Exam

Take an exam

Before you can obtain certification, you'll need to complete an online exam to ensure you have sufficient knowledge to operate a drone safely. Your choice of exam will depend on where you intend to fly or whether you want to become a Flight Reviewer.

There is a **$10.00 non-refundable fee** for Basic or Advanced Exams and a **$50.00 non-refundable fee** for a Level 1 Complex Operations or Flight Reviewer Exam.

Eligibility

You must be:

- 14 years of age or older to take a Basic Exam
- 16 years of age or older to take an Advanced Exam
- 18 years of age or older and have completed an Advanced Exam to take a Level 1 Complex Operations Exam
- 18 years of age or older and have been issued a pilot certificate for Advanced or Level 1 Complex Operations to take a Flight Reviewer exam

What you need before you start

The exam must be completed within **60 or 90 minutes** depending on the exam taken. You must answer every question within the allotted time before you can submit it. Your answers will be saved as you progress through the exam.

You may return and resume the exam within the time remaining if you experience a problem or exit the exam. Should you run out of time, the exam will be automatically submitted and scored based on the answers provided.

To begin, you will need:

- an understanding of drone and aviation safety
- a Visa®, Mastercard®, or American Express® credit card, Apple Pay® or Google Pay®
  - Debit cards may be used if added to your Apple Wallet® app, or Google Pay® app

Choose your exam

Guides and help

- Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems (TP 15263)
- Find a drone flight school near you
- Getting a drone pilot certificate

Contact us

Civil Aviation Services

Email:
aviation.ont@tc.gc.ca

Telephone:
1-800-305-2059

Hours of operation:
Monday to Friday
8:30 am to 4:30 pm ET

Taking an Exam

Transport Canada Drone Management Portal

Account settings | Sign out

Home → Take an exam → Choose exam

Choose your exam

Choose from one of the following exams:

Small Basic Exam — $10.00

For flying drones weighing **250g to 25kg**

You may not fly:

- Within 5.6 km (3 nautical miles) of an airport
- Within 1.9 km (1 nautical mile) of a heliport
- Within 100 ft (30 m) of people (measured horizontally)
- Over advertised events (e.g. outdoor concert, sporting event)

Select this exam

Small Advanced Exam — $10.00

For flying drones weighing **250g to 25kg**

You may not fly:

- Over advertised events (e.g. outdoor concert, sporting event)
- Over people unless flying a drone that meets the appropriate RPAS Safety Assurance declaration

Select this exam

Flight Reviewer Exam — $50.00

For instructors

Allows one to:

- Perform flight reviews with pilot candidates

Select this exam

Taking an Exam

Choose your exam

Choose from one of the following exams:

Level 1 Complex Operations Exam $50.00

Select this exam

For flying drones weighing

250 g to 150 kg

You may fly:

- with all applicable rules for advanced operations
- beyond visual line-of-sight (BVLOS) in uncontrolled airspace for operations away from populated areas or over sparsely populated areas if flying a drone that meets the appropriate manufacturer RPAS safety assurance declaration

Materials Required

The examinations are delivered via computer. However, we suggest having a pencil and paper handy before beginning the examination, to make diagrams or execute calculations during the examination.

Time limits and pass marks

Examination	Questions	Time limit	Pass mark
Remotely Piloted Aircraft Systems–Basic Operations:	35	1 ½ hour	65%
Remotely Piloted Aircraft Systems–Advanced Operations:	50	1 hour	80%
Remotely Piloted Aircraft Systems–Flight Reviewers:	30	1 ½ hour	80%

Materials Required

Rewriting of examinations

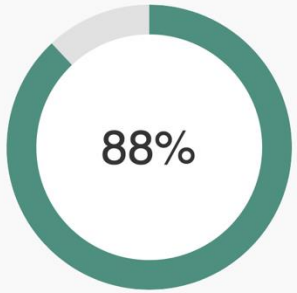
- In the case of any examination for operation of sRPAS, the examination may be rewritten after 24 hours.

Examination feedback

- Feedback statements in the results letter will inform the candidate where questions were answered incorrectly.
- Example of feedback statement:
  - Identify classes of airspace from an aeronautical chart

This exam was completed on March 14, 2019 with a passing mark of **88**%:

OVERALL RESULT



Minimum of 80% needed to pass

Subject area
01 AIR LAW, AIR TRAFFIC RULES AND PROCEDURES
02 RPAS AIRFRAMES, POWER PLANTS, PROPULSION AND SYSTEMS
03 HUMAN FACTORS
04 METEOROLOGY
05 NAVIGATION
06 FLIGHT OPERATIONS
07 THEORY OF FLIGHT
08 RADIOTELEPHONY

Administration & Compliance

Manuals, Checklists & SOPs

- Record keeping and documentation is going to be an important part of your operations. Developing a proper operations manual will be critical to your future operations.
- Build proper documentation to ensure compliance and the repeatability of successful flight operations.
- Keep your insurance, registration and licensing documentation along side manuals for your airframes/payloads with the associated standard operating procedures (SOPs)
- Inspection of Aircraft, Requests for Production of Documents and Prohibitions
- **Aviation Documents:** Who may demand and inspect aviation documents? Transport Canada, or a representative of including law enforcement

Air Documents

- Every person who is may be inspected
  - (a) is the holder of a Canadian aviation document,
  - (b) is the owner, operator or pilot-in-command of an aircraft in respect of which a Canadian aviation document, technical record or other document is kept, or
  - (c) has in possession a Canadian aviation document, technical record or other document relating to an aircraft or a commercial air service
  - shall produce the Canadian aviation document, technical record or other document for inspection in accordance with the terms of a demand made by a peace officer, an immigration, Representative or Transport Canada officer or the Minister.
  - (3) No person shall
    - (a) lend a Canadian aviation document to any person who is not entitled to it by these Regulations, or allow any such person to use a Canadian aviation document; or
    - (b) mutilate, alter or render illegible a Canadian aviation document.

Air Documents

- For the purposes of this section, other document includes all writings, papers and other records made, held or maintained by the owner, operator or pilot-in-command of an aircraft for the purpose of recording any action, activity, performance or use of the aircraft or any activity of the owner, operator or crew members in respect of that aircraft, whether or not the documents are required by law to be made, held or maintained.
- **Return of Canadian Aviation Documents**
  - Where a Canadian aviation document has been suspended or cancelled, the person to whom it was issued shall return it to the Minister immediately after the effective date of the suspension or cancellation.
- **Record Keeping**
  - Recording systems, including computer records and microfiche, that do not comprise entries on paper may be used to comply with the record-keeping requirements of these Regulations if
    - (a) measures are taken to ensure that the records contained in the recording systems are protected, by electronic or other means, against inadvertent loss or destruction and against tampering; and
    - (b) a copy of the records contained in the recording systems can be printed on paper and provided to the Minister on reasonable notice given by the Minister.

Common Terms

Interpretation

900.01 The following definitions apply in this Part.

- ***advertised event*** means an outdoor event that is advertised to the general public, including a concert, festival, market or sporting event. (événement annoncé)
- ***BVLOS*** means beyond visual line-of-sight. (BVLOS)
- ***BVLOS operation*** means an operation of a remotely piloted aircraft that is not in visual line-of-sight, but does not include an extended VLOS operation or a sheltered operation. (opération en BVLOS)
- ***contingency procedures*** means the procedures to be followed to address conditions that could lead to an unsafe situation. (procédure de contingence)
- ***contingency volume*** means the area immediately surrounding the flight geography within which contingency procedures are intended to be used to return a remotely piloted aircraft to the flight geography or safely terminate the flight. (volume de contingence)
- ***extended VLOS operation*** means an operation of a remotely piloted aircraft that is not in visual line-of-sight but during which unaided visual contact is maintained with the airspace in which the aircraft is operating in a manner sufficient to detect conflicting air traffic and other hazards and take action to avoid them. (opération en VLOS prolongée)
- ***flight geography*** means the area within which a remotely piloted aircraft is intended to fly for a specific operation. (géographie de vol)

Common Terms

Interpretation

900.01 The following definitions apply in this Part.

- ***fly-away*** means, in respect of a remotely piloted aircraft, 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. (dérive)
- ***ground risk buffer*** means the area immediately surrounding the contingency volume that, when measured horizontally from the perimeter of the contingency volume, is at least equal to the planned maximum altitude of the remotely piloted aircraft for the flight. (tampon de risque au sol)
- ***mandatory action*** means the inspection, repair or modification of a remotely piloted aircraft system that is necessary to prevent an unsafe or potentially unsafe condition. (mesure obligatoire)
- ***medium remotely piloted aircraft*** means a remotely piloted aircraft that has an operating weight of more than 25 kg (55 pounds) but not more than 150 kg (331 pounds). (aéronef télépiloté moyen)
- ***operating weight*** means the weight of a remotely piloted aircraft at any point during a flight, including any payload and any safety equipment that is on board or otherwise connected to the aircraft. (masse opérationnelle)
- ***operational volume*** means the area that is composed of the flight geography, contingency volume and ground risk buffer. (volume opérationnel)

Common Terms

Interpretation

900.01 The following definitions apply in this Part.

- ***payload*** means a system, object or collection of objects, including a slung load, that is on board or is otherwise connected to a remotely piloted aircraft but that is not required for flight. (charge utile)
- ***populated area*** means an area with more than five people per square kilometre. (zone peuplée)
- ***RPAS ground school instruction means instructor-led training given to one or more persons, delivered in-person*** or virtually, and provided through an organized program of lectures, homework or self-paced study. (instruction théorique au sol pour les SATP)
- ***RPAS operations manual*** means the manual established by an RPAS operator under section 901.217. (manuel d'exploitation de SATP)
- ***RPAS operator*** means the holder of an RPAS operator certificate. (exploitant de SATP)
- ***RPAS operator certificate*** means a certificate issued under section 901.214. (certificat d'exploitation de SATP)
- ***sheltered operation*** means an operation of a remotely piloted aircraft that is not in visual line-of-sight and during which the aircraft remains at a distance of less than 200 feet (61 m), measured horizontally, from a building or structure and at an altitude no greater than 100 feet (30 m) above that building or structure. (opération protégée)

Common Terms

Interpretation

900.01 The following definitions apply in this Part.

- ***small remotely piloted aircraft*** means a remotely piloted aircraft that has an operating weight of at least 250 g (0.55 pounds) but not more than 25 kg (55 pounds). (petit aéronef télépiloté)
- ***sparsely populated area*** means an area with more than 5 but not more than 25 people per square kilometre. (zone peu densément peuplée)
- ***Standard 922*** means Standard 922 — RPAS Safety Assurance, published by the Department of Transport. (norme 922)
- ***visual line-of-sight or VLOS*** means unaided visual contact maintained with a remotely piloted aircraft in a manner sufficient to maintain control of the aircraft, know its location and scan the airspace in which it is operating in order to detect conflicting air traffic and other hazards and take action to avoid them. (visibilité directe ou VLOS)
- ***visual observer*** means a crew member who is trained to assist the pilot in ensuring the safe conduct of a flight. (observateur visuel)
- ***VLOS operation*** means an operation of a remotely piloted aircraft in visual line-of-sight. (opération en VLOS)
- ***Water Aerodrome Supplement*** has the same meaning as in section 300.01. (Supplément hydroaérodromes)

Negligent Operations

Reckless or Negligent Operation

- 900.06 No person shall operate a remotely piloted aircraft system in such a reckless or negligent manner as to endanger or be likely to endanger aviation safety or the safety of any person.

Registering Your Drone

Registration

- 900.13 (1) Subject to subsection (2), no person shall operate a remotely piloted aircraft system that includes a remotely piloted aircraft having an operating weight of 250 g (0.55 pounds) or more unless the remotely piloted aircraft is registered in accordance with this Division.
- (2) A person may operate a remotely piloted aircraft system that includes a remotely piloted aircraft that is not registered in accordance with this Division if the operation is conducted in accordance with a special flight operations certificate — RPAS issued under section 903.03.

Registration Number

- 900.14 No pilot shall operate a remotely piloted aircraft system unless the registration number referred to in paragraph 900.16(3)(a) is clearly visible on the remotely piloted aircraft.

Registering Your Drone

Qualifications To Be Registered Owner of Remotely Piloted Aircraft

- 900.15 (1) Subject to subsection (2), a person is qualified to be the registered owner of a remotely piloted aircraft if they are
- (a) a Canadian citizen or permanent resident of Canada;
- (b) a corporation or entity that is incorporated or formed under the laws of Canada or a province; or
- (c) a government in Canada or an agent or mandatary of such a government.
- (2) No individual is qualified to be the registered owner of a remotely piloted aircraft unless that individual is at least 14 years of age.

Registering Your Drone

Registration Requirements

- 900.16 (1) The Minister shall, on receipt of an application, register a remotely piloted aircraft if the applicant is qualified to be the registered owner of the aircraft.
  - (2) The application shall include the following information:
    - (a) if the applicant is an individual,
      - (i) the applicant's name and address,
      - (ii) the applicant's date of birth, and
      - (iii) an indication as to whether the applicant is a Canadian citizen or permanent resident of Canada;
    - (b) if the applicant is a corporation or entity that is incorporated or formed under the laws of Canada or a province,
      - (i) the corporation's or entity's legal name and address,
      - (ii) the name and title of the person making the application, and
      - (iii) the business number assigned to the corporation or entity by the Minister of National Revenue, if any;

Registering Your Drone

Registration Requirements

- 900.16 (1) The Minister shall, on receipt of an application, register a remotely piloted aircraft if the applicant is qualified to be the registered owner of the aircraft.
    - (c) if the applicant is His Majesty in right of Canada or a province,
        - (i) the name of the government body, and
        - (ii) the name and title of the person making the application;
    - (d) an indication as to whether the aircraft was purchased or built by the applicant;
    - (e) the date of purchase of the aircraft by the applicant, if applicable;
    - (f) the manufacturer and model of the aircraft, if applicable;
    - (g) the serial number of the aircraft, if applicable;
    - (h) the category of aircraft, such as a fixed-wing aircraft, rotary-wing aircraft, hybrid aircraft or lighter-than-air aircraft; and
        - (i) any Canadian registration number previously issued in respect of the aircraft.

Registering Your Drone

Register of Remotely Piloted Aircraft

- 900.16 (1) The Minister shall, on receipt of an application, register a remotely piloted aircraft if the applicant is qualified to be the registered owner of the aircraft.
  - (3) On registering the remotely piloted aircraft, the Minister shall issue to the registered owner of the aircraft a certificate of registration that includes
    - (a) a registration number;
    - (b) the name and address of the registered owner; and
    - (c) the serial number of the aircraft, if applicable.
- 900.17 The Minister shall establish and maintain a register of remotely piloted aircraft in which there shall be entered, in respect of each aircraft for which a certificate of registration has been issued under section 900.16,
  - (a) the name and address of the registered owner;
  - (b) the registration number referred to in paragraph 900.16(3)(a); and
  - (c) any other particulars concerning the aircraft that the Minister determines necessary for the registration of the remotely piloted aircraft.

Registering Your Drone

Cancellation of Certificate of Registration

- 900.18 (1) A registered owner of a remotely piloted aircraft shall, within seven days after becoming aware that any of the following events has occurred, notify the Minister that
    - (a) the aircraft is destroyed;
    - (b) the aircraft is permanently withdrawn from use;
    - (c) the aircraft is missing and the search for the aircraft is terminated;
    - (d) the aircraft has been missing for 60 days or more; or
    - (e) the registered owner has transferred legal custody and control of the aircraft.
- (2) When an event referred to in subsection (1) has occurred, the certificate of registration in respect of the remotely piloted aircraft is cancelled.

Registering Your Drone

Cancellation of Certificate of Registration

- 900.18 (1) A registered owner of a remotely piloted aircraft shall, within seven days after becoming aware that any of the following events has occurred, notify the Minister that
  - (3) The certificate of registration of a remotely piloted aircraft is cancelled when
    - (a) the registered owner of the aircraft dies;
  - (b) the entity that is the registered owner of the aircraft is wound up, dissolved or amalgamated with another entity; or
  - (c) the registered owner of the aircraft ceases to be qualified to be a registered owner under section 900.15.
- (4) For the purposes of this Division, an owner has legal custody and control of a remotely piloted aircraft when the owner has complete responsibility for the operation and maintenance of the remotely piloted aircraft system of which the aircraft is an element.

Registering Your Drone

Change of Name or Address

- 900.19 The registered owner of a remotely piloted aircraft shall notify the Minister of any change in the name or address of the registered owner by not later than seven days after the change.

Access to Certificate of Registration

- 900.20 No pilot shall operate a remotely piloted aircraft system unless the certificate of registration issued in respect of the remotely piloted aircraft that is an element of the system is easily accessible to the pilot for the duration of the operation.

Marking & Insurance

Marking

- Basic and Advanced Register your drone and mark it with the registration marks Transport Canada provides.

Liability insurance

- All operators who fly a drone that weighs more than 250 g for any purpose should to be insured through a liability insurance provider for at least $100,000 or more. Some client operations can require $5,000,000 insurance to get on site.
- You can purchase insurance from an insurance provider who covers the risks of public liability, as described in subsection 606.02 (8) of the Canadian Aviation Regulations (CARs).

First Person Viewing (FPV)

Use of First-person View Devices

- 901.38 (1) No pilot shall operate a remotely piloted aircraft system using a first-person view device unless a visual observer maintains unaided visual contact with the airspace in which the remotely piloted aircraft is operating in order to detect conflicting air traffic and other hazards and take action to avoid them.
    - (2) For the purposes of subsection (1), first-person view device means 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 the illusion of flying the aircraft from an onboard pilot's perspective

Night Flight Requirements

Night Flight Requirements

- 901.39 (1) No pilot shall operate a remotely piloted aircraft system at night unless the remotely piloted aircraft is equipped with lights that are sufficient to allow the aircraft to be visible to the pilot or a visual observer, whether with or without night-vision goggles, and those lights are turned on.
    - (2) No pilot shall operate a remotely piloted aircraft system using night-vision goggles unless the goggles are capable of, or the person has another means of, detecting all light within the visual spectrum.


LUME CUBE®

Multiple Remotely Piloted Aircraft

Multiple Remotely Piloted Aircraft

Multiple Remotely Piloted Aircraft

- 901.40 (1) Subject to subsections (2) and (3), no pilot shall operate more than one remotely piloted aircraft at a time unless
    - (a) the aircraft are operated to conduct a VLOS operation;
    - (b) the aircraft are operated in accordance with the operating manuals applicable to the remotely piloted aircraft system;
    - (c) the remotely piloted aircraft system is designed to permit the operation of multiple aircraft from a single control station; and
    - (d) no more than five aircraft are operated at a time.
- (2) A pilot may operate more than five remotely piloted aircraft at a time if the operation is conducted in accordance with a special flight operations certificate — RPAS issued under section 903.03.
- (3) A pilot may operate more than one remotely piloted aircraft at a time to conduct an operation that is not a VLOS operation if the operation is conducted in accordance with a special flight operations certificate — RPAS issued under section 903.03.

Advertised Events

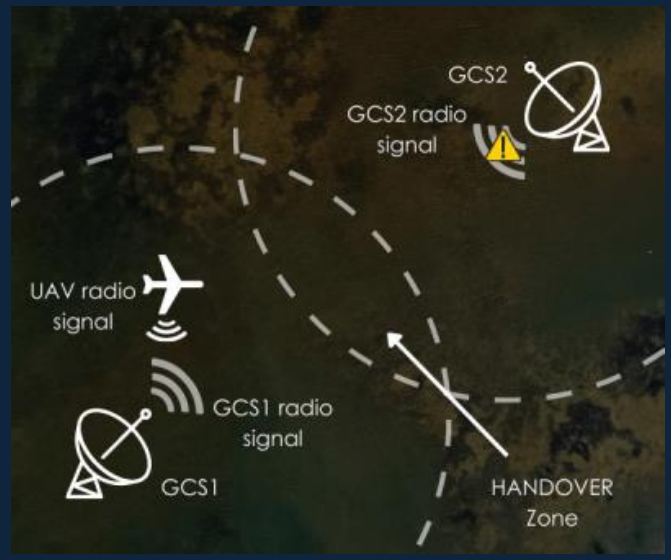
Advertised Events

- 901.41 (1) No pilot shall operate a remotely piloted aircraft system at any advertised event except in accordance with a special flight operations certificate — RPAS issued under section 903.03.
    - (2) Subsection (1) does not apply to the operation of a remotely piloted aircraft system for the purpose of an operation to save human life, a police operation, a fire-fighting operation or any other operation that is conducted in the service of a public authority.

Handovers

Handovers

- 901.42 No pilot shall hand over their responsibilities to another pilot during flight unless, before the take-off or launch of a remotely piloted aircraft,
  - (a) a pre-arrangement in respect of the handover has been made between the pilots; and
  - (b) a procedure has been developed to mitigate the risk of loss of control of the aircraft.



Stay Focused!

- The Pilot in Command is handling an incredible amount of electronic and visual data. For this reason alone, handovers can be hazardous if the procedure is not done with a well laid out plan

Payloads

Flight Termination System

Flight Termination System

- 901.44 No pilot shall activate a system that terminates the flight of a remotely piloted aircraft if it will endanger or will likely endanger aviation safety or the safety of any person.

Emergency Locator Transmitter

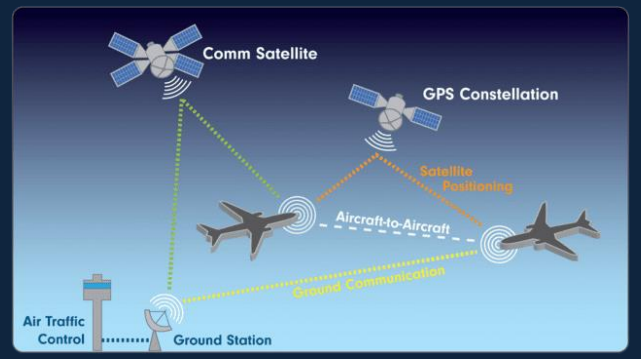
Emergency Locator Transmitter (ELT)

- 901.45 No pilot shall operate a remotely piloted aircraft equipped with an ELT.

Transponder and Automatic Pressure-Altitude Reporting Equipment

Transponder and Automatic Pressure-Altitude Reporting Equipment

- 901.46 (1) Subject to subsection (2), no pilot shall operate a remotely piloted aircraft system if the aircraft is in the transponder airspace referred to in section 601.03 unless the aircraft is equipped with a transponder and automatic pressure-altitude reporting equipment.
  - (2) An air traffic control unit may authorize a pilot to operate a remotely piloted aircraft that is not equipped in accordance with subsection (1) within the airspace referred to in section 601.03 if
    - (a) the air traffic control unit provides an air traffic control service in respect of that airspace;
    - (b) the pilot made a request to the air traffic control unit to operate the aircraft within that airspace before the aircraft entered the airspace; and
    - (c) aviation safety is not likely to be affected.



Operations at or in the Vicinity of an Aerodrome, Airport or Heliport

Operations at or in the Vicinity of an Aerodrome, Airport or Heliport

- 901.47 (1) No pilot shall operate a remotely piloted aircraft at or near an aerodrome that is listed in the Canada Flight Supplement or the Water Aerodrome Supplement in a manner that could interfere with an aircraft operating in the established traffic pattern.
  - (2) Subject to section 901.73, no pilot shall operate a remotely piloted aircraft to conduct a VLOS operation if the aircraft is at a distance of less than
    - (a) three nautical miles from the centre of an airport; and
    - (b) one nautical mile from the centre of a heliport.
  - (3) No pilot shall operate a remotely piloted aircraft to conduct a BVLOS operation if the aircraft is at a distance of less than five nautical miles from the centre of an aerodrome that is listed in the Canada Flight Supplement or the Water Aerodrome Supplement unless the operation is conducted in accordance with a special flight operations certificate — RPAS issued under section 903.03.
  - (4) No pilot shall operate a remotely piloted aircraft if the aircraft is at a distance of less than three nautical miles from the centre of an aerodrome operated under the authority of the Minister of National Defence unless authorized to do so by the Department of National Defence.

Operations at or in the Vicinity of an Aerodrome, Airport or Heliport

Length

3 Nautical mile = 5.556 Kilometre

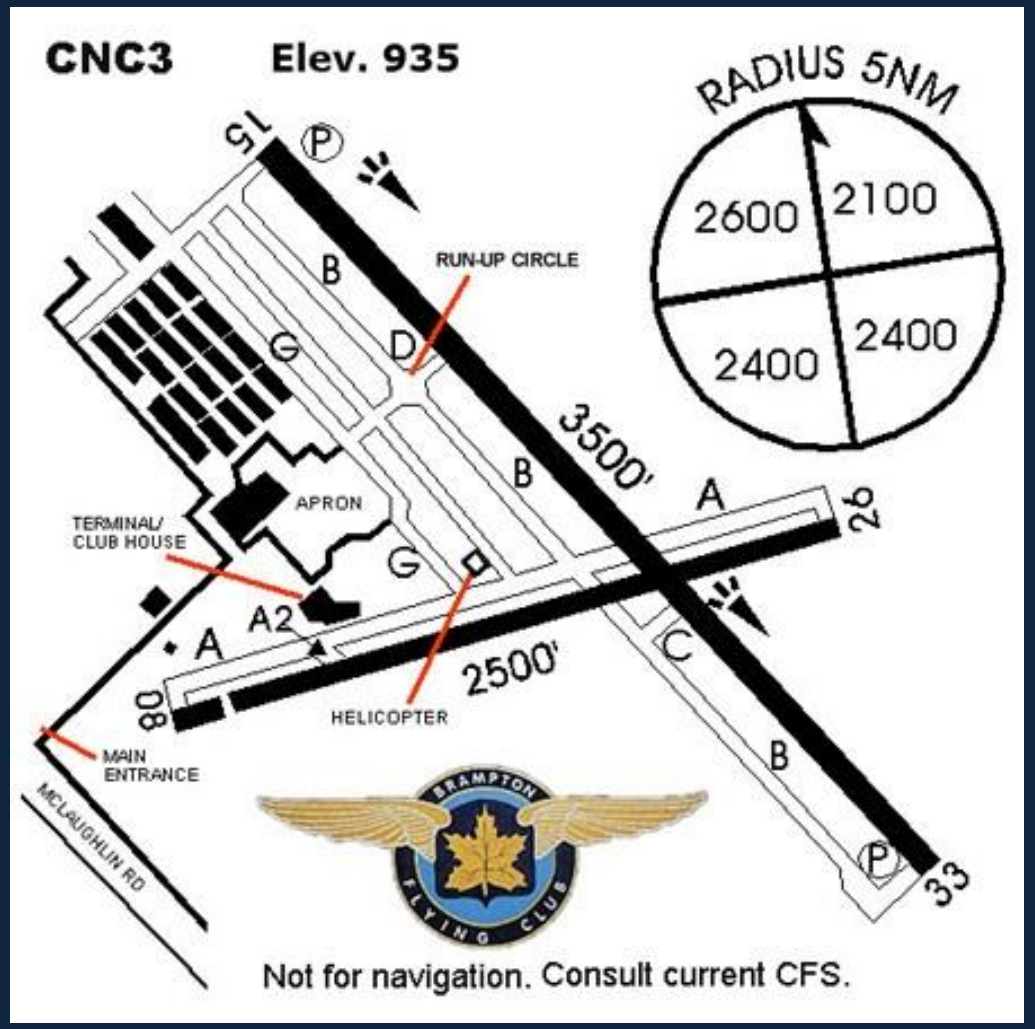
Formula multiply the length value by 1.852

Length

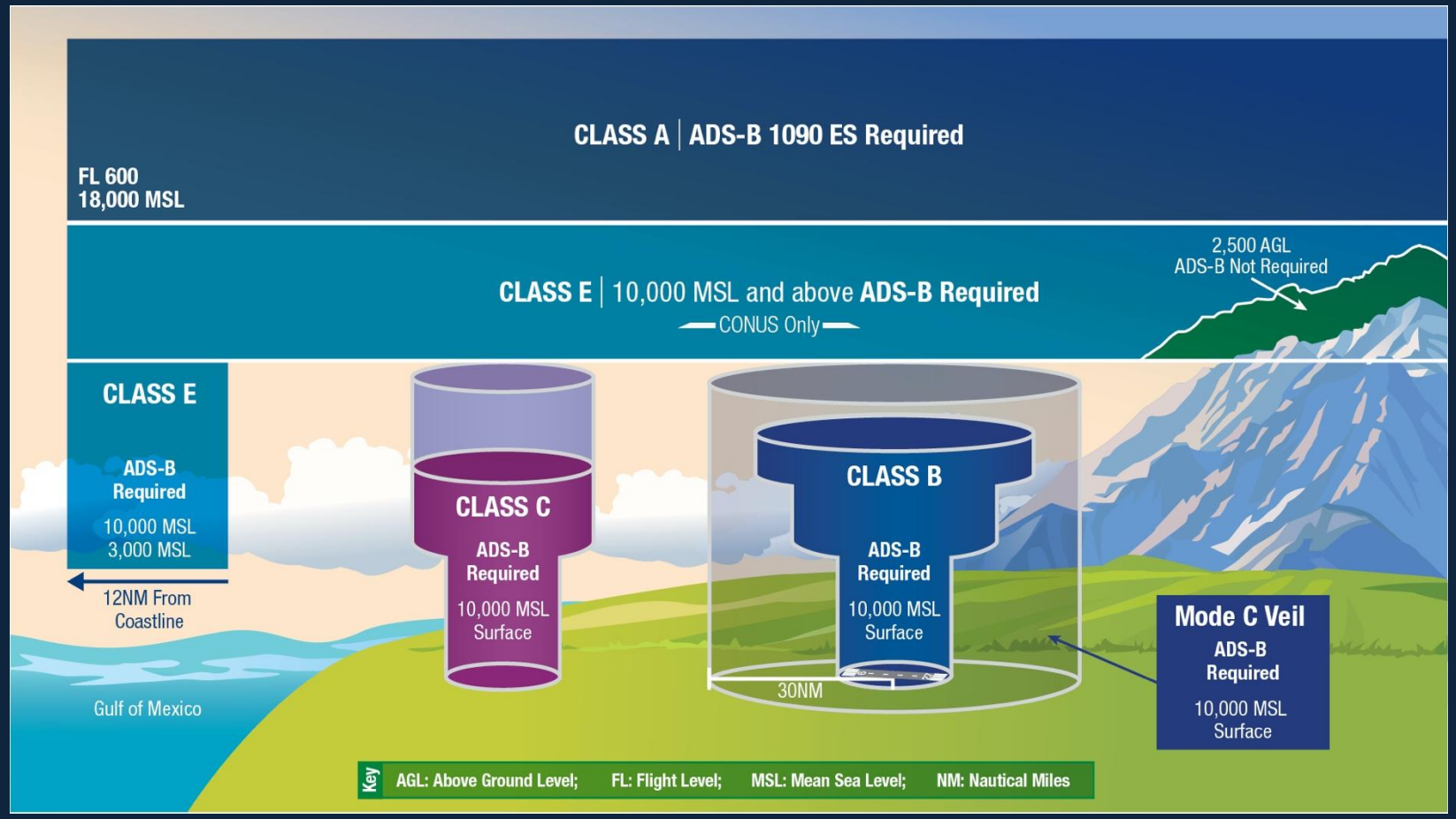
1 Nautical mile = 1.852 Kilometre

Formula multiply the length value by 1.852

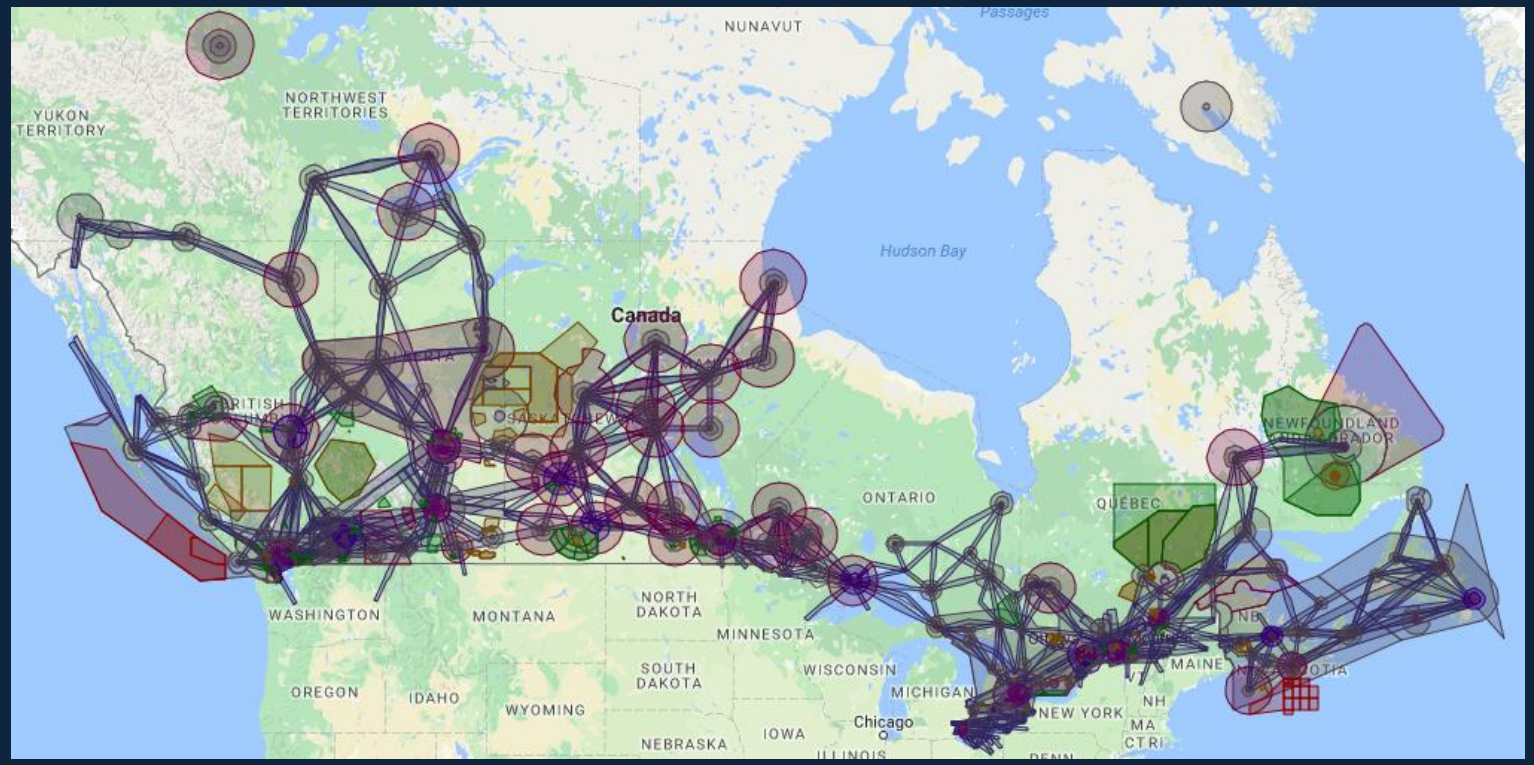
Operations at or in the Vicinity of an Aerodrome, Airport or Heliport



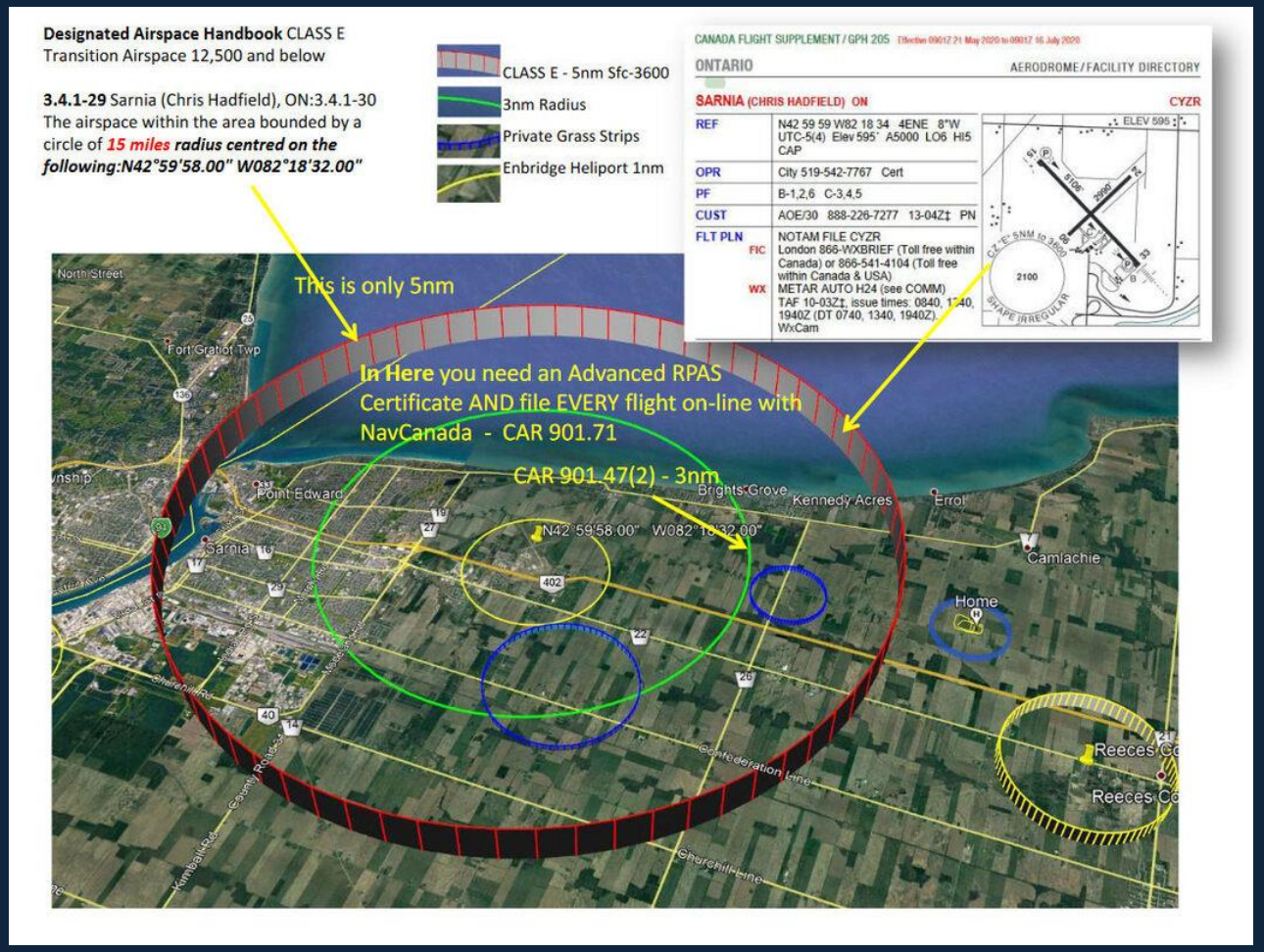
Operations at or in the Vicinity of an Aerodrome, Airport or Heliport



Operations at or in the Vicinity of an Aerodrome, Airport or Heliport



Operations at or in the Vicinity of an Aerodrome, Airport or Heliport



Record Keeping

Records

- 901.48 (1) Every owner of a remotely piloted aircraft system shall keep the following records:
    - (a) a record containing the names of the pilots and other crew members who are involved in each flight and, in respect of the system, the time of each flight or series of flights; and
    - (b) a record containing the particulars of any mandatory action and any other maintenance action, modification or repair performed on the system, including
        - (i) the names of the persons who performed them,
        - (ii) the dates they were undertaken,
        - (iii) in the case of a modification, the manufacturer, model and a description of the part or equipment installed to modify the system, and
        - (iv) if applicable, any instructions provided to complete the work.

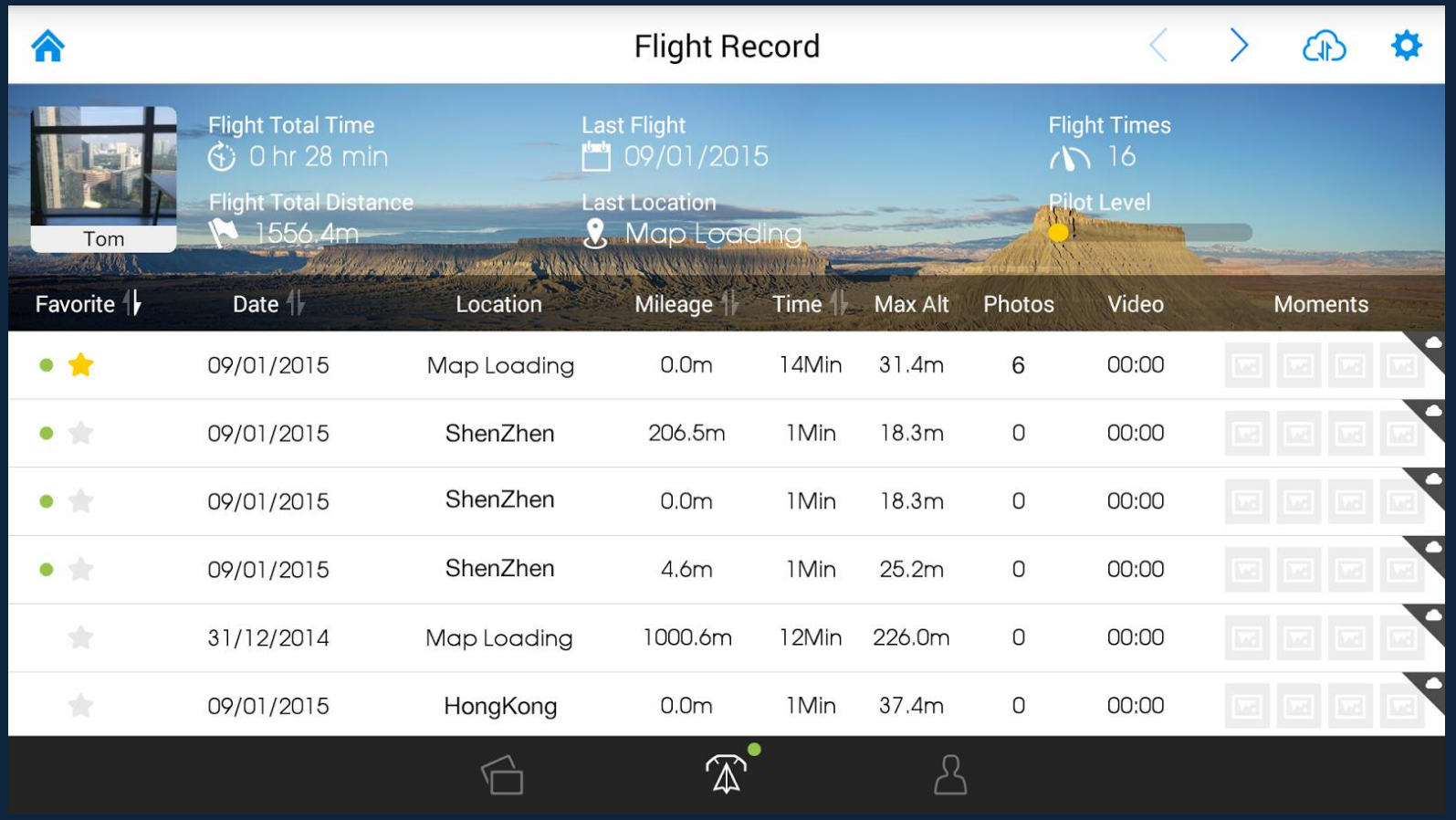
Record Keeping

Records

- 901.48 (1) Every owner of a remotely piloted aircraft system shall keep the following records:
  - (2) Every owner of a remotely piloted aircraft system shall ensure that the records referred to in subsection (1) are made available to the Minister on request and are retained for a period of
    - (a) in the case of the records referred to in paragraph (1)(a), 12 months after the day on which they are created; and
    - (b) in the case of the records referred to in paragraph (1)(b), 24 months after the day on which they are created.
  - (3) Every owner of a remotely piloted aircraft system who transfers ownership of the system to another person shall, at the time of transfer, also deliver to that person all of the records referred to in paragraph (1)(b).

Record Keeping

- Some RPASs have some minimal built-in automatic flight logging



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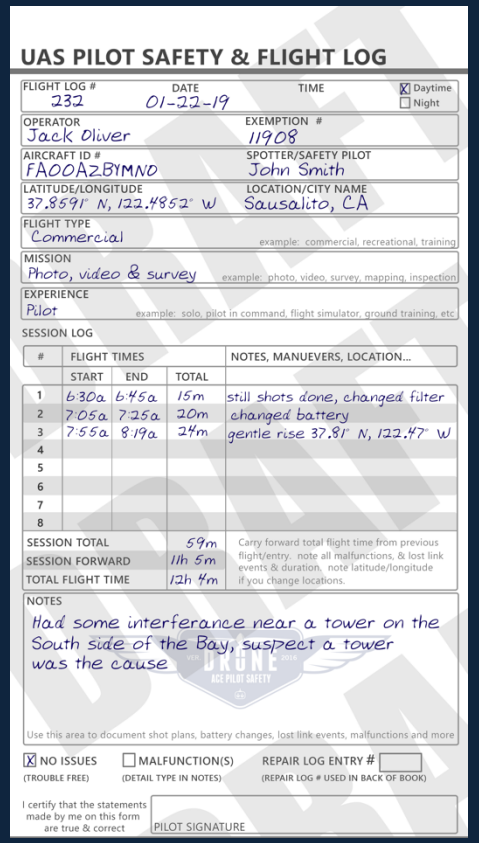
● ☆	09/01/2015	ShenZhen	206.5m	1Min	18.3m	0	00:00	
● ☆	09/01/2015	ShenZhen	0.0m	1Min	18.3m	0	00:00	
● ☆	09/01/2015	ShenZhen	4.6m	1Min	25.2m	0	00:00	
☆	31/12/2014	Map Loading	1000.6m	12Min	226.0m	0	00:00	
☆	09/01/2015	HongKong	0.0m	1Min	37.4m	0	00:00	

Record Keeping

- However, you may want to capture more information than these automatic systems provide
- You can make your own or subscribe to a third-party flight log tracking system



UAS PILOT SAFETY & FLIGHT LOG

FLIGHT LOG # 232 | DATE 01-22-19 | TIME | [X] Daytime [ ] Night

OPERATOR: Jack Oliver | EXEMPTION #: 11908

AIRCRAFT ID #: FA00A2BYMN0 | SPOTTER/SAFETY PILOT: John Smith

LATITUDE/LONGITUDE: 37.8591° N, 122.4852° W | LOCATION/CITY NAME: Sausalito, CA

FLIGHT TYPE: Commercial (example: commercial, recreational, training)

MISSION: Photo, video & survey (example: photo, video, survey, mapping, inspection)

EXPERIENCE: Pilot (example: solo, pilot in command, flight simulator, ground training, etc.)

SESSION LOG

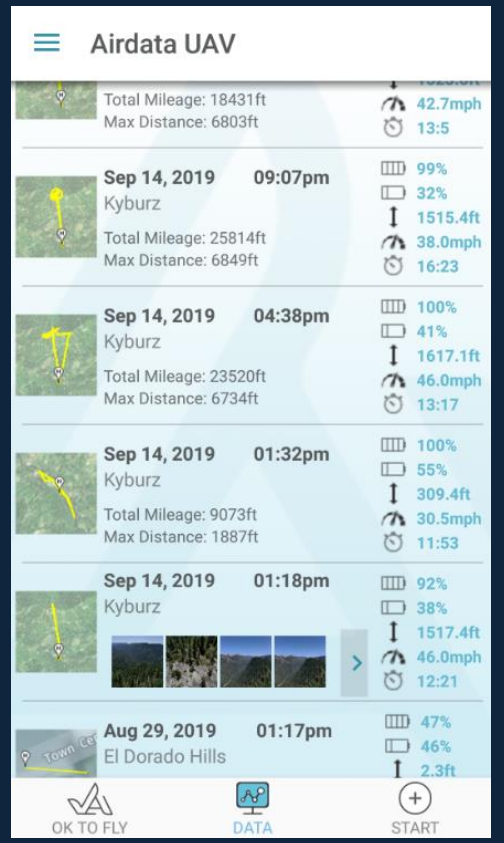
#	FLIGHT TIMES START	END	TOTAL	NOTES, MANUEVERS, LOCATION...
1	6:30a	6:45a	15m	still shots done, changed filter
2	7:05a	7:25a	20m	changed battery
3	7:55a	8:19a	24m	gentle rise 37.81° N, 122.47° W
4				
5				
6				
7				
8				
SESSION TOTAL			59m	Carry forward total flight time from previous flight/entry. note all malfunctions, & lost link events & duration. note latitude/longitude if you change locations.
SESSION FORWARD			11h 5m	
TOTAL FLIGHT TIME			12h 4m	

NOTES: Had some interferance near a tower on the South side of the Bay, suspect a tower was the cause

Use this area to document shot plans, battery changes, lost link events, malfunctions and more

[X] NO ISSUES (TROUBLE FREE) [ ] MALFUNCTION(S) (DETAIL TYPE IN NOTES) REPAIR LOG ENTRY # (REPAIR LOG # USED IN BACK OF BOOK)

I certify that the statements made by me on this form are true & correct — PILOT SIGNATURE



Incidents and Accidents — Associated Measures

Incidents and Accidents — Associated Measures

Incidents and Accidents — Associated Measures

- 901.49 (1) A pilot that operates a remotely piloted aircraft system shall immediately cease operations if any of the following incidents or accidents occurs until such time as an analysis is undertaken as to the cause of the occurrence and corrective actions have been taken to mitigate the risk of recurrence:
    - (a) injuries to any person requiring medical attention;
    - (b) unintended contact between the aircraft and persons;
    - (c) unanticipated damage incurred to the airframe, control station, payload or command and control links that adversely affects the performance or flight characteristics of the aircraft;
    - (d) any time the aircraft is not kept within horizontal boundaries or altitude limits;
    - (e) any collision with or risk of collision with another aircraft;
    - (f) any time the aircraft becomes uncontrollable, experiences a fly-away or is missing; and
    - (g) any incident not referred to in paragraphs (a) to (f) for which a police report has been filed or for which a Civil Aviation Daily Occurrence Report has resulted.

Incidents and Accidents — Associated Measures

Incidents and Accidents — Associated Measures

- (2) The pilot of the remotely piloted aircraft system shall keep, and make available to the Minister on request, a record of any analyses undertaken under subsection (1) for a period of 12 months after the day on which the record is created.

Dropping of Objects

Dropping of Objects

- 901.50 No pilot shall create a hazard to persons or property on the surface by dropping an object from a remotely piloted aircraft in flight.

Requesting Authorization

NAV Drone

- Whether you're planning a drone flight, looking for airspace information or simply want to gain a better understanding of where you can fly your drone in Canada, NAV Drone is the only app that lets you safely and legally request permission to fly a drone in airspace controlled by NAV CANADA. From the web or a mobile device, professional and recreational drone pilots and operators can easily see where they can and cannot fly with interactive maps and, when needed, submit requests to fly in controlled airspace.
    - https://portal.navdrone.ca/
    - There are numerous support videos explaining how to request authorization for your planned flight operation.
        - https://www.navcanada.ca/en/flight-planning/drone-flight-planning/nav-drone-support.aspx

Division V – Advanced Operations

Advanced RPAS Flight Operations

Division V – Advanced Operations

Application

- 901.62 This Division applies in respect of the following operations of a remotely piloted aircraft system:
  - (a) the operation of a small remotely piloted aircraft to conduct a VLOS operation
    - (i) in controlled airspace,
    - (ii) at a distance of less than 100 feet (30 m) but not less than 16.4 feet (5 m), measured horizontally and at any altitude, from any person not involved in the operation,
    - (iii) at a distance of less than 16.4 feet (5 m), measured horizontally and at any altitude, from any person not involved in the operation, or
    - (iv) within three nautical miles from the centre of an airport or within one nautical mile from the centre of a heliport;
  - (b) the operation of a small remotely piloted aircraft to conduct an extended VLOS operation in uncontrolled airspace;
  - (c) the operation of a small remotely piloted aircraft to conduct a sheltered operation;

Division V – Advanced Operations

Application

- 901.62 This Division applies in respect of the following operations of a remotely piloted aircraft system:
  - (d) the operation of a medium remotely piloted aircraft to conduct a VLOS operation in uncontrolled airspace and at a distance of 500 feet (152.4 m) or more, measured horizontally and at any altitude, from any person not involved in the operation;
  - (e) the operation of a medium remotely piloted aircraft to conduct a VLOS operation in uncontrolled airspace and at a distance of less than 500 feet (152.4 m) but not less than 100 feet (30 m), measured horizontally and at any altitude, from any person not involved in the operation;
  - (f) the operation of a medium remotely piloted aircraft to conduct a VLOS operation at a distance of less than 100 feet (30 m), measured horizontally and at any altitude, from any person not involved in the operation; and
  - (g) the operation of a medium remotely piloted aircraft to conduct a VLOS operation in controlled airspace.

Division V – Advanced Operations

Pilot Requirements

- 901.63 (1) Subject to subsection (2), no person shall operate a remotely piloted aircraft system under this Division unless the person
  - (a) is at least 16 years of age; and
  - (b) holds either
    - (i) a pilot certificate — remotely piloted aircraft — advanced operations issued under section 901.64, or
    - (ii) a pilot certificate — remotely piloted aircraft — level 1 complex operations issued under section 901.90.
  - (2) Subsection (1) does not apply if the operation of the remotely piloted aircraft system is conducted under the direct supervision of a person who is permitted to operate such a system under this Division or Division VI.

Division V – Advanced Operations

Advanced RPAS Flight Operations

Issuance of Pilot Certificate

- 901.64 The Minister shall, on receipt of an application, issue a pilot certificate — remotely piloted aircraft — advanced operations if the applicant demonstrates to the Minister that the applicant
  - (a) is at least 16 years of age;
  - (b) has successfully completed the examination "Remotely Piloted Aircraft Systems — Advanced Operations" in accordance with the document entitled Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems, 250 g up to and including 150 kg, Basic and Advanced Operations, TP 15263, published by the Minister; and
  - (c) has, within 12 months before the date of application, successfully completed a flight review in accordance with section 921.02 of Standard 921 — Remotely Piloted Aircraft conducted by a person qualified to act as a flight reviewer under subsection 901.175(1).

Division V – Advanced Operations

Advanced RPAS Flight Operations

Recency Requirements

- 901.65 (1) No holder of a pilot certificate — remotely piloted aircraft — advanced operations or a pilot certificate — remotely piloted aircraft — level 1 complex operations shall operate a remotely piloted aircraft system under this Division unless the holder has, within the 24 months preceding the flight,
  - (a) been issued a pilot certificate — remotely piloted aircraft — advanced operations under section 901.64 or a pilot certificate — remotely piloted aircraft — level 1 complex operations under section 901.90; or
  - (b) successfully completed
    - (i) any of the examinations referred to in paragraph 901.55(b), 901.64(b) or 901.90(d),
    - (ii) any of the flight reviews referred to in paragraph 901.64(c) or 901.90(e), or
    - (iii) any of the recurrent training activities set out in section 921.04 of Standard 921 — Remotely Piloted Aircraft.
  - (2) The person referred to in subsection (1) shall keep a record of all activities completed in accordance with paragraph (1)(b), including the dates on which they were completed, for at least 24 months after the day on which they were completed.

Division V – Advanced Operations

Advanced RPAS Flight Operations

Access to Certificate and Proof of Recency

- 901.66 No pilot shall operate a remotely piloted aircraft system under this Division unless both of the following are easily accessible during the operation of the system:
  - (a) the pilot certificate — remotely piloted aircraft — advanced operations issued under section 901.64 or the pilot certificate — remotely piloted aircraft — level 1 complex operations issued under section 901.90; and
  - (b) documentation demonstrating that the pilot meets the recency requirements set out in section 901.65.

Examination Rules

- 901.67 No person shall commit an act referred to in paragraphs 901.58(a) to (c) in respect of an examination taken under this Division.

Retaking of an Examination or Flight Review

- 901.68 No person who fails an examination or a flight review taken under this Division shall retake the examination or flight review for a period of 24 hours after the examination or review.

Permitted Operations (VLOS)

- 901.69 No pilot shall operate a remotely piloted aircraft system under this Division to conduct any of the following operations unless a declaration to the Minister has been made in accordance with section 901.194 in respect of that model of system and in respect of each of the technical requirements set out in Standard 922 that is applicable to the operation:
  - (a) the VLOS operation of a small remotely piloted aircraft in controlled airspace;
  - (b) the VLOS operation of a small remotely piloted aircraft at a distance of less than 100 feet (30 m) but not less than 16.4 feet (5 m), measured horizontally and at any altitude, from any person not involved in the operation;
  - (c) the VLOS operation of a small remotely piloted aircraft at a distance of less than 16.4 feet (5 m), measured horizontally and at any altitude, from any person not involved in the operation;
  - (d) the operation of a small remotely piloted aircraft to conduct a sheltered operation in controlled airspace;
  - (e) the VLOS operation of a medium remotely piloted aircraft at a distance of 500 feet (152.4 m) or more, measured horizontally and at any altitude, from any person not involved in the operation;

Permitted Operations (VLOS)

- 901.69 No pilot shall operate a remotely piloted aircraft system under this Division to conduct any of the following operations unless a declaration to the Minister has been made in accordance with section 901.194 in respect of that model of system and in respect of each of the technical requirements set out in Standard 922 that is applicable to the operation:
  - (f) the VLOS operation of a medium remotely piloted aircraft at a distance of less than 500 feet (152.4 m) but not less than 100 feet (30 m), measured horizontally and at any altitude, from any person not involved in the operation;
  - (g) the VLOS operation of a medium remotely piloted aircraft at a distance of less than 100 feet (30 m), measured horizontally and at any altitude, from any person not involved in the operation; or
  - (h) the VLOS operation of a medium remotely piloted aircraft in controlled airspace.

Modified RPAS

Operation of a Modified Remotely Piloted Aircraft System

- 901.70 (1) No pilot shall conduct any of the operations described in section 901.69 using a remotely piloted aircraft system that has been modified in any way unless
    - (a) the pilot is able to demonstrate to the Minister that, despite the modification, the system continues to meet the technical requirements set out in Standard 922 that are applicable to the operation; and
    - (b) if applicable, the modification was performed in accordance with the instructions of the manufacturer of the part or equipment used to modify the system.
- (2) No pilot shall conduct an operation described in paragraph 901.69(f) or (g) using a remotely piloted aircraft system that has been modified in any way unless the modification was performed in accordance with the instructions of the person who has made a declaration referred to in 901.194 in respect of that model of system.

Operations in Controlled Airspace

- 901.71 (1) No pilot shall operate a remotely piloted aircraft in controlled airspace under this Division unless an authorization has been issued by the provider of air traffic services in the area of operation and, if requested, the following information has been provided to that provider:
  - (a) the date, time and duration of the operation;
  - (b) the category, registration number and physical characteristics of the aircraft;
  - (c) the vertical and horizontal boundaries of the area of operation;
  - (d) – (f) [Repealed, SOR/2025-70, s. 91]
  - (g) the name, contact information and pilot certificate number of any pilot of the aircraft;
  - (h) the procedures and flight profiles to be followed in the case of a lost command and control link;
  - (i) the procedures to be followed in emergency situations;
  - (j) the process and the time required to terminate the operation; and
  - (k) any other information required by the provider of air traffic services that is necessary for the provision of air traffic management.

Operations in Controlled Airspace

- 901.71 (1) No pilot shall operate a remotely piloted aircraft in controlled airspace under this Division unless an authorization has been issued by the provider of air traffic services in the area of operation and, if requested, the following information has been provided to that provider:
  - (2) Despite section 901.25, a pilot may operate a remotely piloted aircraft in controlled airspace under this Division at an altitude above those referred to in that section if an authorization to that effect has been issued by the provider of air traffic services in the area of operation.
  - (3) No pilot shall operate a remotely piloted aircraft in controlled airspace under this Division unless the authorization referred to in subsection (1) is easily accessible to the pilot during the operation.

Division X – Training & Flight Review

Flight Reviewer

- 901.175 (1) No person shall perform the duties of a flight reviewer for a flight review referred to in paragraph 901.64(c) unless that person
    - (a) holds a pilot certificate — remotely piloted aircraft — advanced operations endorsed with a flight reviewer rating under section 901.176 or a pilot certificate — remotely piloted aircraft — level 1 complex operations endorsed with such a rating; and
    - (b) is able to demonstrate that they are affiliated with a training provider that has made a declaration to the Minister in accordance with the requirements of section 921.05 or 921.08 of Standard 921 — Remotely Piloted Aircraft.
- (2) No person shall perform the duties of a flight reviewer for a flight review referred to in paragraph 901.90(e) unless that person
    - (a) holds a pilot certificate — remotely piloted aircraft — level 1 complex operations endorsed with a flight reviewer rating under section 901.176; and
    - (b) is able to demonstrate that they are affiliated with a training provider that has made a declaration to the Minister in accordance with the requirements of section 921.08 of Standard 921 — Remotely Piloted Aircraft.

Division X – Training & Flight Review

Flight Reviewer Rating

- 901.176 The Minister shall, on receipt of an application, endorse the applicant's pilot certificate with a flight reviewer rating if the applicant demonstrates to the Minister that the applicant
  - (a) is at least 18 years of age;
  - (b) holds a pilot certificate — remotely piloted aircraft — advanced operations issued under section 901.64 or a pilot certificate — remotely piloted aircraft — level 1 complex operations issued under section 901.90 and meets the recency requirements set out in section 901.65 or 901.91, as the case may be;
  - (c) has held one of the certificates referred to in paragraph (b) for at least six months immediately before the date of application; and
  - (d) has successfully completed the examination "Remotely Piloted Aircraft Systems — Flight Reviewers" in accordance with the document entitled Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems, 250 g up to and including 150 kg, Basic and Advanced Operations, TP 15263, published by the Minister.

Division X – Training & Flight Review

Examination Rules

- 901.177 No person shall commit an act referred to in paragraphs 901.58(a) to (c) in respect of an examination referred to in paragraph 901.176(d).

Retaking of Examination

- 901.177 No person shall commit an act referred to in paragraphs 901.58(a) to (c) in respect of an examination referred to in paragraph 901.176(d).

Eligibility to Make Declaration

- 901.179 A training provider is eligible to make a declaration to the Minister in accordance with the requirements of section 921.05 or 921.08 of Standard 921 — Remotely Piloted Aircraft if the training provider is Canadian.

Division X – Training & Flight Review

Training Provider Requirements — Flight Reviews

- 901.180 A training provider that has made a declaration referred to in paragraph 901.175(1)(b) or (2)(b) shall
  - (a) submit to the Minister the name of any person who is affiliated with the provider and who intends to perform the duties of a flight reviewer;
  - (b) ensure that the person referred to in paragraph (a) conducts flight reviews in accordance with section 901.181; and
  - (c) if the person referred to in paragraph (a) ceases to be affiliated with the provider, notify the Minister of that fact within seven days after the day on which the affiliation ceases.

Conduct of Flight Reviews

- 901.181 No person shall conduct a flight review referred to in paragraph 901.64(c) or 901.90(e) unless the review is conducted in accordance with section 921.06 of Standard 921 — Remotely Piloted Aircraft.

Division X – Training & Flight Review

Training Provider Requirements — RPAS Ground School Instruction

- 901.182 (1) No training provider shall deliver the RPAS ground school instruction referred to in paragraph 901.90(c) unless the training provider
    - (a) has made a declaration to the Minister in accordance with the requirements of section 921.08 of Standard 921 — Remotely Piloted Aircraft; and
    - (b) has appointed a chief ground instructor responsible for the delivery of the RPAS ground school instruction.
- (2) A training provider shall inform the Minister within 30 days after any change in the appointment of a chief ground instructor.

Compliance & Procedures

Compliance with Air Traffic Control Instructions

- 901.72 The pilot of a remotely piloted aircraft operating in controlled airspace under this Division shall comply with all of the air traffic control instructions directed at the pilot.

Operations at or in the Vicinity of an Airport or Heliport — Established Procedure

- 901.73 No pilot shall operate a remotely piloted aircraft system under this Division if the remotely piloted aircraft is at a distance of less than three nautical miles from the centre of an airport or less than one nautical mile from the centre of a heliport unless the operation is conducted in accordance with the established procedure with respect to the safe use of remotely piloted aircraft systems that is applicable to that airport or heliport.

Is Your Drone Compliant?

Is Your Drone Compliant?

- When buying a drone, it's important to choose the right one for you. That means selecting a drone that is safe enough to do what you want to do with it. We developed a Remotely Piloted Aircraft System (RPAS) Safety Assurance rating system to help with this.
- The RPAS Safety Assurance tells you what advanced operations your drone is approved for.
    - These include flying your drone:
        - in controlled airspace
        - near or above people
- Advanced operations pose a higher risk to people and aircraft. They include operations near people, over people and in controlled airspace.
- A drone must meet the relevant RPAS Safety Assurance requirements to conduct specific advanced operations. Meeting the RPAS Safety Assurance for one advanced operation does not make the drone fit for all of them.
- For example, a drone may be allowed to operate at a horizontal distance less than 30 metres (100 feet) from bystanders but not over them.

Advanced RPAS Flight Operations

Is Your Drone Compliant?

- https://tc.canada.ca/en/aviation/drone-safety/learn-rules-you-fly-your-drone/choosing-right-drone-advanced-operations#about
- Drones are listed only if they have an RPAS Safety Assurance declaration submitted by their manufacturer. If your drone isn't listed, the manufacturer may have yet to submit the declaration or the declaration is yet to be reviewed. You'll be issued a new registration certificate if the declaration is submitted. Contact your drone's manufacturer to ask if a declaration will be submitted.
- Note: RPAS Safety Assurance declarations may be invalidated after being listed below. If you have a registered RPAS that has been invalidated, you will be notified by email that it no longer qualifies for Advanced Operations and you will be issued an updated registration certificate.
- **Categories of advanced operations:**
  - Controlled airspace - flying your drone within airspace controlled by air traffic control (Class A-F)
  - Near people - flying your drone within 30 metres (100 feet) and 5 metres (16.4 feet) of any person not associated with the operation
  - Over people - flying your drone within 5 metres (16.4 feet) or directly over any person not associated with the operation

Is Your Drone Compliant?

Filter items | Show 10 entries

Manufacturer	Model Name	Model Type	Manufacturer RPAS Safety Assurance		
			Controlled Airspace	Near People	Over People
Acecore Technologies	NEO	Rotary wing	Yes	Yes	
Acecore Technologies	NOA	Rotary wing	Yes	Yes	
Acecore Technologies	ZETONA	Rotary wing	Yes	Yes	
Acecore Technologies	ZOE	Rotary wing	Yes	Yes	
Aeraccess	Hawker Q800X	Rotary wing	Yes	Yes	
Aeraccess	Hawker Q800X Tethered	Rotary wing	Yes	Yes	
Aeraccess	HAWKEYE MK1	Rotary wing	Yes	Yes	
Aerial Vehicle Safety Solutions Inc. (AVSS)	Arctic VTOL	Hybrid	Yes		
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M200 V2 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes

Division XI – RPAS Declaration

Declaration

- 901.194 (1) A person who makes a declaration to the Minister in respect of a model of remotely piloted aircraft system and in respect of any technical requirement set out in Standard 922 shall do so in accordance with subsection (2).
  - (2) The declaration shall
    - (a) specify the legal name, trade name, if any, address and contact information of the person making the declaration and, in respect of the remotely piloted aircraft system,
      - (i) the name of the model,
      - (ii) the configurable elements of the system,
      - (iii) the operations described in section 901.69 or 901.87 that the model of system is intended to conduct, and
      - (iv) the technical requirements set out in Standard 922 that are the subject of the declaration; and

Division XI – RPAS Declaration

Declaration

- 901.194 (1) A person who makes a declaration to the Minister in respect of a model of remotely piloted aircraft system and in respect of any technical requirement set out in Standard 922 shall do so in accordance with subsection (2).
    - (b) indicate that the person making the declaration has verified that the model of system meets the technical requirements specified under subparagraph (a)(iv) and, in the case of a model for which an acceptance letter has been issued under section 901.196, has completed that verification using the means set out in the person's application for an acceptance letter under subparagraph 901.196(2)(c)(ii).
- (3) In the case of a model of remotely piloted aircraft system that is intended to conduct any of the operations described in paragraph 901.69(f) or (g) or 901.87(b), no person shall provide the Minister with a declaration referred to in subsection (1) unless an acceptance letter has been issued in respect of that model of system under section 901.196 in the two years before the making of the declaration.

Division XI – RPAS Declaration

Declaration

- 901.194 (1) A person who makes a declaration to the Minister in respect of a model of remotely piloted aircraft system and in respect of any technical requirement set out in Standard 922 shall do so in accordance with subsection (2).
  - (4) The declaration is invalid if
    - (a) the Minister has determined that the model of remotely piloted aircraft system does not meet the technical requirements specified under subparagraph (2)(a)(iv);
    - (b) the person who has made the declaration has provided a notification to the Minister under section 901.195; or
    - (c) the person who has made the declaration has failed to submit their annual report in accordance with section 901.199.
  - (5) In the case referred to in paragraph (4)(b) in respect of a notification referred to in paragraph 901.195(1)(b), the declaration is only invalid with respect to the operations described in paragraphs 901.69(f) and (g) and 901.87(b).

Division XI – RPAS Declaration

Declaration

- 901.194 (1) A person who makes a declaration to the Minister in respect of a model of remotely piloted aircraft system and in respect of any technical requirement set out in Standard 922 shall do so in accordance with subsection (2).
  - (6) In the case referred to in paragraph (4)(c), the declaration is only invalid with respect to the operations described in paragraphs 901.69(f) and (g) and 901.87(b) and only for the period during which the annual report is outstanding.
  - (7) A person who has made a declaration shall notify the Minister within 30 days after any change to the names, address or contact information referred to in paragraph (2)(a).

Division XI – RPAS Declaration

Notice to the Minister

- 901.195 (1) A person who has made a declaration referred to in section 901.194 shall notify the Minister of
    - (a) any deficiency related to the model of remotely piloted aircraft system that causes the model to no longer meet the technical requirements specified under subparagraph 901.194(2)(a)(iv); and
    - (b) the fact that they are no longer maintaining a service difficulty reporting system, if they are required to establish and maintain such a system under section 901.197.
- (2) The person shall notify the Minister, in the case referred to in paragraph (1)(a), as soon as feasible after the deficiency is identified and, in the case referred to in paragraph (1)(b), on the day on which the person ceases to maintain the service difficulty reporting system.

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
    - (a) verify that the model of system meets the technical requirements set out in Standard 922 for which the applicant proposes to make a declaration referred to in section 901.194;
    - (b) establish and maintain a service difficulty reporting system that meets the requirements of section 901.197; and
    - (c) in the case of an applicant who manufactures an element of the remotely piloted aircraft system, ensure production consistency or, in the case of an applicant who provides a service that is an element of the system, ensure consistent activation and delivery of the service.

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
  - (2) The applicant shall provide the following information:
    - (a) the applicant's legal name, trade name, if any, address and contact information;
    - (b) a concept of operations that includes
      - (i) a description of the principal design features and specifications of the remotely piloted aircraft system, including a technical description of
        - (A) the remotely piloted aircraft, including the category of aircraft, such as a fixed-wing aircraft, rotary-wing aircraft, hybrid aircraft or lighter-than-air aircraft, and
        - (B) all other elements of the system that are required for it to meet the technical requirements identified under subparagraph (c)(i),

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
    - (ii) an indication of the operations described in section 901.69 or 901.87 that the model of system is intended to conduct,
    - (iii) a description of any operating limitations of the system, including personnel or environmental limitations, that must be adhered to in order for the system to meet the technical requirements identified under subparagraph (c)(i),
    - (iv) any procedures for operating the system, instructions for integrating and testing the elements of the system and instructions related to the servicing and maintenance of the system, and
    - (v) any mandatory actions that must be completed in order for the system to meet the technical requirements identified under subparagraph (c)(i);

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
  - (c) a declaration plan that identifies
    - (i) the technical requirements set out in Standard 922 for which the applicant proposes to make a declaration referred to in section 901.194,
    - (ii) the means to be used to demonstrate that the model system meets the technical requirements referred to in subparagraph (i), including any industry standards that will be followed and any proposed deviations from those standards, and how those means will demonstrate that the system meets those technical requirements,
    - (iii) the resources necessary for carrying out the demonstration referred to in subparagraph (ii), and
    - (iv) the schedule for carrying out the demonstration referred to in subparagraph (ii);
    - (d) copies in English or French, or both, of all standards the applicant intends to follow to demonstrate that the system meets the technical requirements identified under subparagraph (c)(i);

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
  - (e) documentation that demonstrates that the applicant has, or has access to, the technical capability to
    - (i) conduct the design analyses and tests required to demonstrate that the system meets the technical requirements identified under subparagraph (c)(i),
    - (ii) manufacture any elements of the remotely piloted aircraft system for which the applicant is the manufacturer, and
    - (iii) support the operation of the remotely piloted aircraft system in service;
  - (f) in the case of an applicant who manufactures an element of the system, a manufacturing plan that includes a description of the
    - (i) manufacturing processes, including how the applicant will ensure production consistency,
    - (ii) quality control procedures, including with respect to work performed by a supplier contracted by the applicant, and
    - (iii) configuration management processes for all aspects of production;

Division XI – RPAS Declaration

Issuance of Acceptance Letter

- 901.196 (1) The Minister shall, on receipt of an application containing the information set out in subsection (2), issue an acceptance letter to the applicant in respect of a model of remotely piloted aircraft system that is the subject of the application, if the applicant demonstrates the ability to
  - (g) in the case of an applicant who provides a service that is an element of the system, a commissioning plan that includes a description of the
    - (i) procedures and tests for the service's activation, and
    - (ii) procedures for verifying that the service is functioning as intended; and
  - (h) a product support plan that describes how the applicant will support the operation of the system in service, including
    - (i) a description of the service difficulty reporting system that the applicant will establish under section 901.197,
    - (ii) a description of the modifications that can be performed on the system by a person other than the applicant and any instructions with respect to those modifications,
    - (iii) a description of the required system maintenance and how the system, or elements of it, can be returned for maintenance, and
    - (iv) a description of how any mandatory actions will be made available to each user of the model of system.

Division XI – RPAS Declaration

Establishing a Service Difficulty Reporting System

- 901.197 (1) If a declaration referred to in section 901.194 is made in respect of a model of remotely piloted aircraft system for which an acceptance letter has been issued under section 901.196, the person who has made the declaration shall establish and maintain a service difficulty reporting system for the purpose of receiving, recording, analyzing and investigating reports and information concerning any reportable service difficulty related to that model.
  - (2) The service difficulty reporting system shall include
    - (a) a means for receiving reports and information concerning any reportable service difficulty; and
    - (b) instructions regarding what information must be submitted to the person who has made the declaration.

Investigation of Service Difficulty Reports

- 901.198 If a person receives a service difficulty report in respect of a model of remotely piloted aircraft system for which they have made a declaration referred to in section 901.194 and for which an acceptance letter has been issued under section 901.196, that person shall investigate the service difficulty and, if it results from a deficiency in the model that causes the system to no longer meet the technical requirements specified under subparagraph 901.194(2)(a)(iv), develop a mandatory action to rectify the deficiency.

Division XI – RPAS Declaration

Annual Report

- 901.199 (1) A person who has made a declaration referred to in section 901.194 in respect of a model of remotely piloted aircraft system for which an acceptance letter has been issued under section 901.196 shall submit to the Minister an annual report in respect of that model.
  - (2) The annual report shall include
    - (a) the name of the person submitting the report;
    - (b) the name of the model of remotely piloted aircraft system;
    - (c) the actual, if available, or estimated total number of hours of operation in Canada of systems of that model during the year to which the annual report relates; and
    - (d) the number of reportable service difficulty reports received during the year to which the annual report relates, a summary of the reports in respect of which mandatory actions were developed and a description of those mandatory actions.
  - (3) The annual report shall be submitted to the Minister each year by not later than the anniversary of the day on which the declaration referred to in section 901.194 was made.

Division XI – RPAS Declaration

Documentation

- 901.200 A person who has made a declaration referred to in section 901.194 in respect of a model of remotely piloted aircraft system shall make available to each user of that model of system
  - (a) a maintenance program that includes
    - (i) instructions related to the servicing and maintenance of the system, and
    - (ii) an inspection program to maintain system readiness;
  - (b) any mandatory actions the person develops in respect of the system; and
  - (c) an operating manual that includes
    - (i) a description of the system,
    - (ii) the ranges of weights and centres of gravity within which the system may be safely operated under normal and emergency conditions and, if a weight and centre of gravity combination is considered safe only within certain loading limits, those limits and the corresponding weight and centre of gravity combinations,
    - (iii) with respect to each flight phase and mode of operation, the conditions required to maintain a stable command and control link and the minimum and maximum altitudes and velocities within which the remotely piloted aircraft can be operated safely under normal and emergency conditions,

Division XI – RPAS Declaration

Documentation

- 901.200 A person who has made a declaration referred to in section 901.194 in respect of a model of remotely piloted aircraft system shall make available to each user of that model of system
  - (c) an operating manual that includes
    - (iv) a description of the effects of foreseeable weather conditions and other environmental conditions on the performance of the system,
    - (v) the characteristics of the system that could result in severe injury to crew members during operation,
    - (vi) the design features of the system, and their associated operations, that are intended to protect against injury to persons not involved in the operations,
    - (vii) the warning information provided to the pilot in the event of a degradation in system performance that may result in an unsafe operation condition,
    - (viii) procedures for operating the system in normal and emergency conditions,
    - (ix) assembly, adjustment and modification instructions for the system, and
    - (x) instructions for integrating the elements of the system.

Division XI – RPAS Declaration

Record Keeping

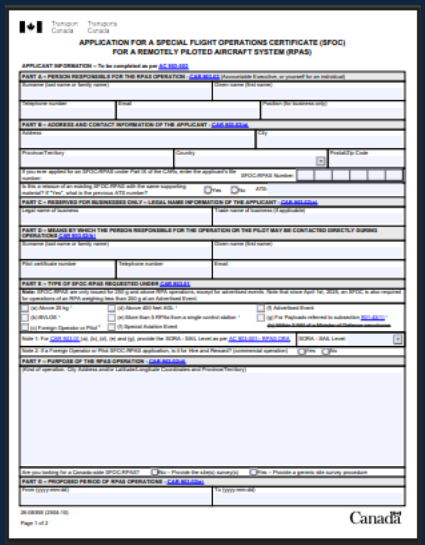
- 901.201 (1) A person who has made a declaration referred to in section 901.194 in respect of a model of remotely piloted aircraft system shall keep, and make available to the Minister on request, a record of
    - (a) any mandatory actions developed in respect of the system;
    - (b) the results of, and the reports related to, the verifications that the person has undertaken to ensure that the model of system meets the technical requirements specified under subparagraph 901.194(2)(a)(iv); and
    - (c) the results of any service difficulty investigations that the person has undertaken, if that person must establish and maintain a service difficulty reporting system under section 901.197.
  - (2) The person shall keep the records referred to in subsection (1) for the later of
    - (a) two years after the day on which manufacturing of the model of remotely piloted aircraft system permanently ceases; and
    - (b) two years after the day on which the person provides a notification to the Minister under section 901.195.

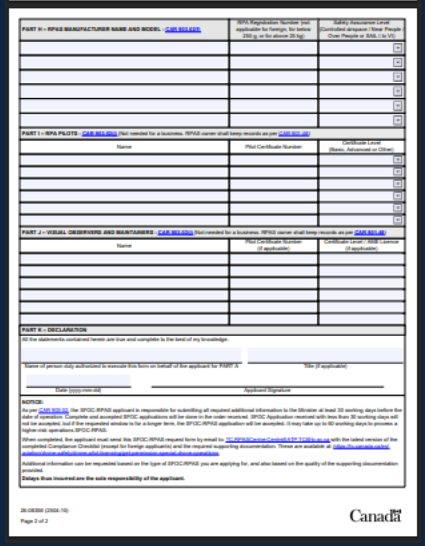
Special Flight Operators Certificate

Apply for your SFOC-RPAS

- MUST have for foreign pilots
- Complete a TP15263 compliant ground school and apply for a SFOC-RPAS Form 26-0835E
- See Advisory Circular (AC) 903-002 - Application Guidelines for an SFOC-RPAS
- Send your SFOC-RPAS application form and documents by email to: TC.RPASCentre-CentreSATP.TC@tc.gc.ca

Service	New Fee
SFOC – Very Low complexity	$20
SFOC – Low complexity	$75
SFOC – Medium complexity	$900
SFOC – High Complexity	$2,000





Advanced RPAS Flight Operations

Special Flight Operators Certificate

Prohibition

- 903.01 No person shall conduct any of the following operations using a remotely piloted aircraft system unless the person complies with the provisions of a special flight operations certificate — RPAS issued by the Minister under section 903.03:
  - (a) the operation of a remotely piloted aircraft having an operating weight of more than 25 kg (55 pounds);
  - (b) the operation of a remotely piloted aircraft having an operating weight of less than 250 g (0.55 pounds) at an advertised event; and
  - (c) any other operation of a small remotely piloted aircraft for which the Minister determines that a special flight operations certificate — RPAS is necessary to ensure aviation safety or the safety of any person.

Special Flight Operators Certificate

Application

- 903.02 An application for a special flight operations certificate — RPAS shall be submitted to the Minister and include the following information:
  - (a) the legal name, trade name, address and contact information of the applicant;
  - (b) the means by which the person responsible for the operation or the pilot may be contacted directly during operations;
  - (c) the operation for which the application is made;
  - (d) the purpose of the operation;
  - (e) the dates, alternate dates and times of the operation;
  - (f) the manufacturer and model of the system, including three-view drawings or photographs of the aircraft and a complete description of the aircraft, including performance, operating limitations and equipment;
  - (g) a description of the safety plan for the proposed area of operation;
  - (h) a description of the emergency contingency plan for the operation;
  - (i) a detailed plan describing how the operation is to be carried out;

Special Flight Operators Certificate

Application

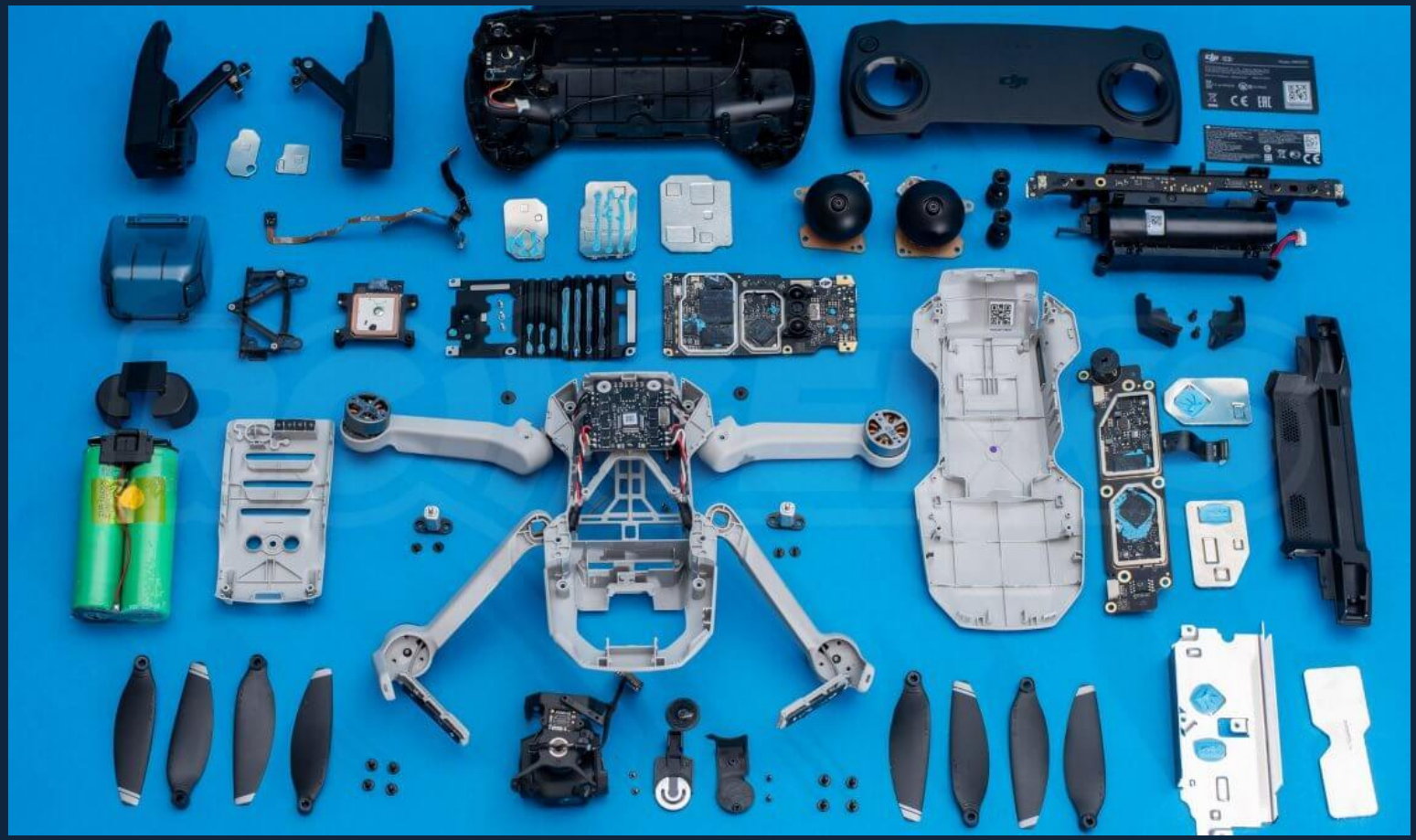
- 903.02 An application for a special flight operations certificate — RPAS shall be submitted to the Minister and include the following information:
  - (j) the names, certificates, licences, permits and qualifications of the crew members, including the pilots and visual observers, and the remotely piloted aircraft system maintenance personnel;
  - (k) the instructions regarding the maintenance of the system and a description of how that maintenance will be performed;
  - (l) a description of weather minima for the operation;
  - (m) a description of separation and collision avoidance capability and procedures;
  - (n) a description of normal and emergency procedures for the operation;
  - (o) a description of air traffic control services coordination, if applicable; and
  - (p) any other information requested by the Minister pertinent to the safe conduct of the operation.

Special Flight Operators Certificate

Issuance

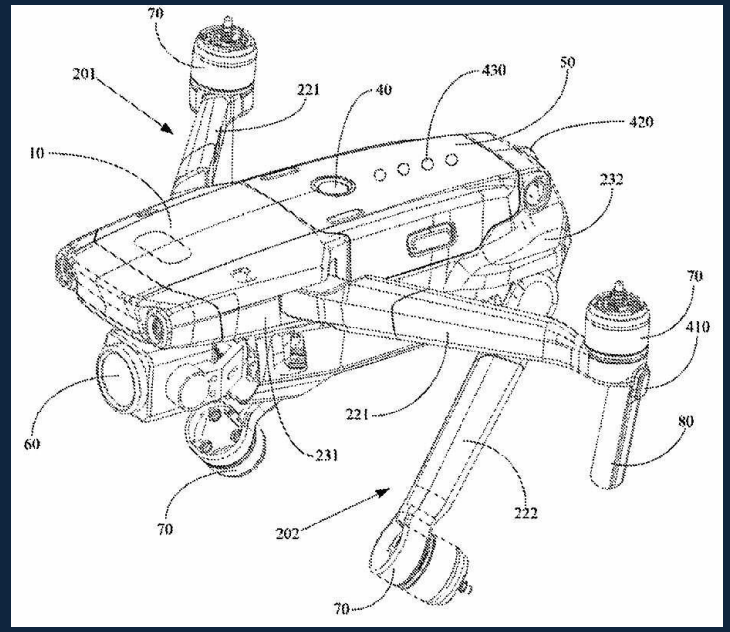
903.03 The Minister shall, on receipt of an application submitted in accordance with section 903.02, issue a special flight operations certificate — RPAS if the applicant demonstrates to the Minister the ability to perform the operation without adversely affecting aviation safety or the safety of any person.

Airframes, Power & Propulsion



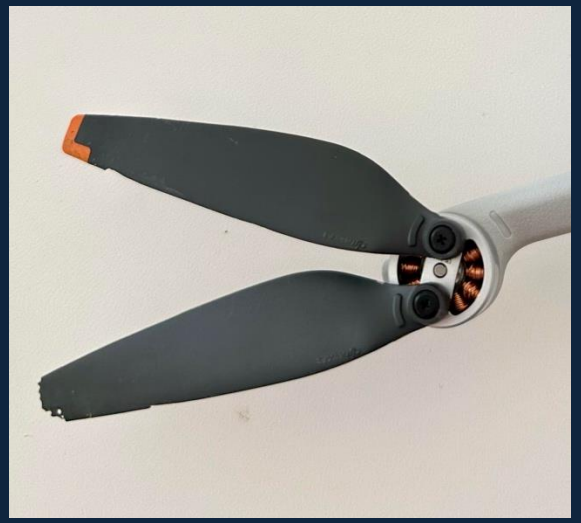
Airframes

- When it comes to the RPAS Airframe there are certain tasks that the operator can perform to ensure the equipment is safe to operate. Other tasks however may require an authorized repair facility to repair.
- To ensure you are not attempting to repair a component of your aircraft that must be repaired by an authorized facility you must find the manufacturer guidelines for your particular RPAS.

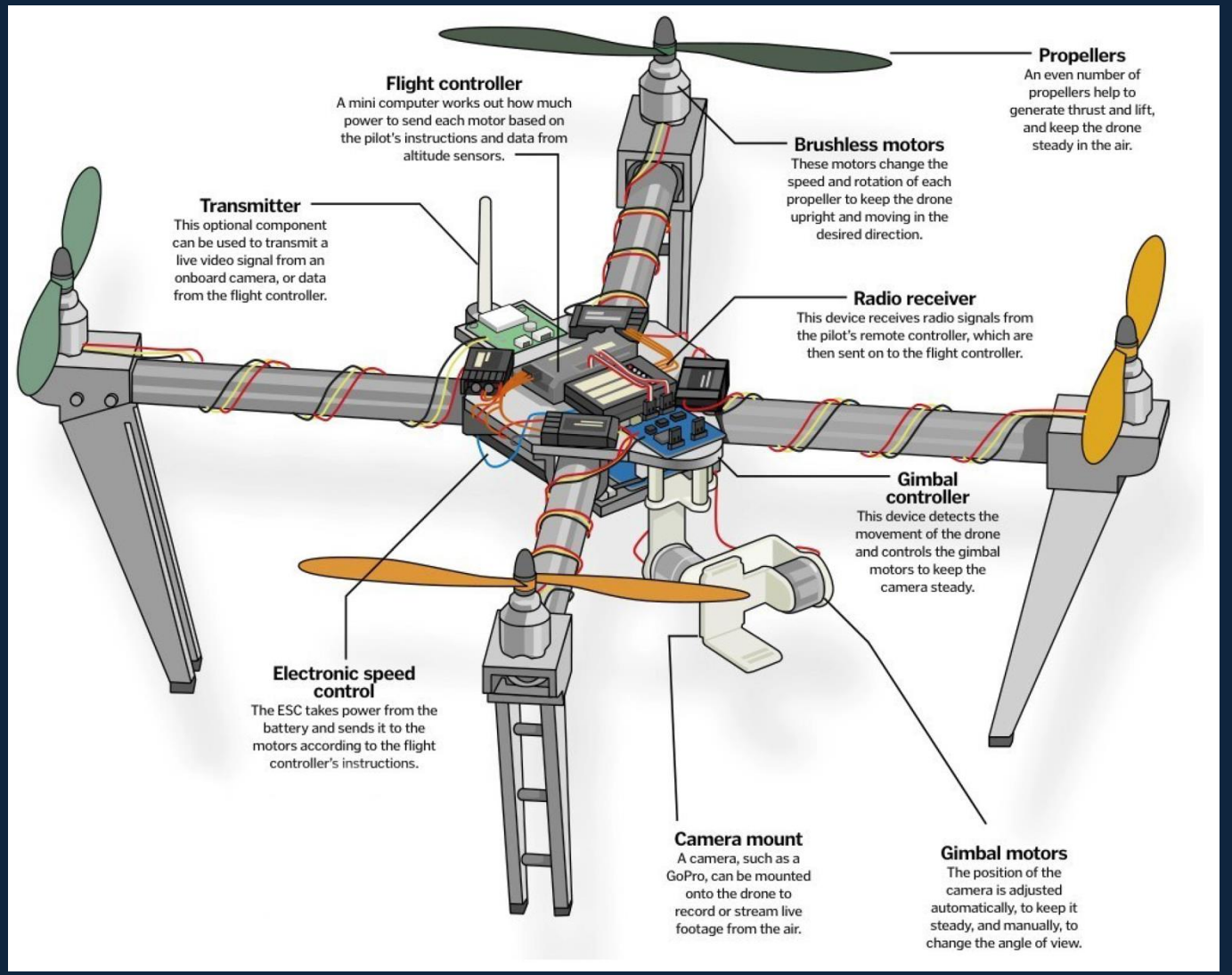


Airwothiness

- Props and motors are examples of components of the RPAS that an Operator could work on using original parts from the manufacturer.
- How do I identify Propeller Damage ?
  - A visual scan may immediately identify prop damage; however it is best to run your fingers along the edges and surface of the prop.
- An overall check of your aircraft should take place before and after every flight. To identify any issues from surface contamination, wiring or structural damage to the aircraft. It's a good idea to develop a comprehensive maintenance schedule



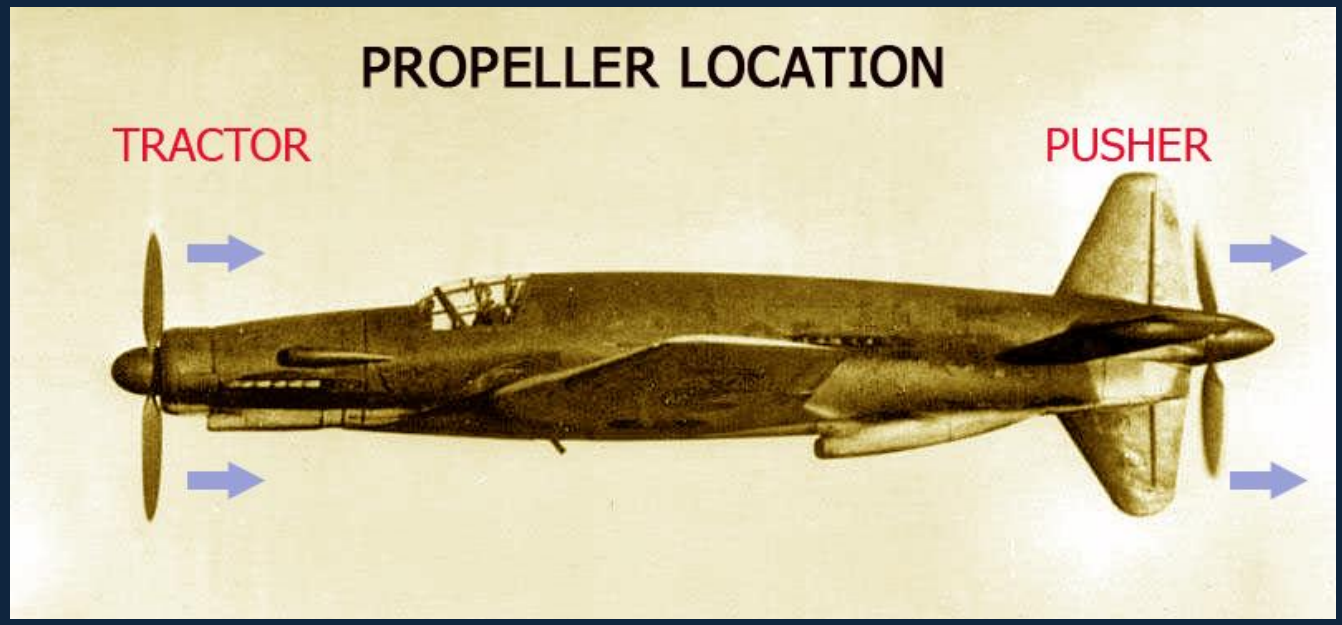
Parts of a Drone



Propellers

Pusher Props

- The Pusher props are at the back and push the UAV forward hence the name “Pusher props”. These contra-rotating props exactly cancel out motor torques during stationary level flight. Opposite pitch gives downdraft.
- These can be made of plastic with the better pusher props made from carbon fiber. You can also purchase guards for the pusher props.



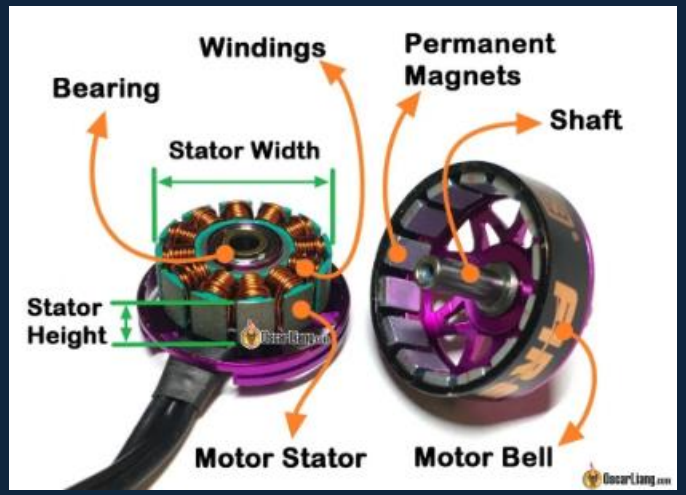
Propellers

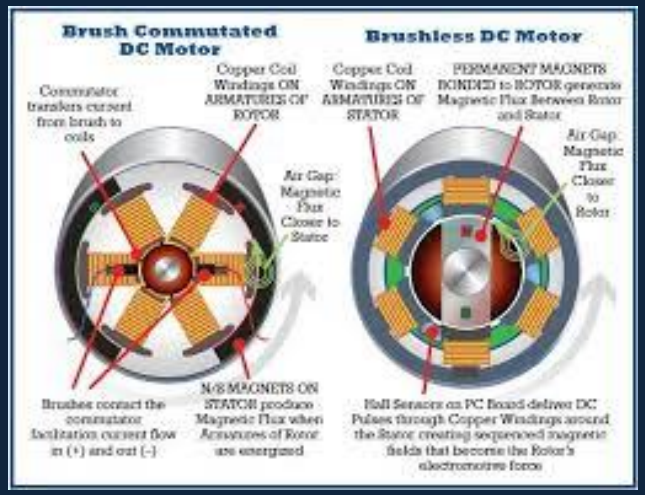
Standard Props

- The “tractor” propeller are the props at the front of the quadcopter. These props pull the quadcopter through the ai like a tractor. While some drones like the DJI Phantom look more or less the same from any angle, there is a front and back.
- Most drone propellers are made of plastic and the better quality made of carbon fiber. For safety, you can also add drone prop guards which you need especially if you are flying indoors or near people.
- Propeller design is an area where there is plenty of new innovation. Better prop design will assist in a smoother
- flying experience and longer flight times. There is also some big innovation towards low noise uav props.
- Tip: It is always good practice to inspect your props before flying and carry an extra set in case you notice some damage on a prop. Never fly with a damaged or bent prop.

Brushless Motors

- Practically all the latest drones use a brushless electric “out-runner” type, which is more efficient, more reliable, and quieter than a brushed motor. More efficient motors save battery life and give the owner more flying time, which is what every pilot wants.
- Motors are constantly improving in efficiency and power.
- Examine the motors regularly. Make sure they are clean and free from dust. Get to know how your drone sounds - most of the sound comes from the motors. If it doesn’t sound right, then examine your drone.
- Fly a couple of feet off the ground and close to you. Look to see if one of the motors is failing. It’s not a bad option to have a spare motor or 2.





Motor Mount

- The drone motor mount is sometimes built into the combination fittings with landing struts or can be part of the RPAS frame.
- Check the motor mounts and areas close to the motors for stress cracks. If you find stress cracks and your quadcopter is under warranty, then you can send it back and have it fixed. Alternatively, the manufacturer may have some strengthener motor mounts.
- When you first receive your new drone, it is also a good to examine areas around the motor mounts or where screws are used. Sometimes, screws can be wound in too tight and actually can crack the frame. It may be just a hairline crack but these won't fix themselves.

Landing Gear

- Typically, most RPAS use one of two types of landing gear - Fixed and Retractable.
- A DJI M300 has fixed landing gear where as a DJI Inspire 2 uses retractable landing gear.
- Drones, which need high ground clearance may adopt helicopter style skids mounted directly to the body, while other drones which have no hanging payload may omit landing gear altogether.
- Most drone has a fixed landing gear. However, the best drones will have retractable landing gear giving a full 360 degree view when in the air.

Drone Body

- This is the central hub. It houses battery, main boards, processors avionics, cameras, and sensors.

Batteries

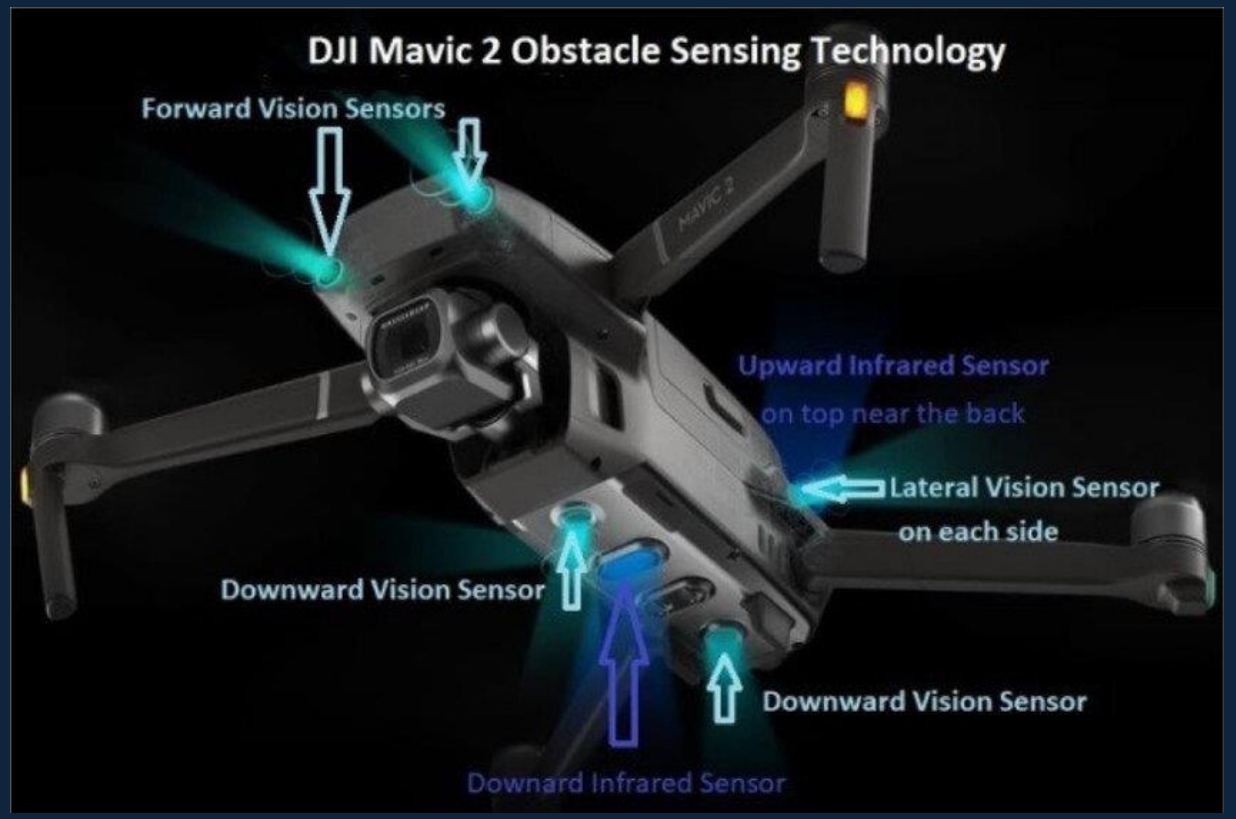
- Lithium polymer (LiPo) batteries offer the best combination of energy density, power density, and lifetime on the market.
- Airlines have strict rules on battery sizes and you may have to ship your batteries if they're above the threshold. Check with the airline to confirm prior.

Gimbals

- The drone gimbal is the pivoting mount, which rotates about the x, y, and z axes to provide stabilization and pointing of cameras or other sensors.
- Some drones like the M300 from DJI can support multiple gimbals & payloads.
- Be careful to not damage the gimbal when powering on your drone.

Collision Avoidance Sensors

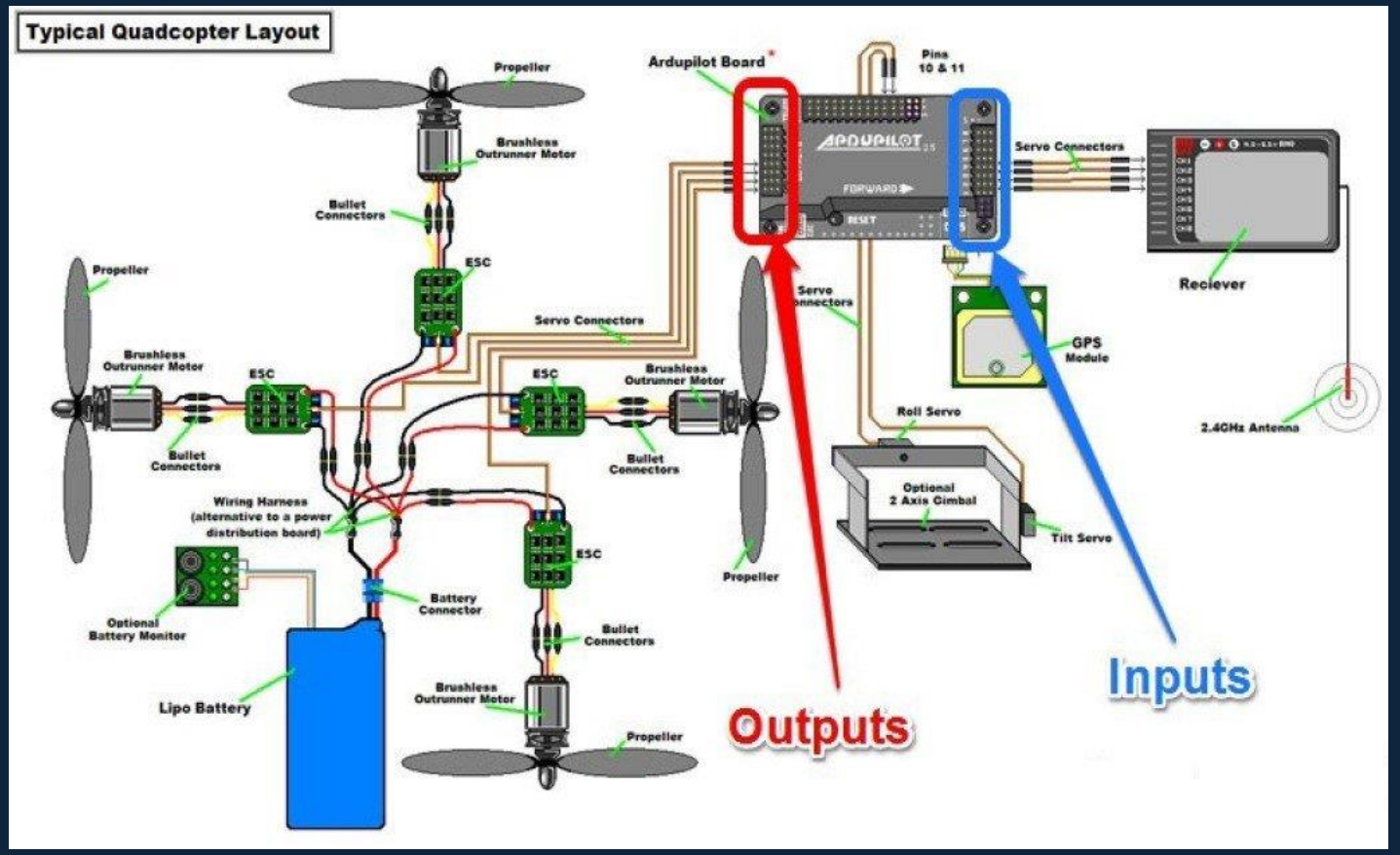
- Drones today can come with 2 types of sensors. The above for creating 3D images of the external world by using Lidar
- and Thermal vision cameras. The 2nd type is on-board sensors for collision avoidance using Monocular Vision, Ultrasonic (Sonar), Infrared, lidar, Time-of-Flight (ToF) and Vision Sensors.



Summary

- It is highly important to develop regular inspection and maintenance procedures as part of your documentation. Proper inspection and maintenance will ensure the long-term use of your drone as well as providing a safe aircraft.

RPAS Electrical Systems



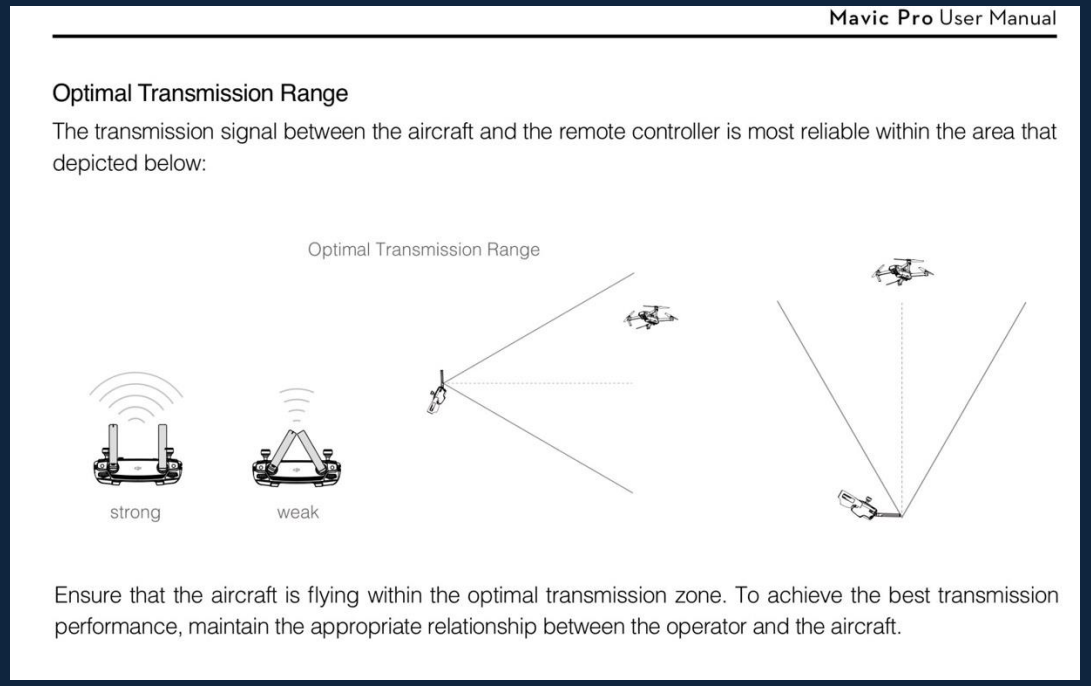
Servos

Servos

- It's simply a device that converts an electrical impulse into a mechanical action - typically rotating a wheel to a position specified by the electrical signal.
- This movement could be used to press a camera shutter, raise or lower landing gear, move the control surfaces of an aircraft, etc.
- "Servo" is short for "servo motor".
- There is at least two modalities along which servos (continuous or otherwise) usually fail: gear problems and motor breakdown.
- When the gear fails (broken tooth, hard point, etc.), the servo may get stuck, free moving or any combination.
- When the motor breaks (usually the brushes inside the DC motor are the culprit), the servo stops working altogether (as if it was unplugged) or overheats and burns. In your case, since it's humming and behaves differently when actuated by hand
- It is very important to keep your RPAS dry as water damage can occur.

Pilot & Antenna Orientation

- The Positioning of your antenna on your transmitter is very important. Improper positioning of the antenna can cause LOS (Loss of signal) or a weaker signal that could cause loss of control of your RPAS. The following video is an example of proper and improper positioning of a transmitter antenna. As always consult your specific manufacturer for further information on your RPAS.



Mavic Pro User Manual

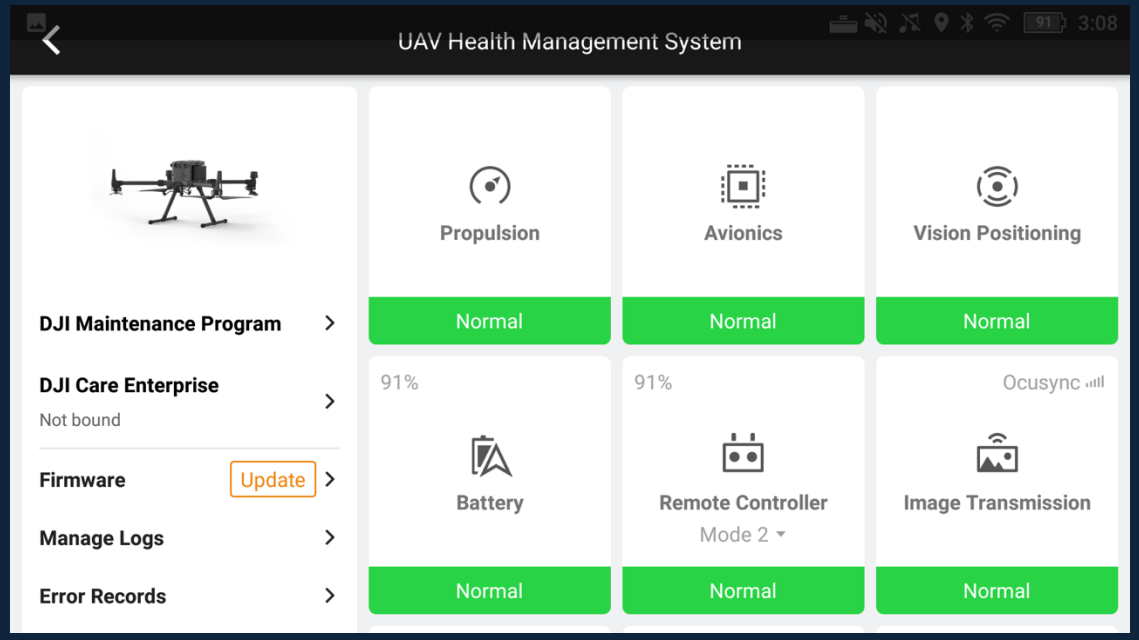
Optimal Transmission Range

The transmission signal between the aircraft and the remote controller is most reliable within the area that depicted below:

Ensure that the aircraft is flying within the optimal transmission zone. To achieve the best transmission performance, maintain the appropriate relationship between the operator and the aircraft.

Software Version Control

- It is critical to your RPAS operations that you keep up to date on control software and firmware versions. If there is an incident with your RPAS this could be called into question.
- More importantly it will correct any firmware or software problems in previous versions.

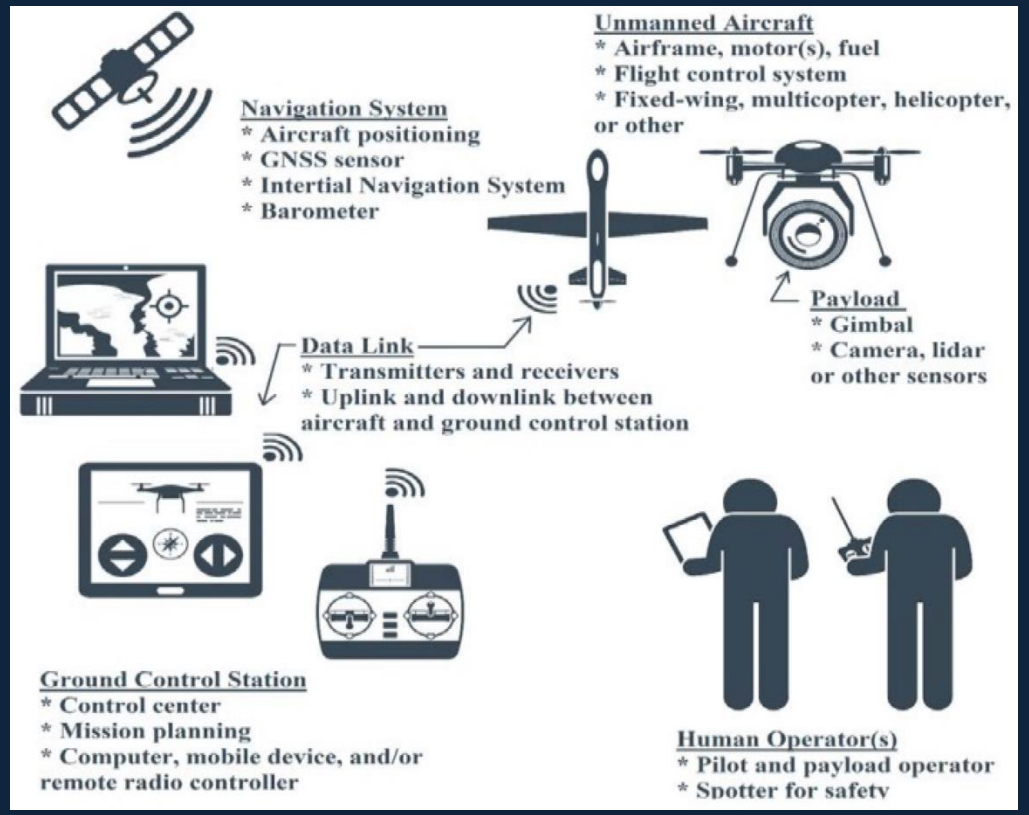


Flight Simulation

- A RPAS Flight simulator is a great way to practice flying in a variety of situations. Keep in mind that as good as a simulator may be, it will never be the same as actual flying and control of your RPAS in a real environment.

Data Links

- Frequency Bands (licensed and unlicensed)
- Radio Line of Sight
- Interference
- Gain, Signal to noise ratio

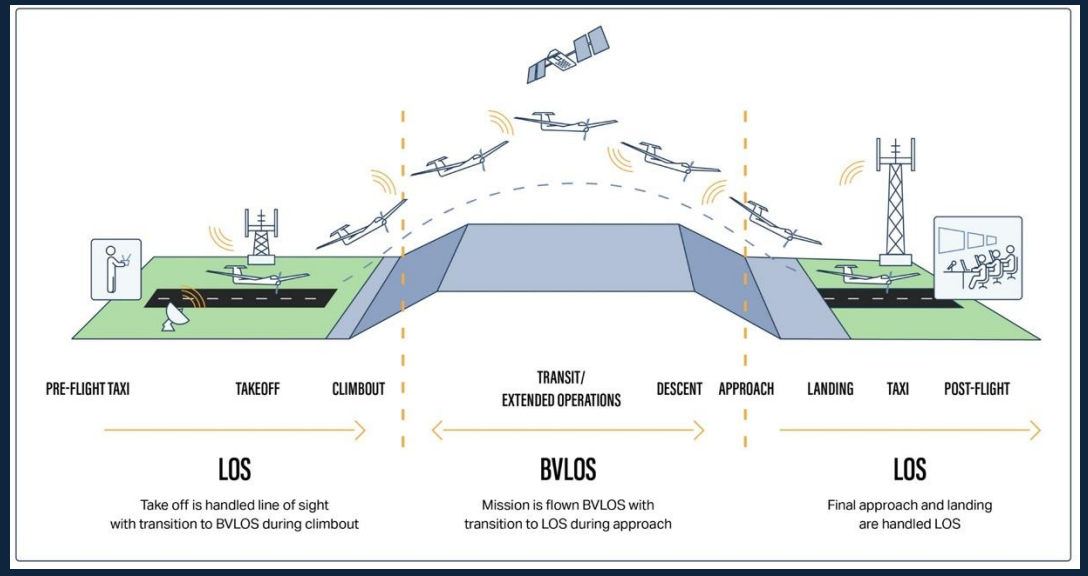


Frequency Bands

- Wireless spectrum is getting crowded around the world. Industry Canada does spectrum management in Canada and most organizations can only access certain frequencies. The busy visual below shows just a part of the Radio Frequency Allocation Chart that Industry Canada manages.

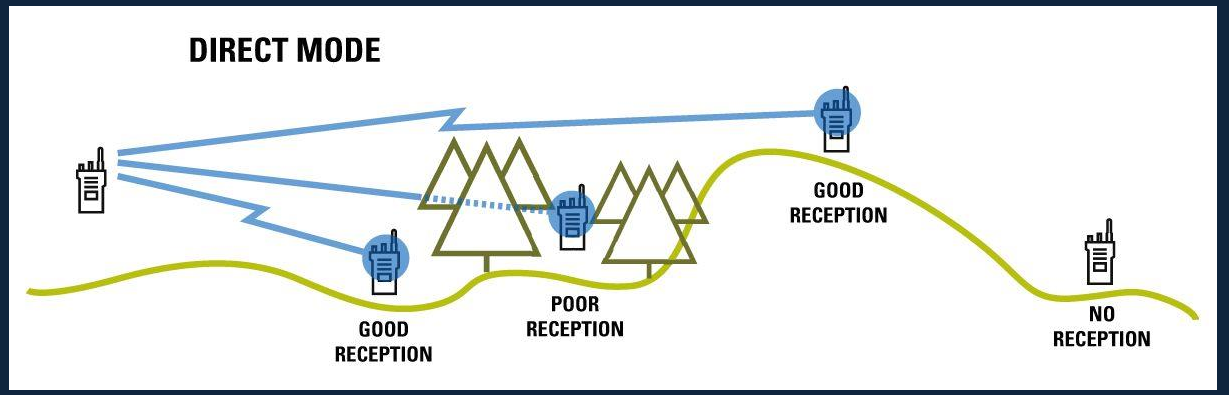
Visual Line of Sight

- Visual Line Of Sight (VLOS) operations; means exactly that, keeping the unmanned aircraft in visual-line-of-sight at all times. This means not flying an unmanned aircraft into clouds or fog, not behind trees, buildings or other [even partial] obstructions.
- VLOS also means un-aided vision except for prescription glasses or sunglasses, and not having to use binoculars, telescopes or zoom lenses to see the unmanned aircraft. We will discuss VLOS in more depth later on, but it is important to remember that VLOS is not directly related to transmitter range.



Radio Line of Sight

- Radio transmission requires a clear path between antennas known as radio line of sight. It is necessary to understand the requirements for radio line of sight when designing a network operating in the 2.4Ghz ISM band. Line of sight is the direct free-space path that exists between two points.
- Topographic features, forest cover, buildings and distance can significantly degrade your signal.



Ground Control Station (GCS)

- In most cases you are operating as a Ground Control station with your controller linking to your RPAS, however companies such as Amazon who plan on using RPAS for delivery will have a much more sophisticated system including likely many GCS.
- Just as it is important to place your antenna on your controller GCS require proper antenna placement to ensure no loos of signal to the RPAS. Remember, radio line of sight always applies in all operations.

What Causes Interference?

- There can be many factors that can cause interference or loss of signal on your RPAS Here are a few examples.

Cell Towers

Buildings

Transmission Lines

Radio/Electronic Interference Controlling them during Flight Operations

- The UAV operator shall not permit the use of a portable electronic device at the control station of a UAV system where the device may impair the functioning of the systems or equipment.
- Does Interference Affect your drone?
- We live in a world where wireless signals surround us, effecting our every movement and more importantly our devices.
- Electromagnetic interference: Flying near power lines and cell phone towers can have a huge electromagnetic interference effect on your drone. It is extremely likely to cause a drone fly away and to lose your drone if you do this.
- One of the external forces that can reduce the satellite signal strength and cause a string of mishaps that might lead to the dreaded flyaway is a geomagnetic storm and this aspect of space weather is measured using the Kp-index (also known as the K-index).

Loss of Signal Prevention

- Here are five simple steps you can take to prevent your drone from flying away.
    1. Make Sure a Home Point Has Been Set.
    2. Watch Out for Compass Interference.
    3. Keep Your Drone Within Line of Sight.
    4. Reset Your Home Point if You're Moving.
    5. Set an Appropriate RTH Altitude.
- These are preventative measures , in the field you can try moving to a higher location or away from anything that may be causing the LOS. Some drones will automatically RTH when signal loss occurs.

Gain and Signal to Noise Ratio

SIGNAL

- In terms of sound, signal refers to any electrical voltage that provides
- information, such as midi data or an audio signal. In terms of audio, signal refers to the information, or sound that is being recorded.

NOISE

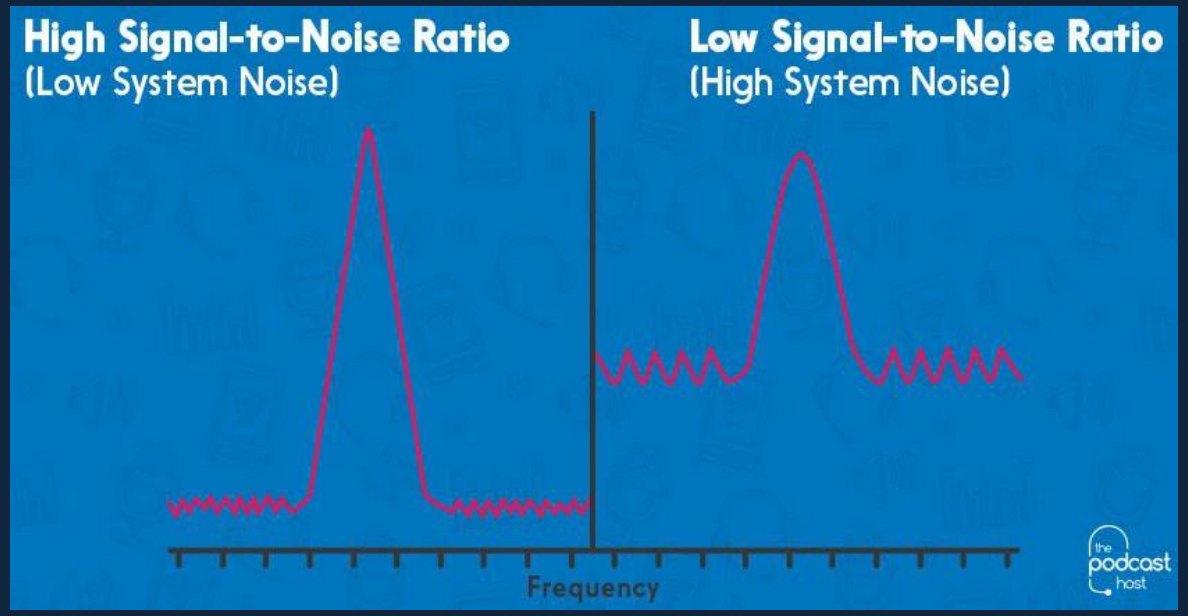
- Noise is any constant sound that is not your signal. It is typically a sound source that you're trying to filter out, or rise above, in order to communicate some other audio information.
- Noise can range from an inaudible drone, to a clearly perceptible hiss, to a cacophony of loud machinery.

SIGNAL TO NOISE

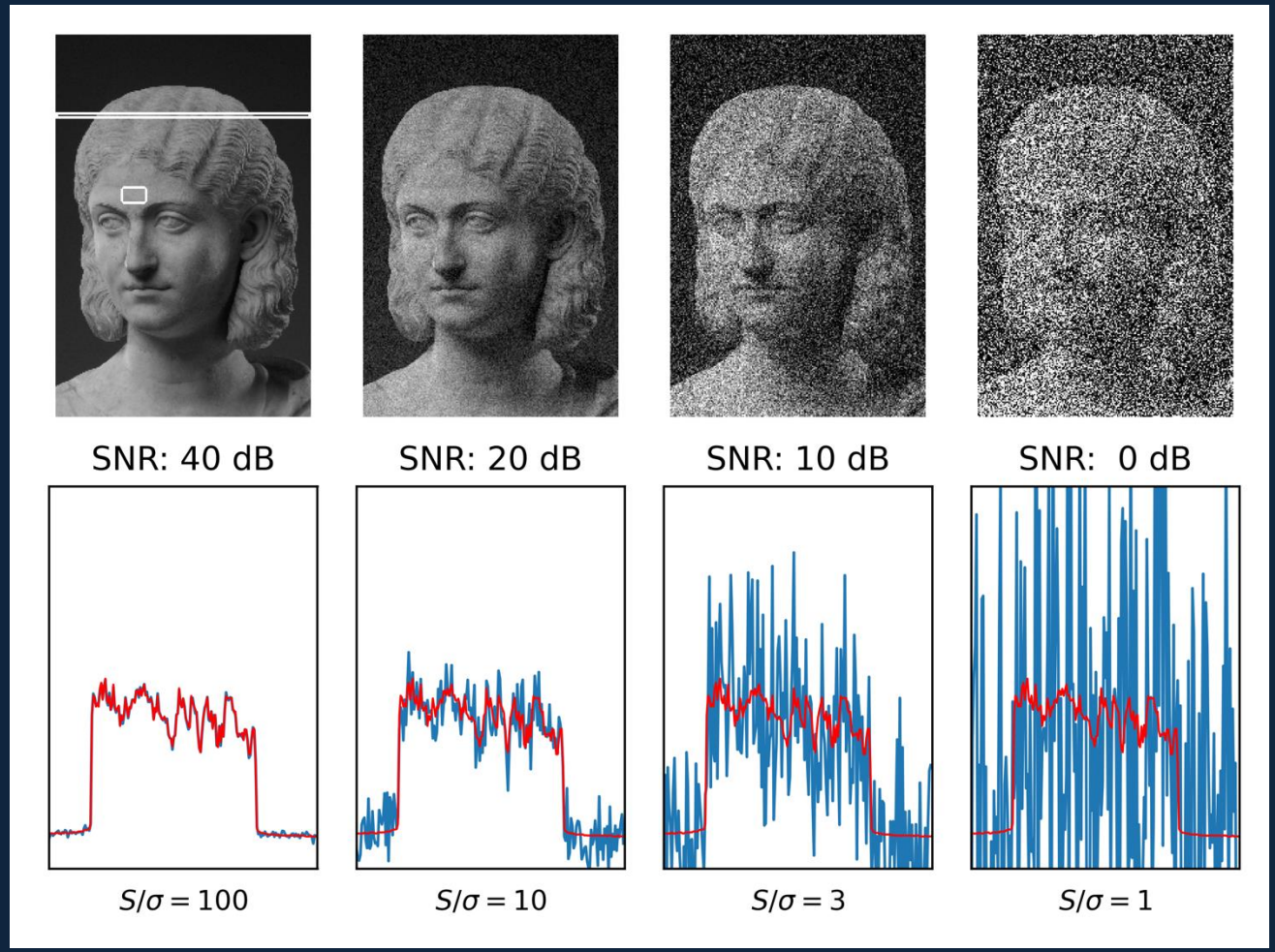
- Signal-to-noise, then, is simply the ratio of desired signal (S) in relationship to unwanted noise (N).
- When we think about signal-to-noise in our audio equipment, we're simply asking if our equipment is quiet enough to carry the audio signal without being distracting.

Gain and Signal to Noise Ratio

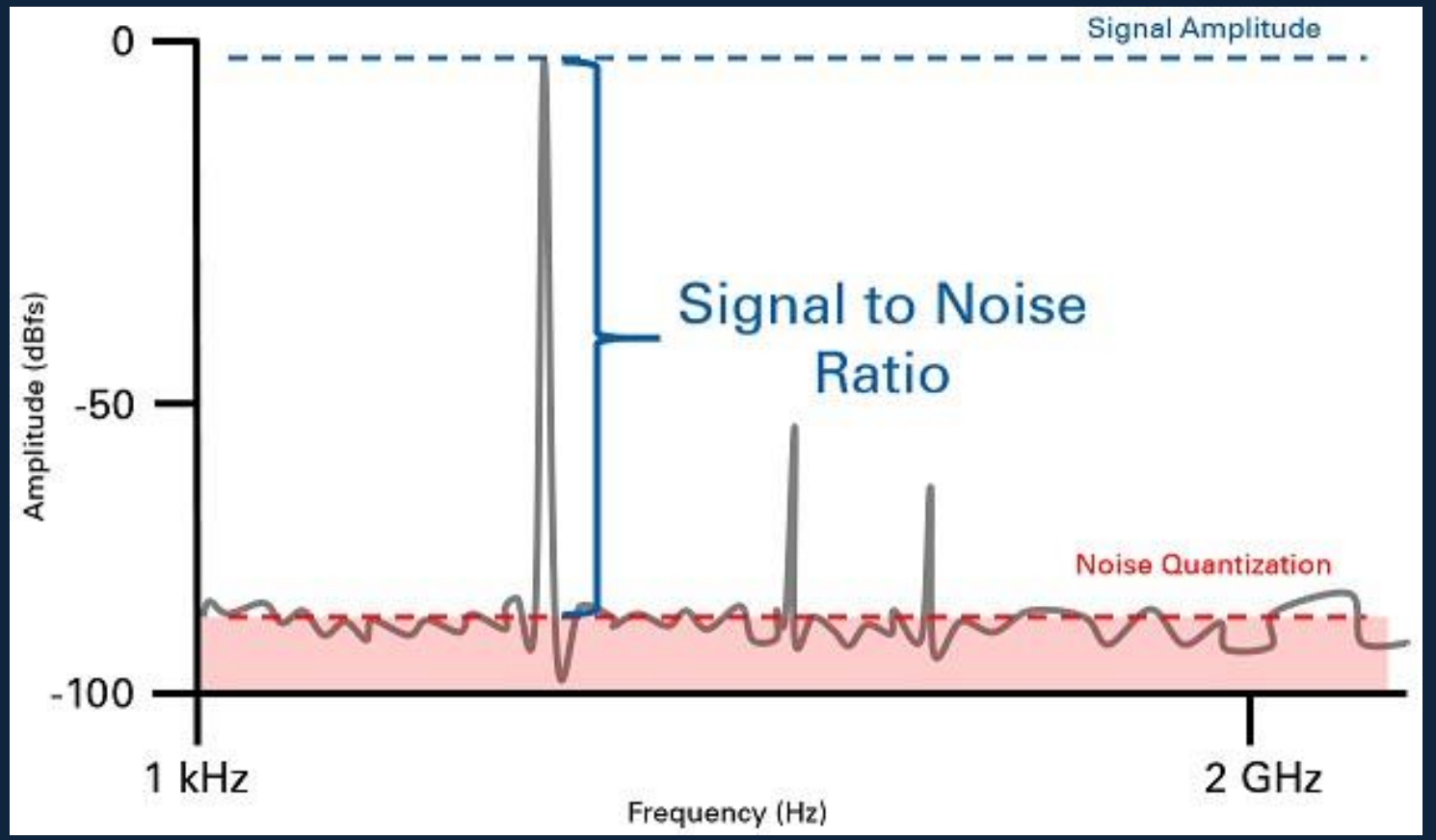
- This relates to RPAS by comparing the signal strength to the noise, noise being interference signals in the RPAS operating area. IE . The electromagnetic radiation from a hydro tower.
- More powerful antenna could increase GAIN therefore bosting the signal above the background environmental noise



Gain and Signal to Noise Ratio

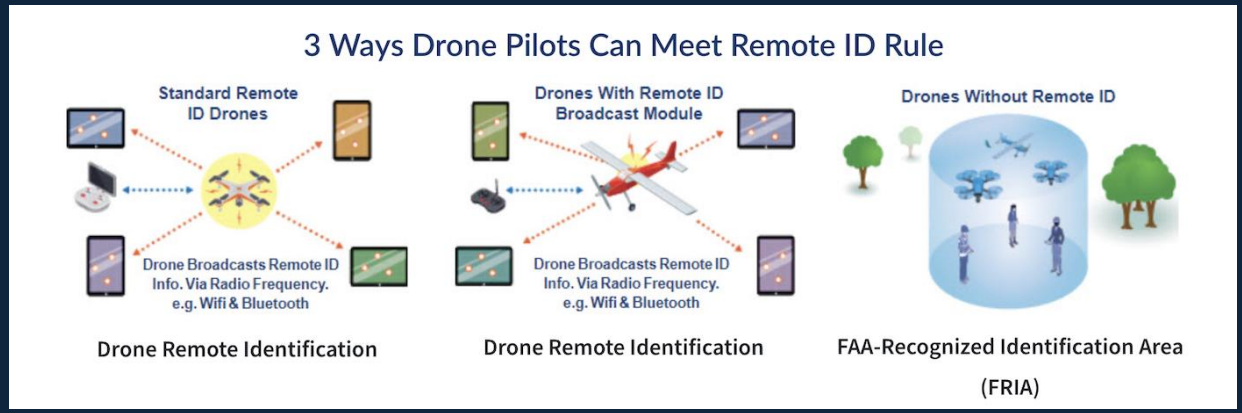


Gain and Signal to Noise Ratio



Remote ID

- The Federal Aviation Administration issued proposed rules for the remote identification of drones in the U.S. The “next exciting step in safe drone integration” (their words) aims to offer a kind of license plate analog to identify some 1.5 million drones currently registered with the governmental body.
- DJI has implemented FAA regulations relating to Remote ID in the U.S. All DJI drones in the U.S. are required to have remote ID capabilities, or are RID linkable through a separate module
- Transport Canada may adopt a similar stance on remote ID as the technology has been put in place by Manufacturers.



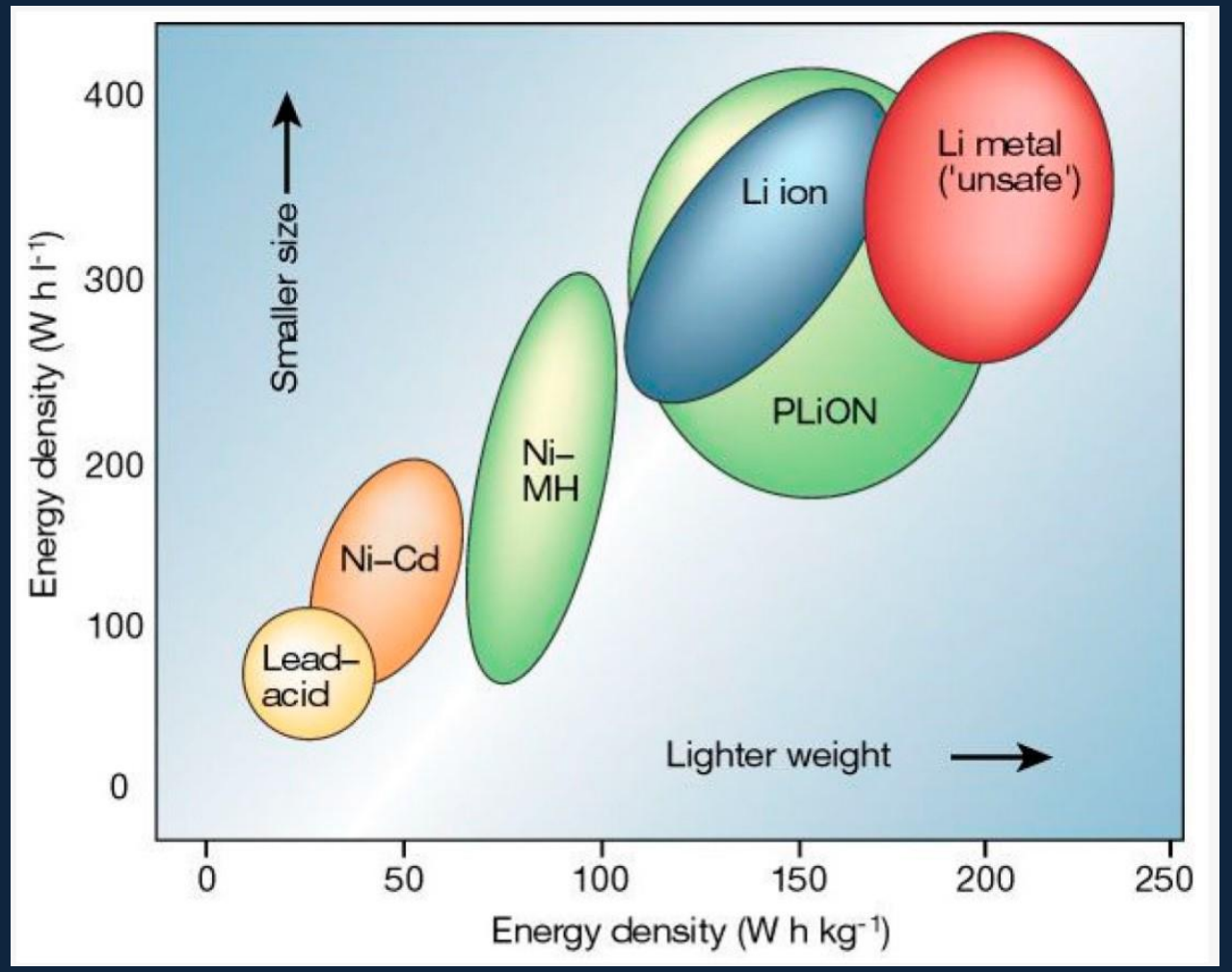
Batteries

- Types and hazards
- Battery Parameters
- Battery configurations (Parallel, Series)
- Charging cycles, storage and maintenance
- Transport of Batteries (Dangerous Goods Regulations)

Batteries

- Though there are several different types of batteries in use for RPAS and RC aircraft the most popular and most used for RPAS are LIPO batteries.
- The two main possible alternatives to LiPo batteries are Nickel Metal Hydride (NiMH) and Nickel Cadmium (NiCd) batteries. LiPo (lithium polymer) batteries offer significant advantages over other types of batteries. The advantages that LiPo batteries offer over NiCd and NiMH batteries are:
- LiPo batteries have higher capacities which allows them to hold more power
- LiPo batteries have higher discharge rates allowing faster power transfer
- LiPo batteries are lighter and can be made in different shapes and sizes
- However, LiPo batteries also have some drawbacks. These include:
- LiPo batteries have a shorter lifespan of about 300 to 400 cycles, as compared to NiMH and NiCd batteries
- If the battery gets punctured and vents into the air, there is a possibility that this could result in a fire
- Some extra care needs to be taken when charging, discharging, or storing LiPo batteries

Batteries


Energy density (W h l⁻¹)
400
300
200
100
0
Smaller size
Li ion
Li metal ('unsafe')
PLiON
Ni–MH
Ni–Cd
Lead–acid
Lighter weight
0
50
100
150
200
250
Energy density (W h kg⁻¹)

What Can Go Wrong?

What Can Go Wrong?

Battery Hazard Factors

- Only use chargers designed for LiPo batteries. They have built-in safety features to help avoiding problems.
- Always monitor LiPo batteries that are being charged.
- Keep a fire extinguishing device (extinguisher or sand) nearby in case things go wrong.
- Use a LiPo charging bag. These are designed to contain the flames should a battery be faulty. These bags are inexpensive and can prove to be a life saver.
- If you crash, inspect your battery because it may have been damaged.
- A bulging LiPo is an accident waiting to happen. Like a volcano, hazardous gases & fumes are ready to burst out of your battery. The toxic materials emanating from a LiPo battery can ignite when in contact with air.
- Never puncture a LiPo battery, it will most certainly catch fire.
- Charge you LiPo batteries in a well-ventilated area and on a flame resistant surface.

Other Factors

- Improper storage or discharge
- Excessive heat or cold
- Age and improper charging
- Hard landing/crash

Travelling with your Batteries

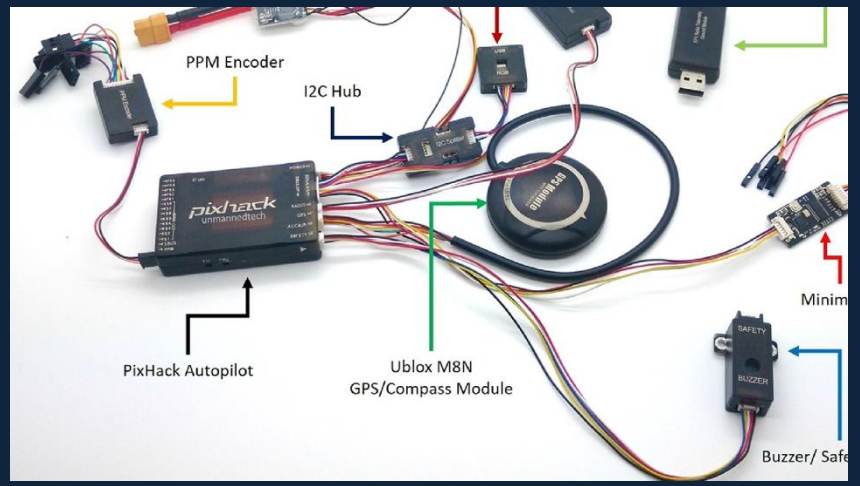
- Lithium batteries are dangerous goods, much like gasoline, propane, and sulphuric acid and fall under the dangerous goods act in Canada.
- Always check with your Airline to see what their particular rules are with regard to LiPo batteries.
- Some Airlines allow LiPo batteries in carry on in limited amounts. Batteries must never be turned on during the flight.
- You must check with your carrier with regards to carrying batteries in your checked luggage.
- LiPo Batteries should always be carried in fire retarded bags.

Battery Storage & Transport

- Storage and Transport options can go from special fire-resistant bags to more heavy-duty solutions.
- Remember always consult your RPAS manufacturer for the storage and transport solution for your RPAS. Be aware your home insurance may not cover a fire if LIPO batteries were not stored properly.

Autopilots Vs Flight Controllers

- There is no fixed definition but I like to refer to an autopilot as a complete system that enables your drone to fly autonomously to way-points etc.…,
- A flight controller is just the device that will keep your aircraft stable. However, depending on who you talk to many people use these two words interchangeably.
- As an example on most mini racing quadcopters, you use a flight controller that helps keep your craft stable and constantly calculates the best command to send the motors based on the pilot input.
- A mapping drone will have any autopilot system which includes a flight controller and other equipment such as GPS that will keep the aircraft stable while working out where it is and where it needs to go.



Pilot Intervention

- At some point it may become necessary to intervene in your flight if something goes wrong during automated or normal flight.
- There are many conditions such as loss of signal or intermittent LOS that you may have to directly intervene by triggering your termination of light system.
- You may have to directly take control and fly your RPAS with out the aid of GPS or controller visual systems.

Waypoint Control

- Most drones have software that lets you create simple and complex flight patterns using waypoints in various configurations.
- Some software can replay a previous flight or combine gimbal actions with flight maneuvers.
- Mapping flights are almost always conducted with waypoints. This ensures the data is collected properly and the flight operation is repeatable.

Stabilization Control

- For a drone to fly perfectly, the gyro stabilization and flight controller technology is essential. Drones today use three and six axis gyro stabilization technology to provide navigational information to the flight controller, which make drones easier and safer to fly.
- Gyro stabilization technology is one of the most important components, allowing the drone to fly super smooth even in strong winds and gusts. This smooth flight capabilities allow us to film fantastic aerial views of our beautiful planet.

Flight Termination Systems

- A Flight Termination System (FTS) consists of the components onboard a launch vehicle that provide the ability to end that vehicle's flight in a controlled manner.
- An FTS may comprise different types of equipment or procedure, including: a self-destruct system for remote initiation, a separation system, a parachute release system or any other systems or components onboard the launched vehicle that may be used to terminate flight.
- In order to increase flight safety, these kind of systems must be completely independent. For this reason, an FTS must have its own dedicated communications datalink. In case of autopilot or communications error, the FTS will therefore still be capable of terminating the flight.

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PARAZERO

DRONE SAFETY SYSTEMS

Payloads

Payloads

- **Payload**
  - means all elements of the aircraft that are not necessary for flight but are carried for the purpose of fulfilling specific mission objectives. This may include such sub-systems as intelligence and surveillance assets, communication relay equipment, sensors, cargo and cameras.
- **Payload Operator**
  - means the person (s) trained to operate the payload system, and in some cases, manage the flight profile.
- RPAS can carry a variety of payloads. Most of us are familiar with the site of a RPAS carrying a camera, however RPAS used in industry can carry a variety of payloads.
- These can include specialized Cameras for film and TV and a variety of other sensors such as radiation detection equipment, lidar, ground penetrating radar, magnetometers, fertilizer hoppers, multispectral cameras and more.

Site Survey Factors

- 901.27 No pilot shall operate a remotely piloted aircraft system unless, before commencing operations, they determine that the site for take-off, launch, landing or recovery is suitable for the proposed operation by conducting a site survey that takes into account the following factors:
  - (a) the boundaries of the area of operation;
  - (b) the type of airspace and the applicable regulatory requirements;
  - (c) the altitudes and routes to be used on the approach to and departure from the area of operation;
  - (d) the proximity of manned aircraft operations;
  - (e) the proximity of aerodromes, airports and heliports;
  - (f) the location and height of obstacles, including wires, masts, buildings, cell phone towers and wind turbines;
  - (g) the predominant weather and environmental conditions for the area of operation; and
  - (h) the horizontal distances from persons not involved in the operation.

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  - (g) the predominant weather and environmental conditions for the area of operation; and
  - (h) the horizontal distances from persons not involved in the operation.

Site Survey Factors

- It is incredibly important that you plan each aspect of your flight. This includes launch and recovery options. A proper site survey is a key component to every launch and recovery plan.
- Launch and recovery set-ups and options should be thought out carefully and included in your site survey and emergency procedures and operations manual.

Site Survey Factors

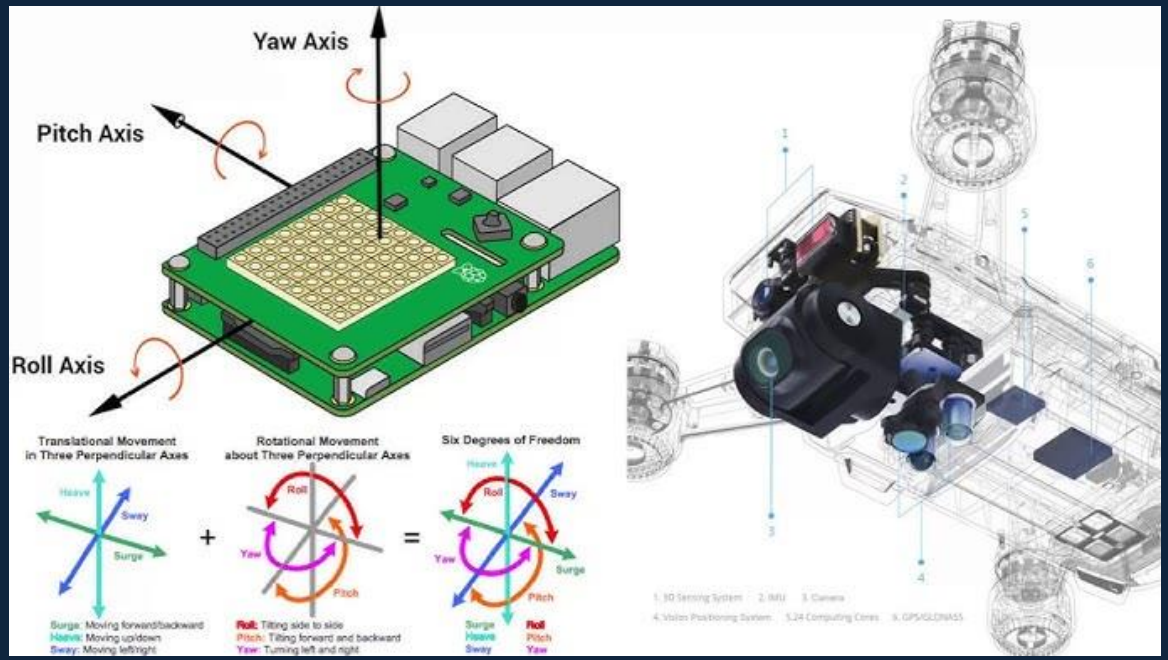
Advanced RPAS Flight Operations

Site Survey Factors

- The process is about knowing your surroundings in order to know where it is safe to fly and elements to avoid. A simple step beyond merely jumping out and flying.
- The biggest and most complex part of this may be knowing the airspace and where nearby airports and helipads may be.
- Many not familiar with manned aviation may be unaware especially of helipads on nearby buildings for example.
- Currently there are not a lot of easy-to-use tools readily accessible to the general public for determine this.
- Online tools like the NRC Site Selection Tool are not 100% accurate.
- There are third party tools available such Drone Pilot Canada and UAV Forecast that can act as basic guides to developing an effective site survey.
- Every operator should have a recovery plan during all RPAS operations. This can include commercial recovery systems such as parachutes, which will ensure the safety of the public and your equipment during a failure condition, or normal flight operations depending on the type of RPAS you fly.
- Again your site survey should show potential recovery areas should the need areas to make a forced landing away from your initial launch point.

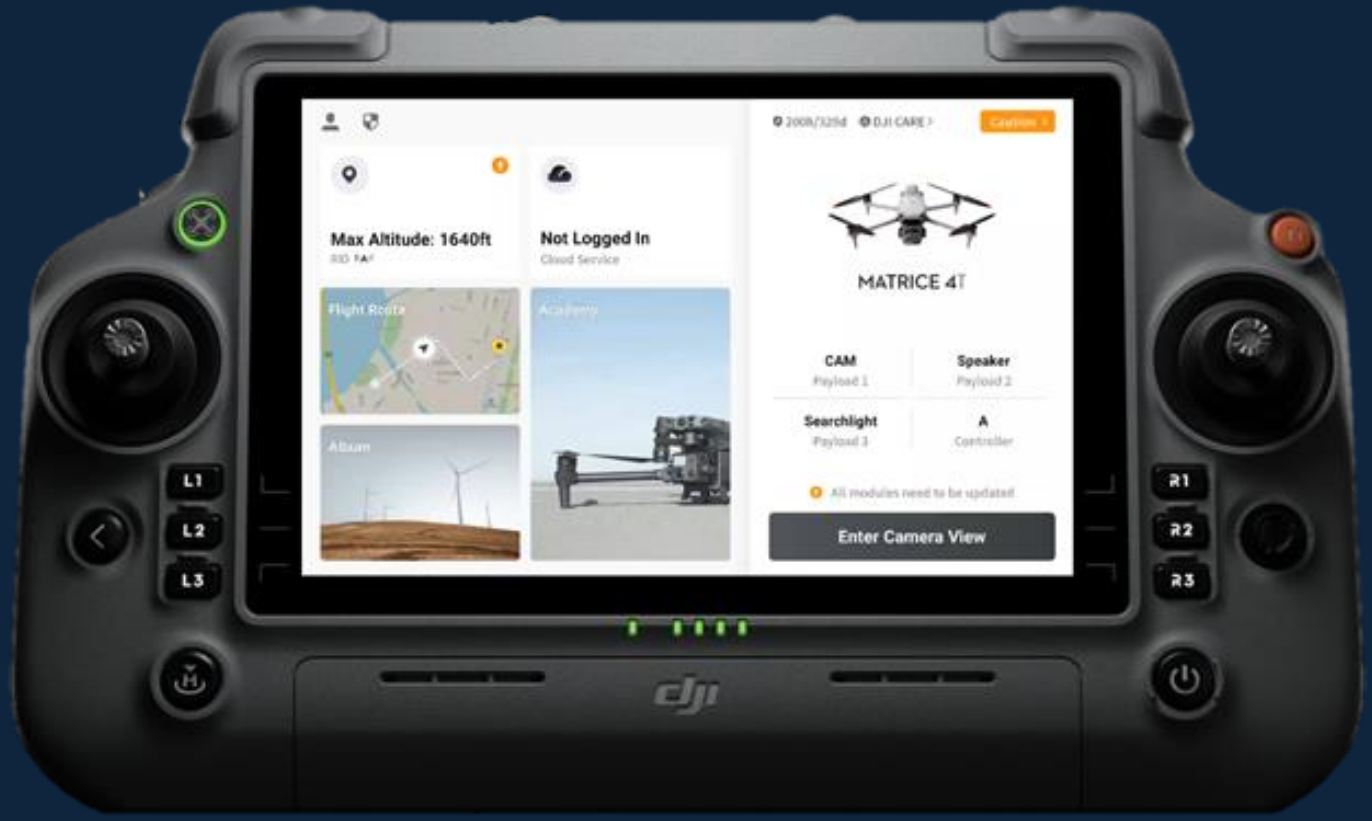
Inertial Measurement Unit

- An inertial measurement unit (IMU) is an electronic device that measures and reports a body's specific force, angular rate, and sometimes the magnetic field surroundings the body, using a combination of accelerometers and gyroscopes, sometimes also magnetometers.



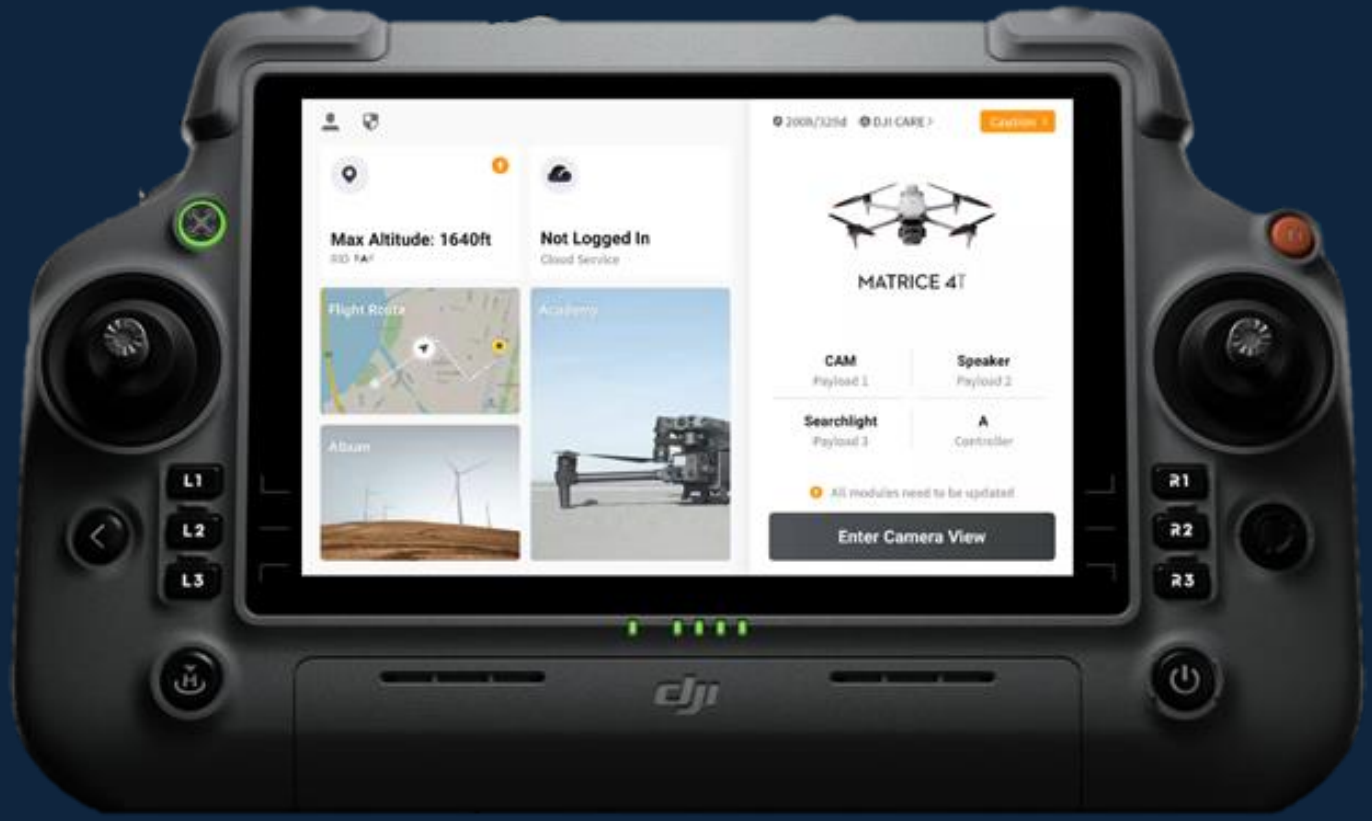
Pilot Equipment & Materials

Flight Controller & Display

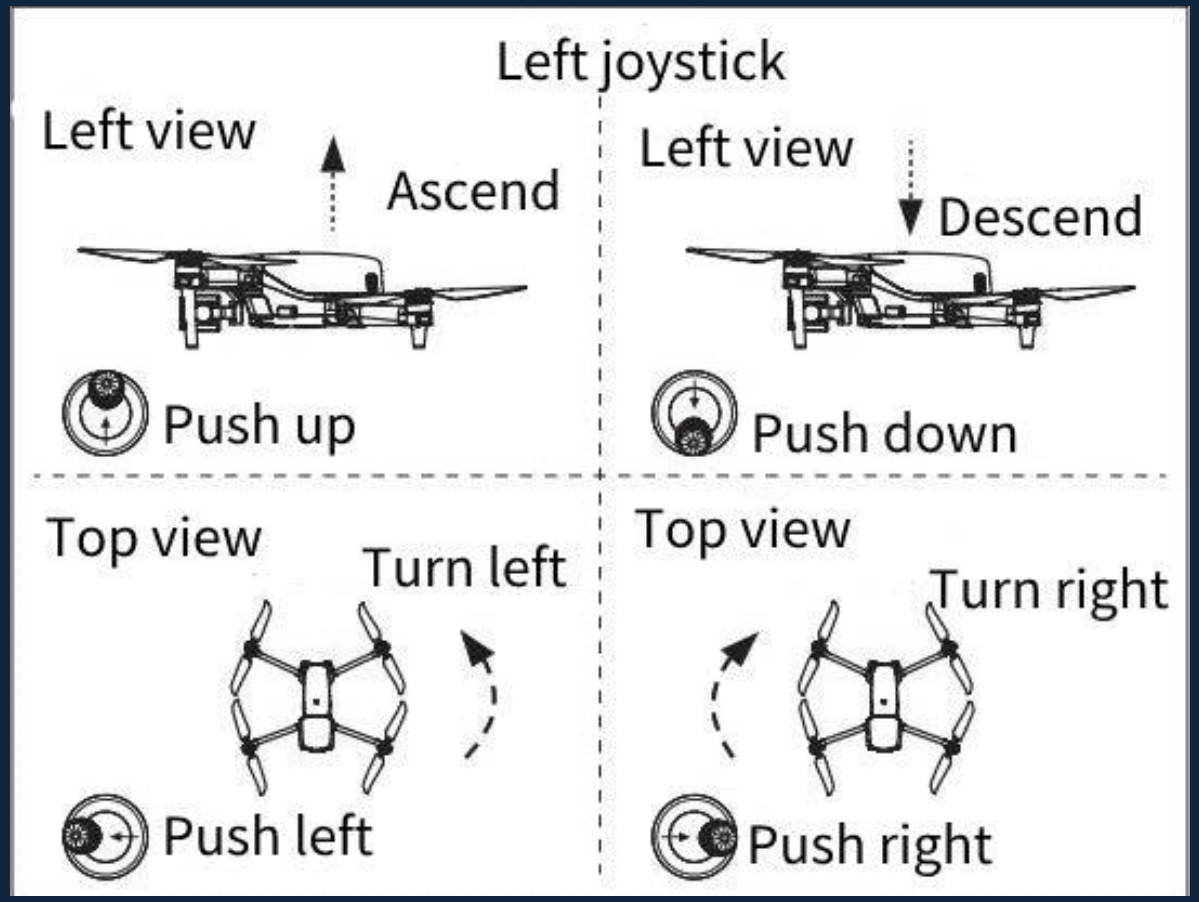


Pilot Equipment & Materials

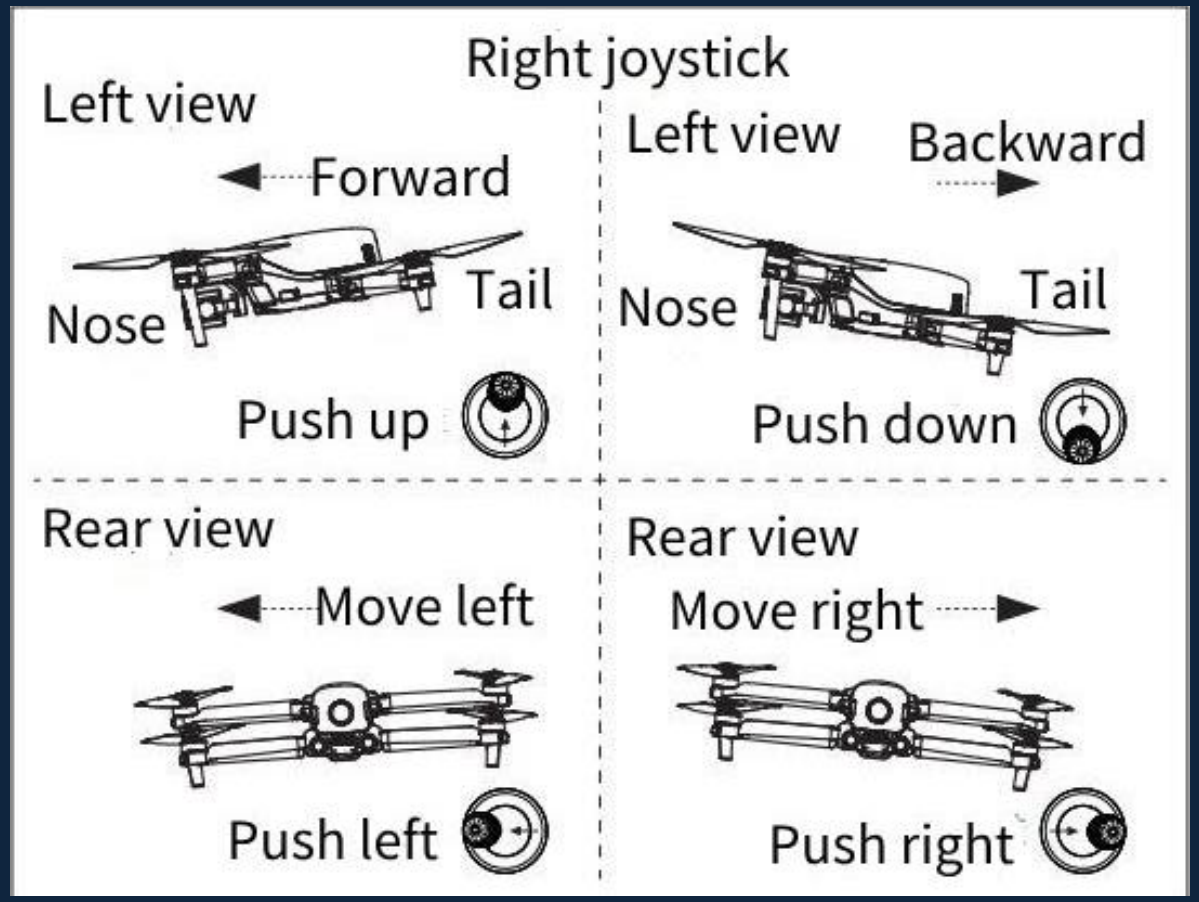
Flight Controller & Display



Mode 2 Drone Controls



Mode 2 Drone Controls



Finger Placement

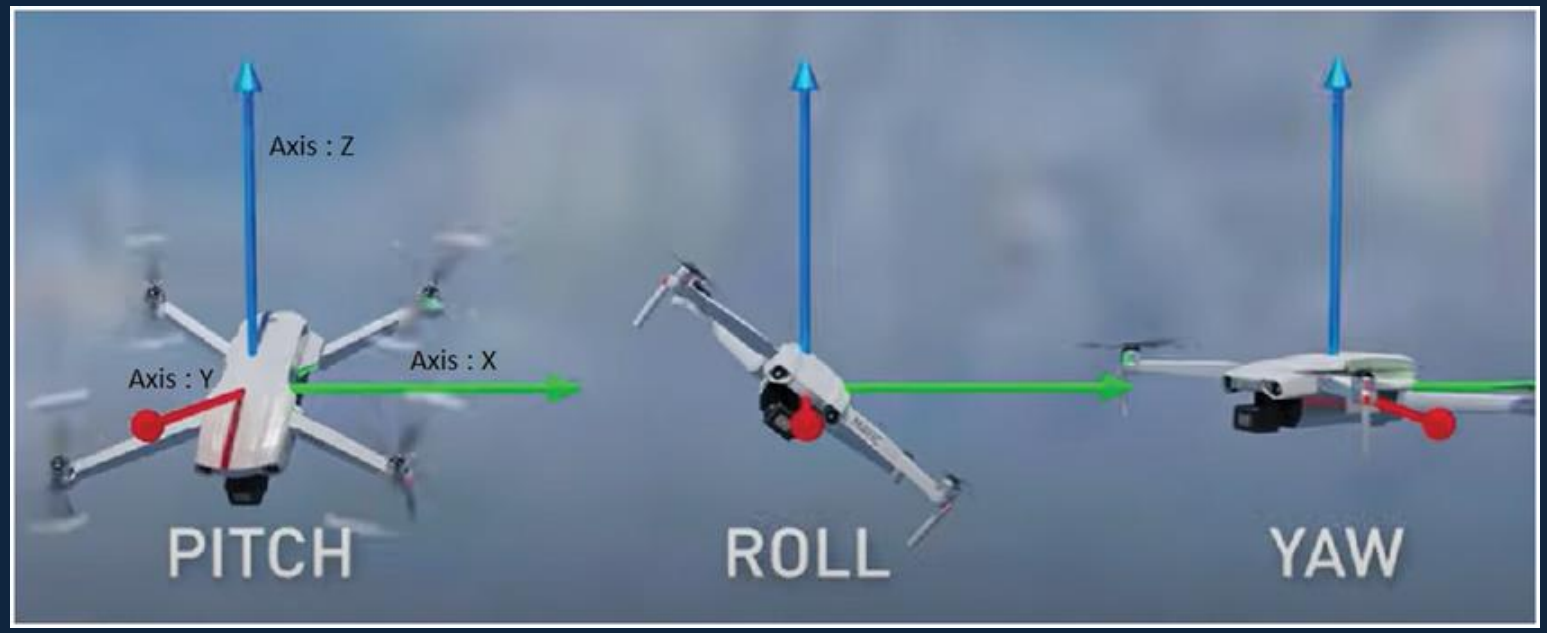
Standard

Pinching

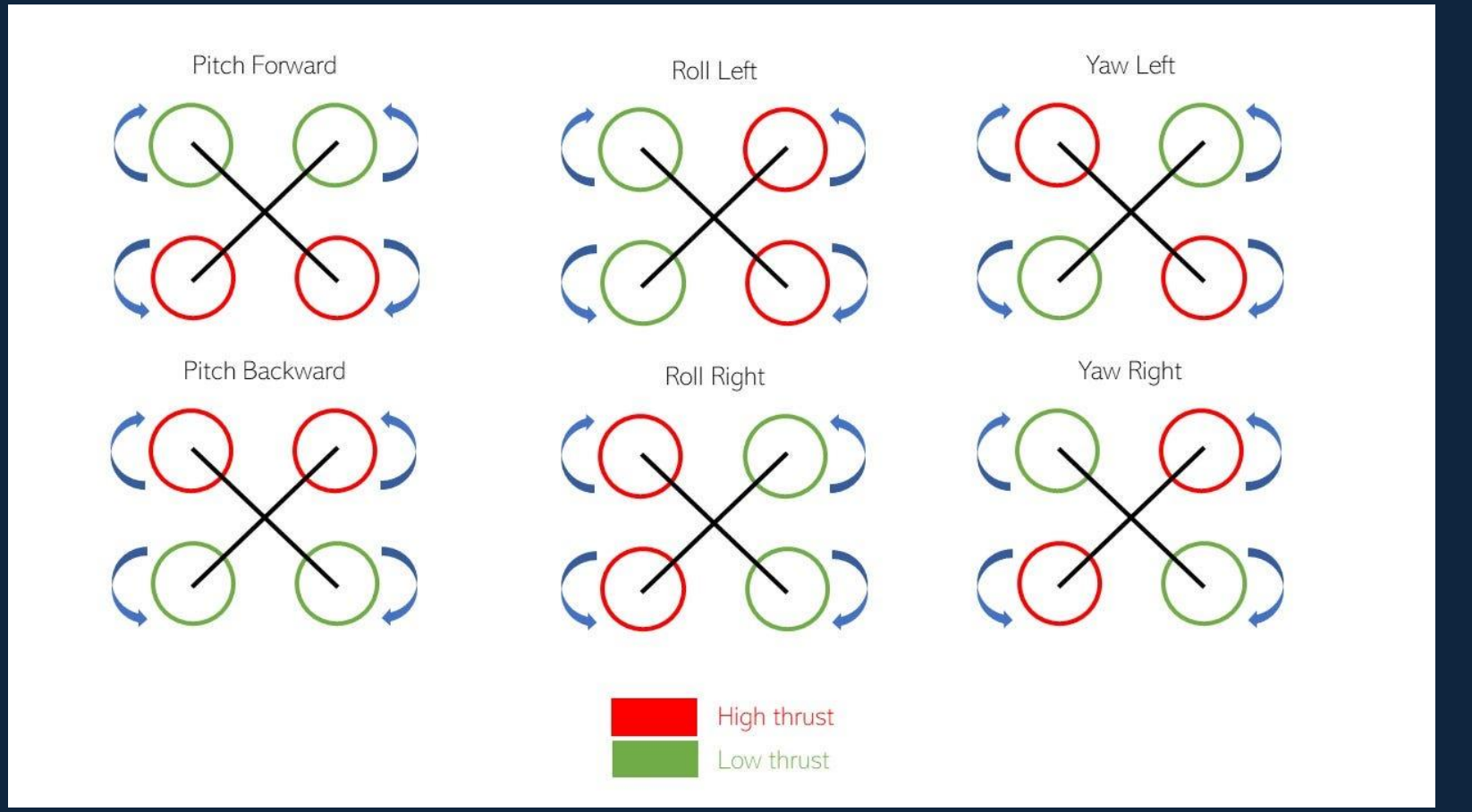
Ok

Better

Pitch, Roll & Yaw

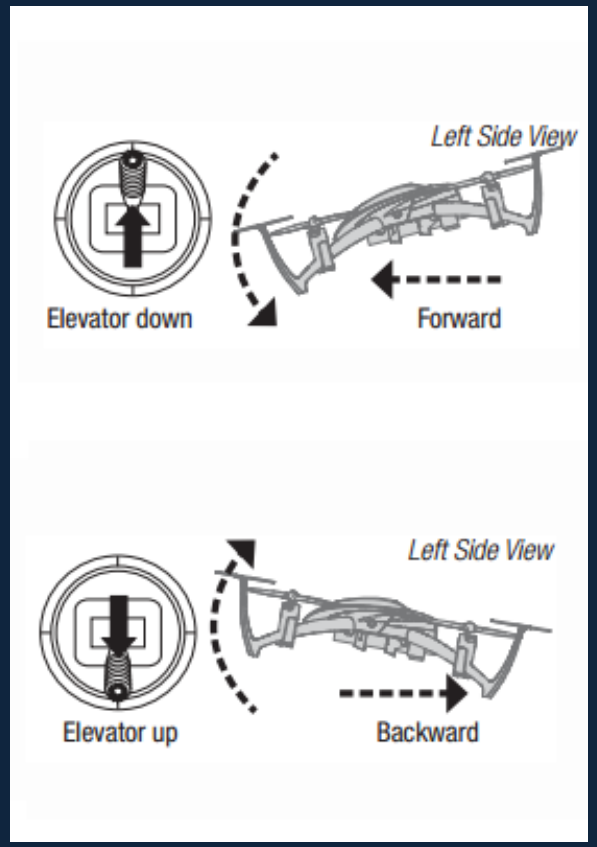


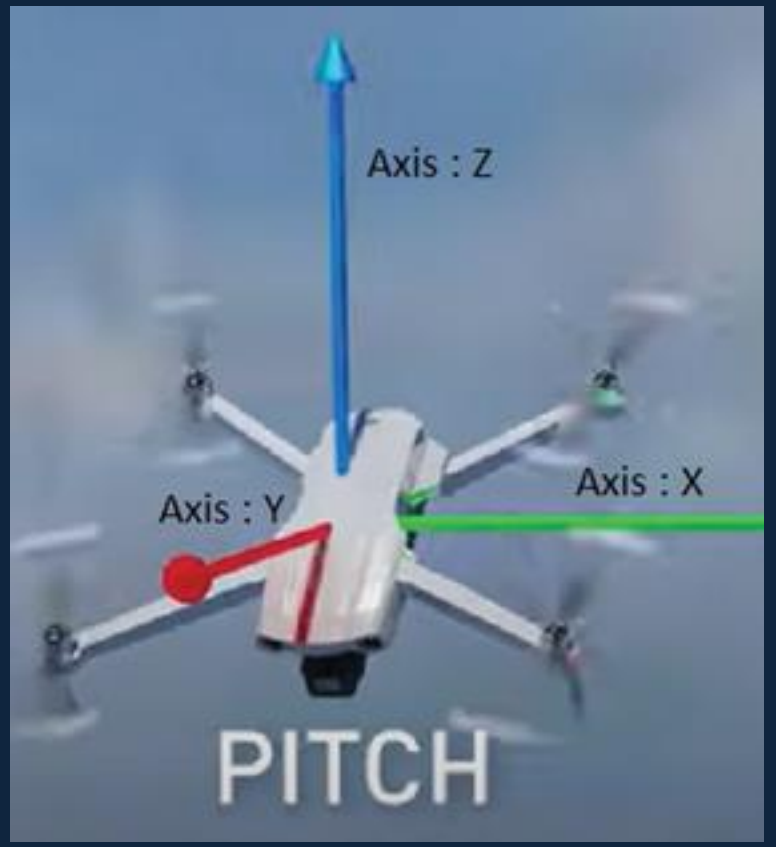
Pitch, Roll & Yaw



Pitch

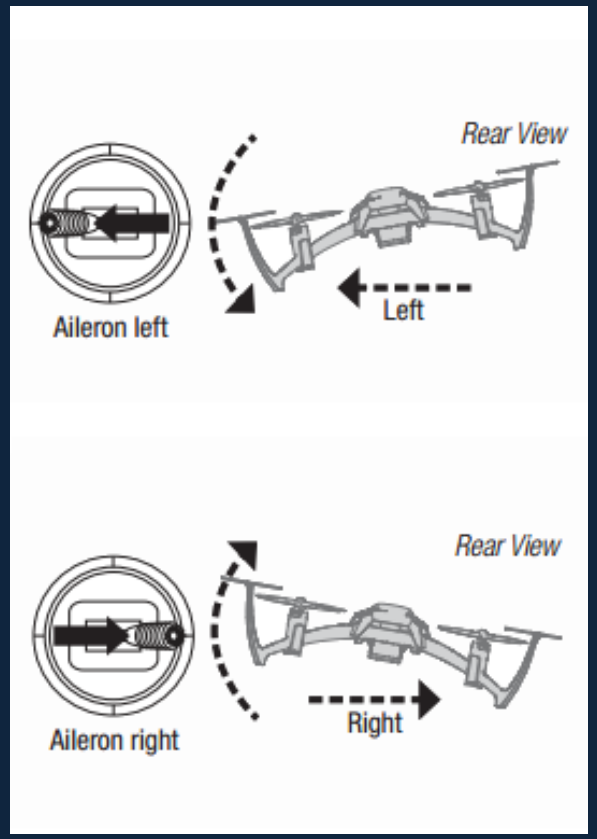
- Pitch is done by pushing the right stick on your transmitter forwards or backwards.
- This will tilt the quadcopter resulting in forwards or backwards movement.





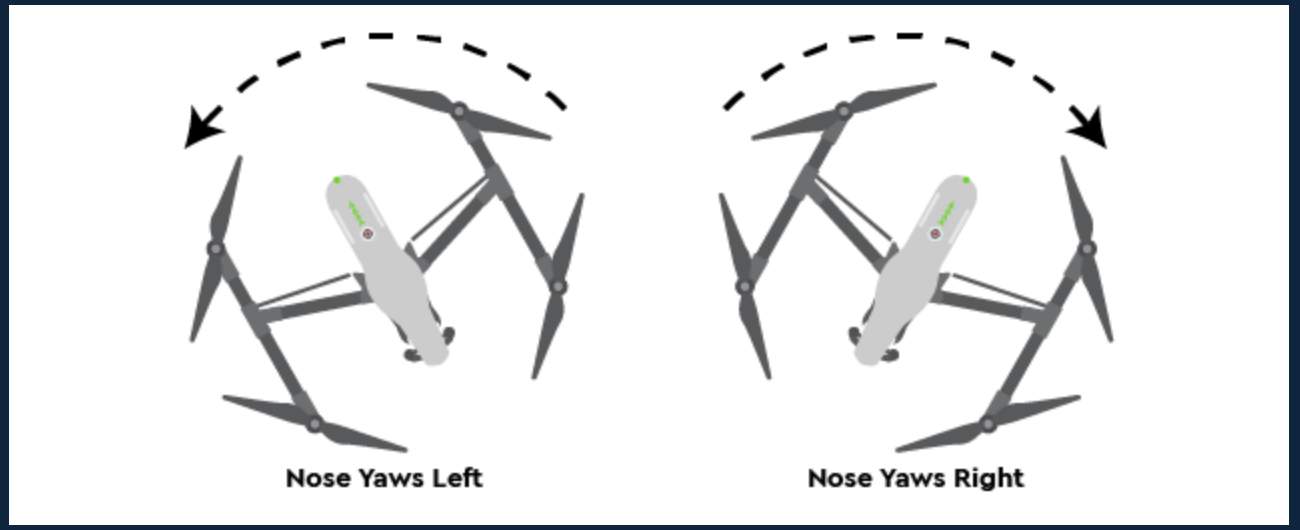
Roll

- Roll moves your quadcopter left or right. It's done by pushing the right stick on your transmitter to the left or to the right.
- The bottom of the propellers will be facing one direction which pushes air the other direction.



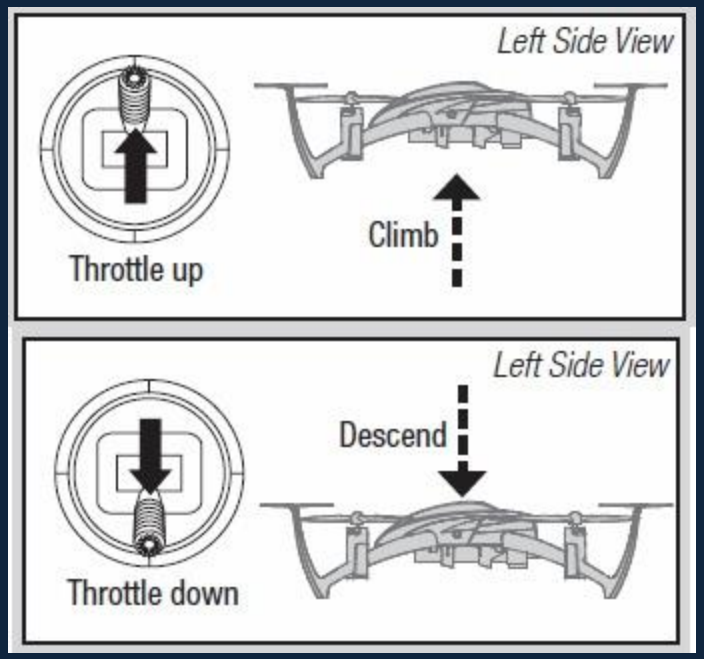
Yaw

- Essentially it rotates the RPAS clockwise or counterclockwise. This is done by pushing the left stick to the left or right.
- Yaw is typically used at the same time as throttle during continuous flight. This allows the pilot to make circles and patterns. It also allows videographers and photographers to follow objects that might be changing directions.



Throttle

- Throttle gives the propellers on your quadcopter enough power to get airborne. When flying, you will have the throttle engaged constantly.
- To engage the throttle, push the left stick forwards. To disengage, pull it backwards.
- Make sure not to disengage completely until you're a couple inches away from the ground. Otherwise, you might damage the quadcopter, and your training will be cut short.



Important Note

- When the quadcopter is facing you (instead of facing away from you) the controls are all switched.
- This makes intuitive sense…
  - Pushing the right stick to the right moves the quadcopter to the right (roll)
  - Pushing the right stick forward moves the quadcopter forward (pitch)
  - Pushing the right stick backward moves the quadcopter backward (pitch)
  - Pay attention to that as you start changing directions. Always be thinking in terms of how the quadcopter will move, rather than how the copter is oriented towards you.

Control Modes

Positioning Mode (P-N Mode)

- P-Mode is the standard flight mode for the majority of pilots. In this mode, all the sensors on your aircraft are active, GPS and any available vision or infrared sensors.
- This results in precise hovering of your aircraft, even if you stop controlling it with the remote controller.

P-Mode requires a strong GPS signal to function and will disconnect if lost.

- This mode is available on all DJI aircraft.

Attitude Mode (ATTI –Sport (S)Mode)

- You've likely heard of the dreaded ATTI Mode and its link to crashes and flyway's, but its bad reputation is not deserved.

Control Modes

- ATTI mode will only maintain the altitude of the aircraft and does not use any GPS or vision systems. The aircraft will therefore drift and move in any wind and needs to be manually controlled. Some pilots prefer this mode as it gives them near-complete control of their aircraft without interference.
- As well as a mode you can select, your aircraft will also enter ATTI Mode if you lose GPS signal or if there's compass interference, which is likely why there's a link with flyways and crashes.
- All pilots should learn to fly in ATTI Mode as it's likely to happen at some point during a flight. Try it out in a large open space with no obstacles and get used to operating your aircraft in this mode.

Control Modes

Sport Mode (S Mode)

- Sport Mode increases the available speed of your aircraft by only using GPS signal. Vision and infrared systems will not be available.
- You should also practise flying in this mode in an open space by slowly increasing the aircraft's speed.
- Not only is it a fun mode to fly in, it can also generate some great footage when you get the hang of it.
- This mode is available on the Spark, Mavic Pro, Phantom 4 Series and the Inspire 2.

Beginner Mode

- Beginner Mode uses GPS and all vision and infrared systems to keep your aircraft safe. Your flight is also limited to a maximum of 30 meters from your specified Home Point.
- This mode can be used for new pilots to get used to flying drones without the worry of it getting too far away.

Pre and Post Flight Checklist

- It is extremely important that you get into the habit of using a pre and post flight checklist when flying your RPAS. It's a proven safety measure in General Aviation, and certainly carries over into radio-controlled flying.
- Remember you are flying an aircraft! More over you are responsible for the over all control and safety your RPAS.
- A check list can save you time and money as well insuring the safe operation of your RPAS. Not discovering a bad prop or battery or even a control issue can lead to damage of your RPAS or even worse cause a safety issue for others or yourself..
- The Checklists you will see are samples and actual checklists will vary depending on your type of RPAS. However, most checklists cover the essentials.
- You can find a variety of checklist on-line and there are some apps available as well. The following are just a few examples.

Pre and Post Flight Checklist

Fixed Wing Pre-Flight Checklist

Charge Batteries
- ☐ Model Batteries
- ☐ Goggle Batteries
- ☐ Transmitter Batteries

Model Check
- ☐ Propellers are removed
- ☐ Inspect for damage
- ☐ Frame damage
- ☐ Control surface damage
- ☐ Control horn damage
- ☐ Control rod damage
- ☐ Motor mount damage
- ☐ Wire wear
- ☐ Broken zip ties
- ☐ Battery strap wear
- ☐ Check all screws and nuts
- ☐ Model power up initialization
- ☐ Servo test
- ☐ Motor test
- ☐ Motors spin freely
- ☐ Motor direction check

Transmitter Communication
- ☐ Transmitter power check
- ☐ Range check
- ☐ Telemetry check (if applicable)
- ☐ Check receiver antennas
- ☐ Check switches for functions

FPV System Functionality
- ☐ Goggles power up and function
- ☐ Channel check
- ☐ Power check
- ☐ Camera focus
- ☐ Transmit check
- ☐ Check antennas on goggles and model

Propellers
- ☐ Install propellers
- ☐ Tighten propeller nuts
- ☐ Prop saver installed correctly
- ☐ Check prop saver o-ring

Pre-flight Notes:

_____
_____
_____
_____

Post-flight Notes:

_____
_____
_____
_____

Flight Log Data:
- Flight Class (Micro, Mini): _____
- Number in Attendance: _____
- Number of Pilots: _____
- Duration of Event: _____
- Number of Incidents: _____
- Nature of Incidents: _____
- Other Information: _____

Pre and Post Flight Checklist

- During your flight operation there is a variety of manual tasks you must perform as well as interpret telemetry and data to ensure a safe operation.
- It is critical as an operator that you develop standard operation procedures each of your RPAS operators.
- This will help you to interpret all of the data on screen as well as assure proper control over your RPAS.
- As a part of your standard operation procedures manual, you should carry checklists to ensure all of operational tasks have been completed.
- Todays RPAS have a great deal of automation and it can become easy to get too complacent during an operation.
- If you interrupted during a checklist, it is important to start from the beginning to be sure you have not missed any critical feature of the checklist.
- In manned Aviation this has caused numerous crashes and near crashes. If possible, have a secondary person go through the checklist as well with you much like the captain and FO on a manned flight.

General Knowledge for Flight Ops

Assumption is the Enemy of Safety

- The unfortunate thing is that there are too many assumptions taking place for new drone pilots.
- The all-too common “how high and high fast can I fly” mentality is incredibly unsafe — and causing more and more issues.

PIC (Pilot in Command)

- Although the pilot-in-command (PIC) of a UAV system is external to the aircraft, they still have responsibility and authority for the operation and safety of the aircraft during flight time.
- As with manned aircraft, the PIC may not always be the individual manipulating the controls and may at times be supervising another pilot.
- The PIC may be supported by other crew members that have been assigned to duties essential to the operation of the UAV (e.g. payload operators, visual observers, operators of launch systems and arresting hooks and mission planners).
- Crew members engaged in the operation of a UAV system shall, during flight time, comply with the instructions of the PIC.
- UAV pilots must be properly trained and proficient to assure safe integration within national airspace.

RPAS Defects

Operational Failures and Management

Potential Causes of Operational Failures

- Human Factors: Human factors can contribute greatly to Operational failures. Human factors will be covered in Part II of this course.
- Electronic Failures: Electronic failures can take place both on a transmitter or on the RPAS itself. These can include battery failures.
- Mechanical Failures:: Mechanical failures ted to be with motors and Propellers.
- Communication Failures: This includes signal failure between transmitter and RPAS or in some cases communication failure between a tablet or phone device and transmitter.
- Software Failure: Device software crash
- Firmware: Firmware errors from manufacturer or errors encountered when updating.

Operational Failures and Management

What can go wrong	What can happen when it does	How to avoid
Think about before you fly		
Inappropriate flying site:		
Radio interference at take- off point	Drone performs unpredictably – likely to crash	Check the HD menu option before flight
Close to iron or steel objects	Compass fails, drone becomes "hot air balloon" and drifts at set altitude with wind	Look for iron and steel structures before flying Practice flying in ATTI mode (replicates what happens if the compass fails)
Too windy	Drone becomes unstable	Check BBC / Met Office / UAV Forecast (app) for wind speed. Use anemometer. Keep low
Not enough space	Collision	See below under "error in flight"
Battery fault	Drone crashes	Check the detailed battery info before flight
Propeller failure	Drone crashes	Check props before flight, listen to drone in hover when it first takes off
Propeller falls off	Drone crashes	Use prop wrench on P3, check for correct fitting on P4 and Inspire
Think about while flying		
Error on take off	Collision with ground, or objects around take off spot	Always take off the same way, climbing vertically at max speed to 10m altitude
Error in flight	Collision	• Keep things simple: fly one stick at a time • Fly forwards: we walk forwards and drive forwards • Look at drone in flight, glancing at screen to check what the drone can see • Avoid split second decisions

Operational Failures and Management

What can go wrong	What can happen when it does
Think about before you fly	
Inappropriate flying site:	
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Close to iron or steel objects	Compass fails, drone becomes “hot air balloon” and drifts at set altitude with wind
Too windy	Drone becomes unstable
Not enough space	Collision
Battery fault	Drone crashes
Propeller failure	Drone crashes
Propeller falls off	Drone crashes
Think about while flying	
Error on take off	Collision with ground, or objects around take off spot
Error in flight	Collision

Error in flight (cont)
Error in flight
Battery runs low
Video link drops out/ green screen
Think about on landing
Error on landing leads to:
Trying to land on a raised landing pad, and missing
Landing on grass
Landing on sand / gravel / dirt
Error in flight (cont)
Error in flight

Winter Flight Operations

- Winter drone flying can sometimes be challenging in extreme conditions. Low temperatures can impact flight performance, and weather can be unpredictable.
- It's possible that you will encounter rain, fog, or snow during flight so how can you have a safe flight and capture great shots during the winter months?
- Here are some safety and camera settings tips to keep in mind when flying your drone during winter.

Winter Flight Operations

Batteries

- Like many of the latest portable devices, DJI drones use Lithium Polymer (LiPo) batteries. Cold temperatures can put your batteries out of their comfort zone, decreasing the chemical activity within batteries. Follow the tips below to ensure a safe flight:
- Only use fully charged batteries.
- Pre-heat your battery to 20°C (68°F) or more. You can check the battery temperature in DJI GO. Use a Battery Heater if one is available for your product.
- Hover for about a minute to allow the battery to warm up or arm the motors on the ground.
- Only push the control sticks gently to prevent any battery voltage drops.
- Batteries drain faster in cold temperatures so keep an eye on the percentage.

Winter Flight Operations

Environment

- Reduced visibility and the moisture of snow can be the hidden dangers behind shooting spectacular winter scenery. It's essential to take the right precautions:
  - Before flying your drone, check the weather conditions.
  - Avoid strong wind, rain, and snow.
  - Do not fly in temperatures below 0°C (32°F).
  - Avoid contact with snow. Moisture can damage the motors. It's recommended to use a landing pad for taking off and landing your drone.
  - Ensure that the GPS signal is strong.

Winter Flight Operations

Environment

- Ever experienced your mobile device unexpectedly
- shutting down from the cold? As explained at the beginning, cold temperatures can shorten a LiPo battery's life.
- So, while taking good care of your Intelligent Flight Batteries, don't forget to keep your mobile device warm. Additionally, watch out for frostbite.
- Operating a remote controller with numb hands is dangerous. It's a good idea wear gloves when flying outdoors during winter months.

Winter Flight Operations

Stay Warm

- Ever experienced your mobile device unexpectedly
- shutting down from the cold? As explained at the beginning, cold temperatures can shorten a LiPo battery's life.
- So, while taking good care of your Intelligent Flight Batteries, don't forget to keep your mobile device warm. Additionally, watch out for frostbite.
- Operating a remote controller with numb hands is dangerous. It's a good idea wear gloves when flying outdoors during winter months

Storage

- If your drone is idle for a long time, its performance might be affected.
- Storing it properly is key to a safe flight. Make sure to:
    - Fully charge and discharge the battery once every three months to maintain battery health.
    - Remove the propellers and attach the gimbal clamp when storing your drone.
    - Store your drone in a dry, non-magnetic place at around 25°C (77°F).

Living Creatures

No Pilot Shall operate an RPAS that transports or carries on board any living creature

Wildlife Hazards

- In one extreme case, the remote-controlled RPAS caused a bear's heart rate to spike from 39 to 162 beats a minute, a whopping 400 percent increase - that's well above the heart-beat jump experienced by people riding a double-corkscrew roller coaster.
- In May 2014 in Utah's Zion National Park, a drone caused a herd of bighorn sheep to scatter—separating mothers from calves.
- A more obvious possible victim of RPAS are birds, individually, in flocks or nesting with young.

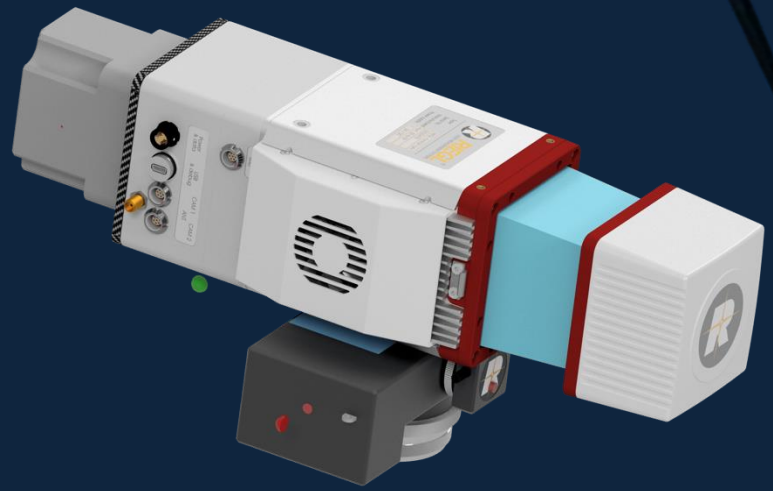
Forest Fires

- Flying drones or UAV around forest fires is dangerous and illegal.
- When you fly a drone near a forest fire, you can put the lives of pilots, firefighters and other emergency service personnel at risk.
- The “no drone zone” is any area within nine kilometers of any forest fire.
- Remotely Piloted Aircraft Systems (RPAS) pilots that airspace around and over a forest fire is closed to all aircraft not directly involved in firefighting operations.

Bright Light Sources

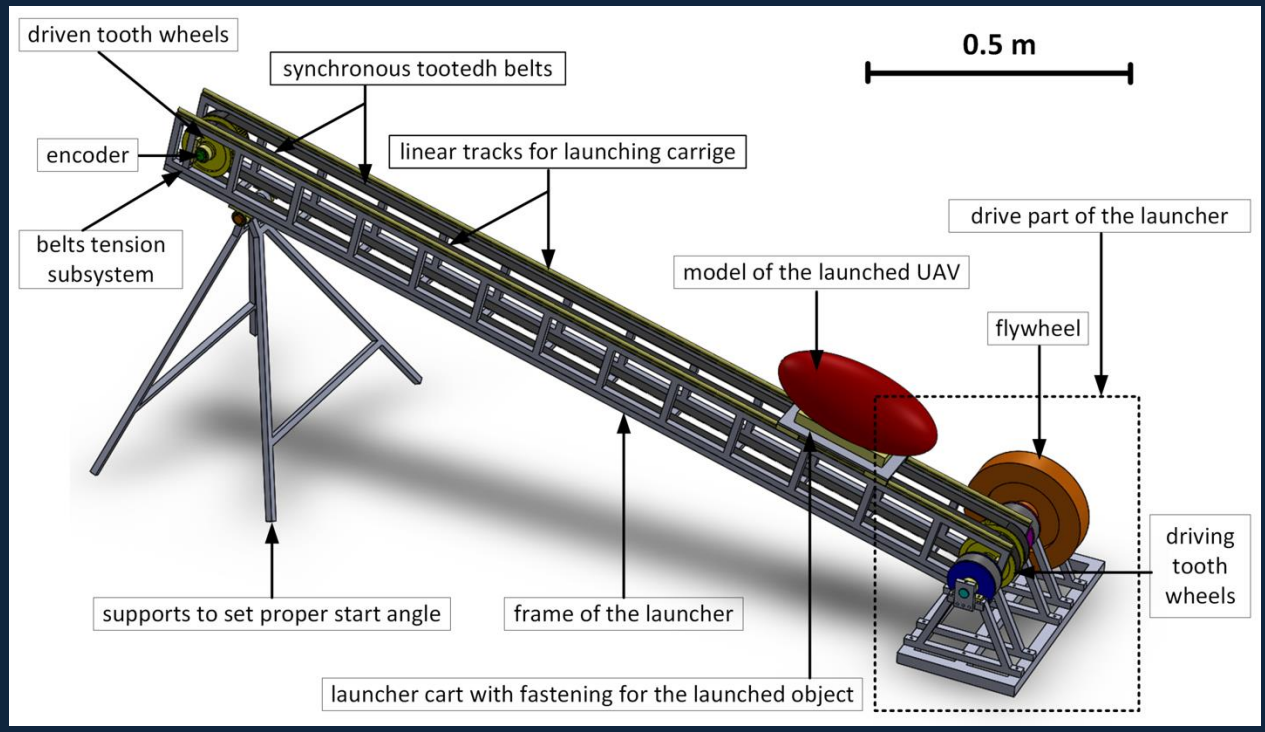
- The projection of bright lights into airspace is prohibited under section 601.20 of the CARs.
- As well, the failure of a person or corporation to provide a written request and obtain written authorization from the Minister to project a directed bright light source into navigable airspace is an offence under subsection 601.21 (1) of the CARs.

Light Detection And Ranging



Launchers

- Typically, it's fixed wing RPAS systems that use launching systems and these systems are most often pneumatic launchers.
- Attention should be paid to conditions at launch such as wind direction and obstacles and other conditions that could interfere with the initial flight path of the RPAS.




N151UX
N151UX

Launchers

- There are different types of launch systems that can be used on fixed wing drone. These include elastic cord launchers, pneumatic and hydraulic. Each of these can be affected by temperature thus decreasing their effectiveness.
- Room-Temperature Rubber. At room temperature, a rubber band snaps back due to its elastic molecular properties. The strands that make up the rubber band stretch, but forces in the rubber molecules pull them back to their original shape.
- The rubber band actually expands when it gets colder! This seems counterintuitive because most materials expand when they are heated and contract when they get cold. This occurs because of the unusual polymer structure of rubber. ... When the chains cool down, they relax and stretch out, causing the material to expand.
- Most solid materials expand when they heat up, but rubber bands shrink because the heat makes the rubber molecules move around and lose alignment, which causes them to shrink, according to Vince Calder in “Rubber Bands and Elasticity.” ... Use a hair dryer to blow hot air on the rubber band.

Launchers

- The conclusion we can draw from this is that the effect on a elastic launcher from heat could cause a stronger launch reaction then anticipated whereas cold could give you weaker launch reaction.
- Your Launch system then should be adjusted according to the operational temperature.

Launchers

- The conclusion we can draw from this is that the effect on a elastic launcher from heat could cause a stronger launch reaction then anticipated whereas cold could give you weaker launch reaction.
- Your Launch system then should be adjusted according to the operational temperature.

Hydraulic Launchers

- Low-Temperature Effects. Low temperature can damage the temperature stability of a hydraulic fluid or lubricant just as much as high temperature. ...
- For hydraulic circulating systems, high oil viscosity causes a drastic drop in the oil's static pressure as suction draws the oil into the pump's inlet.
- Hydraulic fluid temperatures above 180°F (82°C) damage most seal compounds and accelerate degradation of the oil. While the operation of any hydraulic system at temperatures above 180°F should be avoided, fluid temperature is too high when viscosity falls below the optimum value for the hydraulic system's components.

Pneumatic Launchers

- A Pneumatic launcher which uses air pressure (pneumatic), or combustion of a flammable gas (aerosol,) propane,(etc.) to launch projectiles at high speeds.
- In general a much larger pneumatic cylinder is needed to obtain the same force that a hydraulic ram can produce. In terms of energy costs pneumatics is more costly than hydraulics, this is mainly due to the amount of energy lost through heat production while compressing air.
- The expansion of those gases, due to heat or cold again can effect the launch strength of your RPAS

Visual Observers

- 901.75 No visual observer shall perform visual observer duties with respect to an extended VLOS operation under this Division unless they
  - (a) hold
    - (i) a pilot certificate — small remotely piloted aircraft (VLOS) — basic operations issued under section 901.55,
    - (ii) a pilot certificate — remotely piloted aircraft — advanced operations issued under section 901.64, or
    - (iii) a pilot certificate — remotely piloted aircraft — level 1 complex operations issued under section 901.90;
  - (b) maintain unaided visual contact with the airspace in which the remotely piloted aircraft is operating in a manner sufficient to detect conflicting air traffic and other hazards and take action to avoid them; and
  - (c) remain at a distance of not more than two nautical miles from the remotely piloted aircraft at all times during the flight.

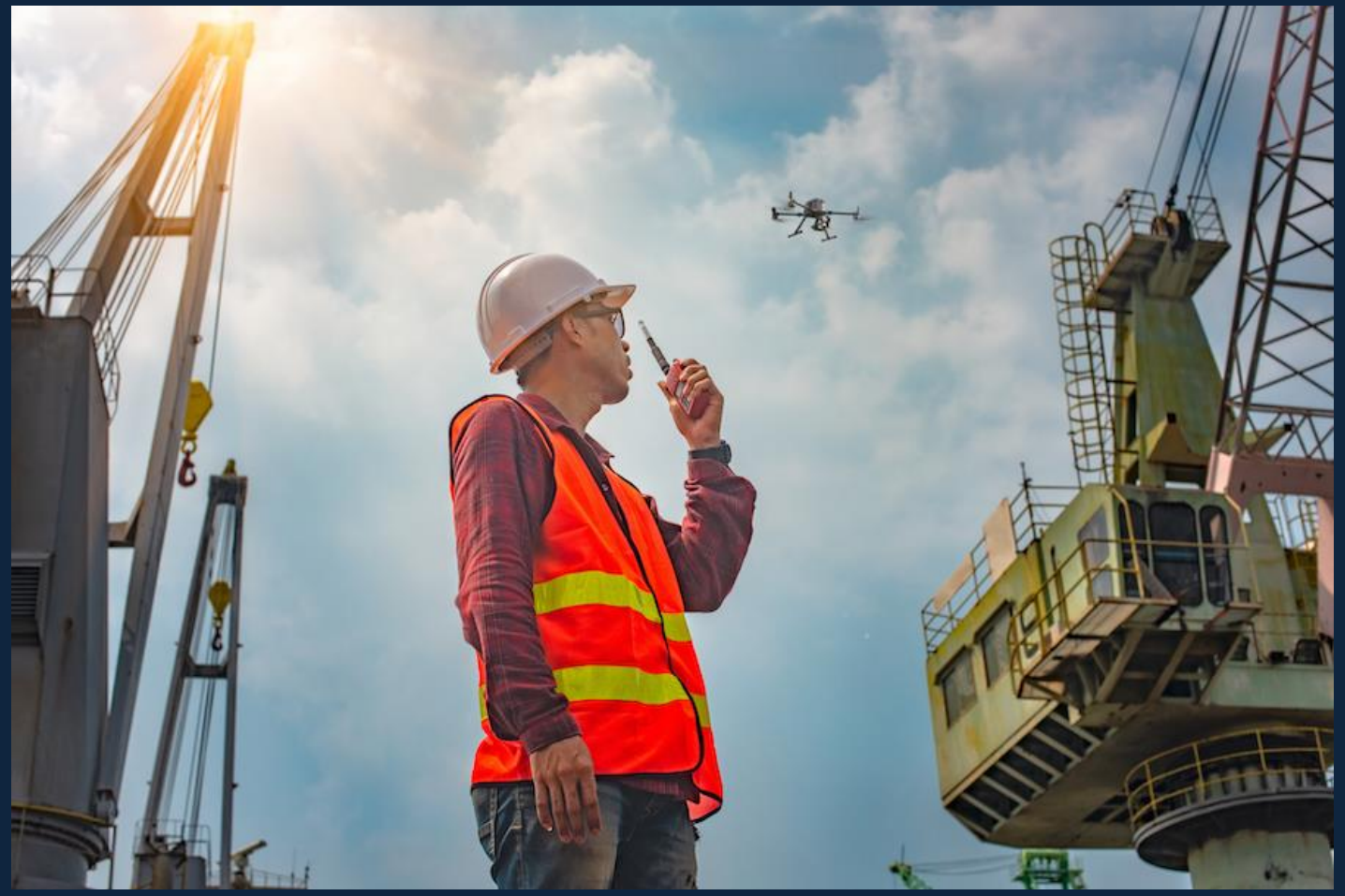
Visual Observers

- 901.20 (1) No pilot shall operate a remotely piloted aircraft system if visual observers are used to assist the pilot in detecting and avoiding conflicting air traffic and other hazards unless reliable and timely communication is maintained between the pilot and each visual observer during the operation.
  - (2) 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.
  - (3) No visual observer shall perform visual observer duties for more than one remotely piloted aircraft at a time unless the aircraft are operated in accordance with subsection 901.40(1) or in accordance with a special flight operations certificate — RPAS issued under section 903.03.
  - (4) No visual observer shall perform visual observer duties while operating a moving vehicle, vessel or aircraft.

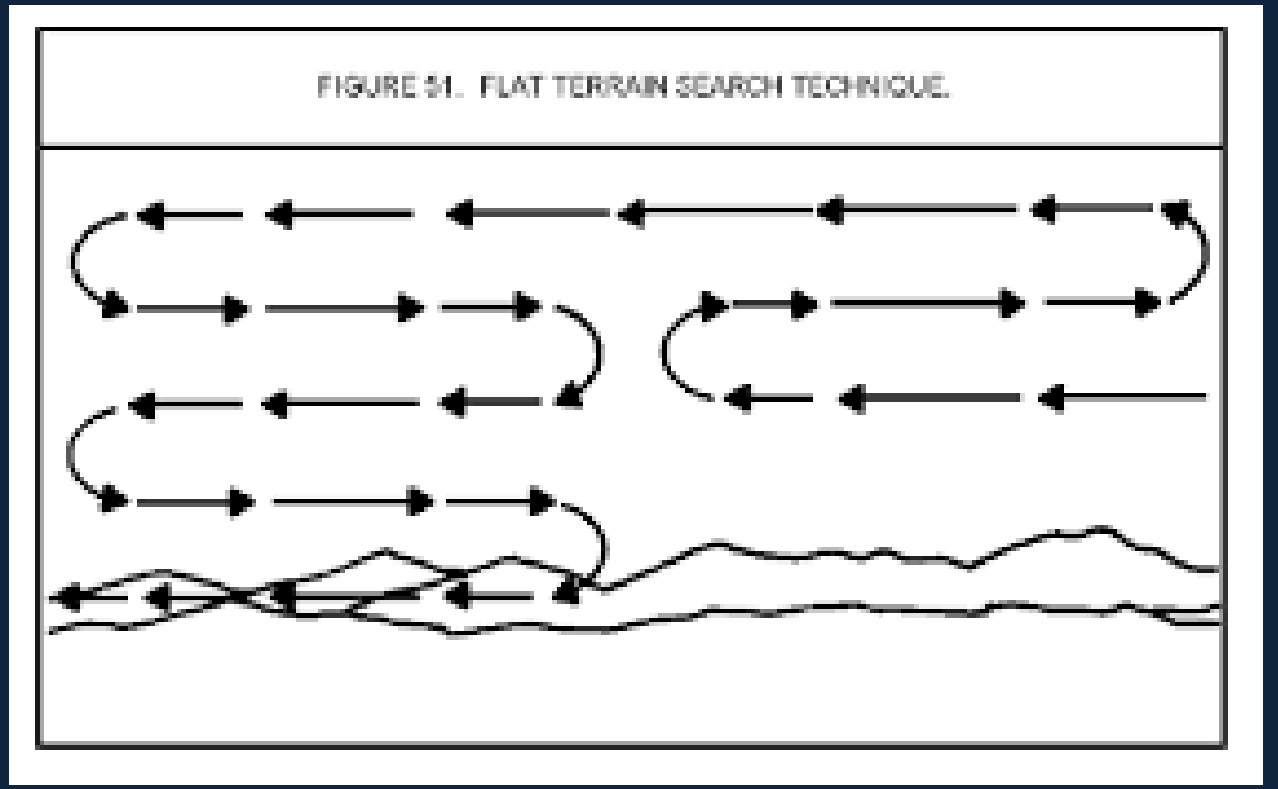
Visual Observers

- Visual line of sight operations rules means that if you operate a remotely piloted aircraft or a free flight model aircraft, then you MUST NOT operate your drone:
  - in any area in which the drone pilots view of the surrounding airspace in which the aircraft will operate is obscured from view by objects, buildings, trees or other natural obstacles.
  - in meteorological weather conditions that stop you from maintaining visual line of sight of the drone.
- A person who operates a RPAS needs to:
  - maintain visual line of sight with the aircraft at all times
  - be able to see the surrounding airspace in which the aircraft is operating
  - operate the aircraft below the cloud base or fog, smoke etc.
- Visual line of sight means a straight line along which an observer has a clear view and which may be achieved by:
  - glasses, contact lenses, or a similar device used to correct any subnormal vision
  - a first-person view and a trained and competent observer who maintains visual line of sight of the drone UAV, can see through and around all of the airspace the drone ifs flying in, and/or maintain direct communication with the person who is operating the aircraft.

Visual Observers



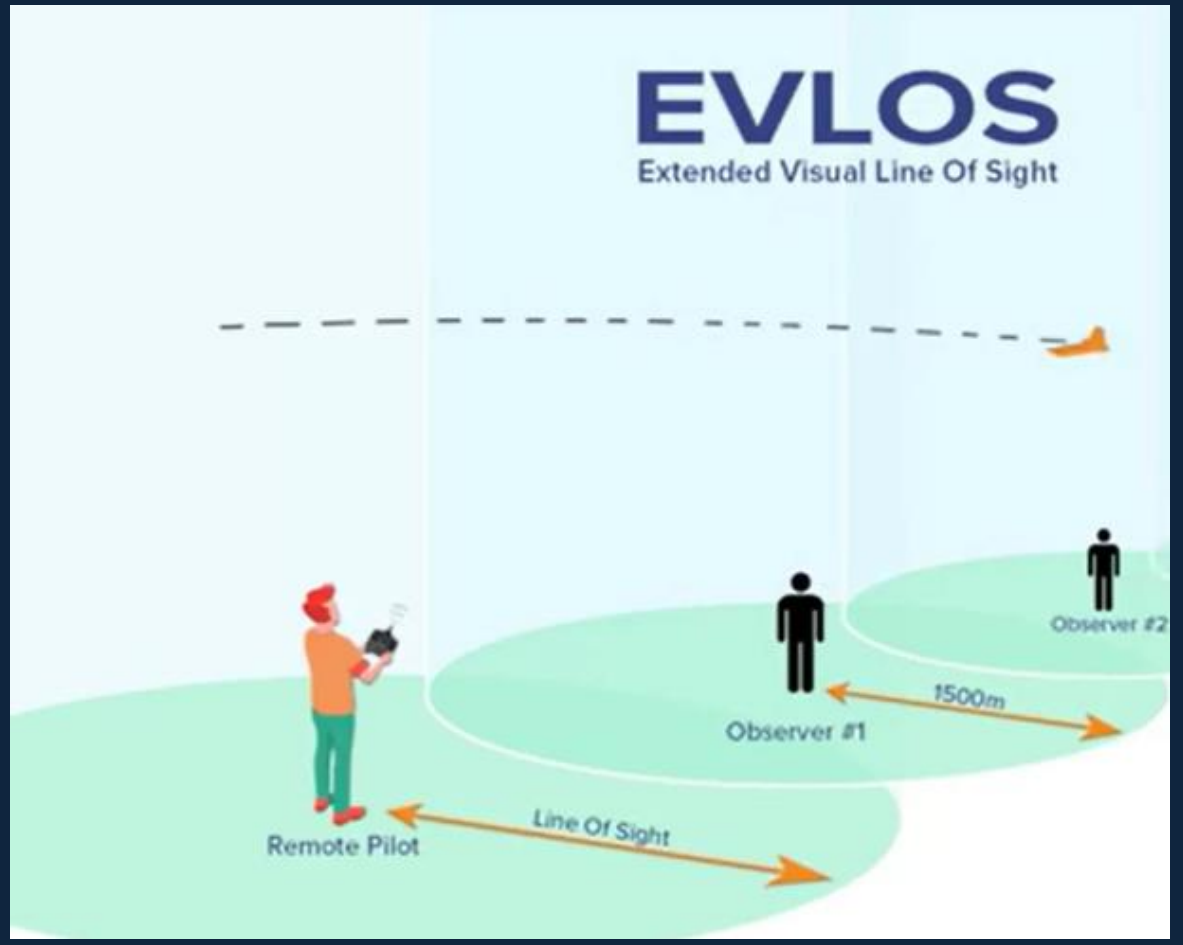
Visual Observers



Extended VLOS Operations and Sheltered Operations

- 901.74 (1) No pilot shall operate a remotely piloted aircraft system under this Division to conduct an extended VLOS operation or a sheltered operation unless
  - (a) the pilot and control station are located at the site set aside for take-off, launch, landing or recovery at the time of those activities;
  - (b) the remotely piloted aircraft is at a distance of not more than two nautical miles from the pilot, the control station and the visual observer at any time during the flight; and
  - (c) the operation is conducted at a distance of at least 100 feet (30 m), measured horizontally and at any altitude, from any person not involved in the operation.
- (2) No pilot shall operate a remotely piloted aircraft system under this Division to conduct an extended VLOS operation unless a visual observer maintains unaided visual contact with the airspace in which the remotely piloted aircraft is operating in a manner sufficient to detect conflicting air traffic and other hazards and take action to avoid them.

Extended Visual Line of Sight



Landowner Authorizations

- In many cases you will need to acquire permission to fly over specific sites. In cases such as this several factors must be considered.
- A proper site survey will give you the information you need to properly place a launcher if using a fixed wing RPAS, the placement of visual observers and safe recovery areas. These factors apply to all RPAS flights.
- Other Factors to consider:
  - Charging areas
  - Site control safety perimeter
  - Launch and recovery points obstacles
  - Emergency Procedures
  - Crew roles and responsibilities
  - Proper communication
  - Post Flight Actions

Crew Briefing

- As a part of your operational standards you should be having preflight and post flight ground and flight crew briefings. If you're working alone, it's critical that you have comprehensive pre and post flight checklists. When working with a ground crew the pre and post light briefing can save you from errors that could cause a safety concern. Typical items in briefings:

  - crew roles & responsibilities
  - objectives for the flight
  - the flight plan
  - timeline for the operation
  - performance limitations
  - emergency procedures
  - airspace conflicts
  - escape maneuvers
  - recovery & safe areas
  - interference with the client and public site manager
  - expectations on what they will observe
  - electro-magnetic interference
  - (clean cockpit) no interference or distractions for the PIC.
  - flyways and public interference

Crew Briefing

Crew Briefing

- Communicate vital actions such as countdown to launch command, emergency abort, transfer of aircraft control, air traffic contacts, progress of the flight and expected maneuvers.
- Be sure to include recommended post flight actions I.e.. The downloading of data, checking for any damage that might have occurred to your RPAS, cleaning and drying of RPAS components as required, removal of batteries recording all flight and equipment information into logs, disassembling of equipment and proper packing.

Occupational Health & Safety

- Fire extinguisher, sand bags and/or fire blanket
- First aid kit & basic tool kit
- Cones/barricades for marking operational & charging areas
- Measuring tape for marking specific areas
- Assess weather threats for example incoming lightning storms , fog etc.
- Typical emergency contacts Police, Fire, EMS , Local airports
- Legal site access issues, insurance permissions and crew safety training

Occupational Health & Safety

Equipment

Equipment

- Each member of your ground and flight crew should have personal safety equipment this should include:
  - A fire blanket makes a good backup if your fire extinguisher fails to work. Also, if you travel abroad, you won't be able to take your fire extinguisher on the plane so having a fire blanket as a backup is a necessity.
  - A good landing mat could mean the difference between you being able to take off or not. If the grass is long where you are trying to take off, you may end up getting unwanted dirt of morning dew on the lens. Get yourself a good-sized landing mat that is big enough for your aircraft. A small pop up one that you can't peg down won't be much use in a slight breeze.
  - It's also an excellent opportunity to show off some branding and really make yourself stand out Cones are useful if you need to start to cordon your take off and landing point off, to stop people not under your control entering the vicinity. Combined with cordon tape, you can quickly set up an effective barrier.
  - Although it may be warm when you leave the house, when you are out in the field, and a steady breeze gets you, it can get quite cold. Having some warm clothing in your flight pack, especially in winter can be a lifesaver.
  - Warm dry clothing also will be very beneficial if you are caught unaware in the rain and need to get out of your sopping wet clothes after trying to get your drone packed away.

Equipment

- Sometimes high visibility vests are a requirement by local authorities and construction sites when operating, so it's a good idea to have some spare ones in your flight pack. It's also an excellent opportunity to have some branded vests - nothing like a bit of self-promotion!
- Always keep plenty of bottles of water in the back of your car/truck, but also keep a few in your flight box for an emergency. It can be a real inconvenience if you've parked a long way from your take off and landing point and forgot to grab a bottle.
- Be sure to bring an appropriate amount of food and water for the day.
- An anemometer is used to measure the wind speed locally. You may have checked the weather reports, and they all say the wind speeds are fine, but things could be completely different on top of an open hill or down the valley.
- Don't get caught out and have your drone fly away, if the wind feels unusually strong, measure it and keep everyone safe.
- If you're going to be running through and travelling a lot with drone batteries, you may want to invest in some LiPo bags to securely hold your batteries. In the event of a battery setting on fire during transport, at least the bags are another barrier to containing the fire.
- Keep a couple of spare bags in your flight box; if you do forget to bring bags with your aircraft, at least you know you can store some of your discharged batteries safely.

Where can and can’t I fly?

- To keep yourself and others safe, fly your drone:
  - where you can see it at all times
  - below 122 meters (400 feet) in the air
  - away from bystanders, at a minimum distance of 30 meters for basic operations away from emergency operations and advertised events
  - avoid forest fires, outdoor concerts and parades
  - Stay 5.6 kilometers (3 nautical miles) from airports
  - Stay 1.9 kilometers (1 nautical mile) from heliports far away from other aircraft
  - Don’t fly anywhere near airplanes, helicopters and other drones
  - Always respect the privacy of others while flying.

Tips For First Time Pilots

- Make sure it is safe to fly (ask yourself, for example: are the batteries fully charged? Is it too cold or windy to fly?)
- Fly your drone with someone who has flown a drone before Fly your drone in an open space and away from people
- Fly your drone close to the ground and at a low speed Fly your drone during daylight and in good weather
- We recommend buying public liability insurance for your drone. However, it is not required. Note that most standard home insurance policies do not cover the use of drones.
- Visual-line-of-sight means keeping your device in sight at all times without visual aid (for example, binoculars or video feed). This means not flying into clouds or fog, or behind trees, buildings or other (even partial) obstructions.
- Bystander refers to anyone that is not directly associated with operating the drone. Among others, this excludes the pilot and crew.

Flight Reviews

- The small RPAS pilot operating within visual line of sight must be able to:
  - Provide a satisfactory site survey
  - Brief flight crew or visual observers of any duties they are to perform or any other information relevant to the flight
  - Use appropriate and current aeronautical charts and other current flight publications
  - Properly identify airspace, obstructions, and terrain features
  - Select a safe and efficient take-off location and flight route
  - Obtain all pertinent information about local air routes and aerodromes
  - Retrieve and interpret weather information and NOTAM relevant to the intended flight
  - Determine the acceptability of existing or forecast weather conditions

Flight Reviews

- If you are flying in the RPAS Advanced Category after passing your advanced exam you are issued a basic certificate from Transport Canada.
- You are required to complete a flight review before you are issued the Advanced certificate.
- Keep in mind that until you complete the flight Review you must fly under the basic operations rules.

Flight Reviews

From Transport Canada

- A flight review is the one of two knowledge requirements for conducting advanced operations with your drone or “Remotely Piloted Aircraft Systems (RPAS)”.
- Flight reviewers are Transport Canada-approved drone pilots who can administer a flight review.
- What you need to know before you start
  - Before you conduct your flight review, you must pass the Small Advanced Exam.
  - We recommend reading Appendix A: Flight Reviewer's Guide - sRPAS Exercises in the Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems 250g up to and including 25 kg, Operating within Visual Line-of-Sight (VLOS).
  - Appendix A lists the skills that your flight reviewer will ask you to demonstrate during your flight review.

Flight Reviews

Scheduling a Flight Review

- Every flight reviewer is associated with a self-declared drone flight school.
- Contact the drone flight school directly to schedule a flight review. You must provide the school with: a digital or physical copy of the results page of your successfully completed small advanced exam
- a valid (not expired) piece of government-issued (federal/provincial/territorial/state government authority
- or the equivalent body abroad) identification that provides their name and date of birth the Certificate of Registration for the drone used for the flight review

About the flight review

- The flight reviewer will assess your ability to operate your drone safely.
- You may be charged a fee by the flight reviewer for your flight review. Prices are set by the reviewer.

Flight Reviews

After you complete the flight review

- Within 24 hours of your flight review, the flight reviewer will submit your results online and you will receive an email confirmation with a link to view your results. You will need to keep your knowledge up to date. If you let your knowledge level lapse for more than 2 years, we may invalidate your results.
- If you pass the flight review, you can apply for a Pilot Certificate – Advanced Operations.
- If you fail the flight review, you may schedule another review the next day. There is no limit to the number of times you can retake a flight review, but you may need to pay a fee each time.

Guides and help

- Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems—TP 15263

Flight Reviews

- Select the most favorable and appropriate altitudes, considering weather conditions and equipment limitations
- Determine the appropriate departure procedure
- Make a competent “GO/NO-GO” decision based on available information for the flight
- Demonstrate that the weights and center of gravity are within acceptable manufactures limits
- Determine the impact on their sRPAS operations, of unserviceability of equipment or equipment configuration changes for the proposed flight
- Organize and arrange material and equipment in a manner that makes the items readily available.

RTF
READY-TO-FLY

Flight Reviews

Emergency procedures

Small basic operation	Small advanced operation	Topics
n/a	✔	Demonstrate the procedures to be used when an emergency occurs.

The small RPAS pilot operating within visual line of sight must be able to:

- Describe emergency procedures that apply to your sRPAS;
- Describe the lost-link procedures that apply to your sRPAS;
- Describe the procedures to follow in the event of a fly-away, including who to contact.

Perform a take-off

Small basic operation	Small advanced operation	Topics
n/a	✔	Perform an organized and efficient safe departure

The small RPAS pilot operating within visual line of sight must be able to:

- Complete all pre-flight inspection/checks on your sRPAS;
- Note take-off time;
- Use an organized and efficient procedure to take off;
- Comply with all departure clearances and instructions if the flight review is conducted in controlled airspace; and
- Complete appropriate checklists.

Flight Reviews

Manual flight procedure

Small basic operation	Small advanced operation	Topics
n/a	✔	Show the ability to manually control the sRPAS through various stages of flight.

The small RPAS pilot operating within visual line of sight must be able to:

- Maintain a stable airspeed, cruising altitude, and heading;
- Navigate by applying systematic navigation techniques;
- Orient the sRPAS to the direction of flight;
- Navigate around an obstacle or fixed point;
- Determine the position of the aircraft with respect to distance and altitude from the candidate;
- Apply an organized method that would:
  - verify the position of the aircraft
  - revise headings to correct any existing track error to maintain the aircraft's position due to wind
  - confirm or revise the battery power available at the destination landing point with a degree of accuracy that would make arrival assured
  - confirm current fuel/power levels vs requirements for the flight

Flight Reviews

Lost link procedures

Small basic operation	Small advanced operation	Topics
n/a	✔	Demonstrate verbally the procedures to be used when a lost link occurs.

The small RPAS pilot operating within visual line of sight must be able to:

- Correctly program the sRPAS for a “return to home” if it is equipped with that function;
- Select a power setting and altitude appropriate for the lost link situation;
- Promptly recognize when a lost link has occurred;
- Show an ability to regain control of the sRPAS if it reconnects the lost link;
- Take an appropriate course of action, once link has been re-established and confirmed; and
- Contact the appropriate facility to provide information on the lost link if needed.

Flight Reviews

“Fly away” procedures

Small basic operation	Small advanced operation	Topics
n/a	✔	Verbally demonstrate the ability to perform all the needed actions relating to a “fly away” situation.

The small RPAS pilot operating within visual line of sight must be able to:

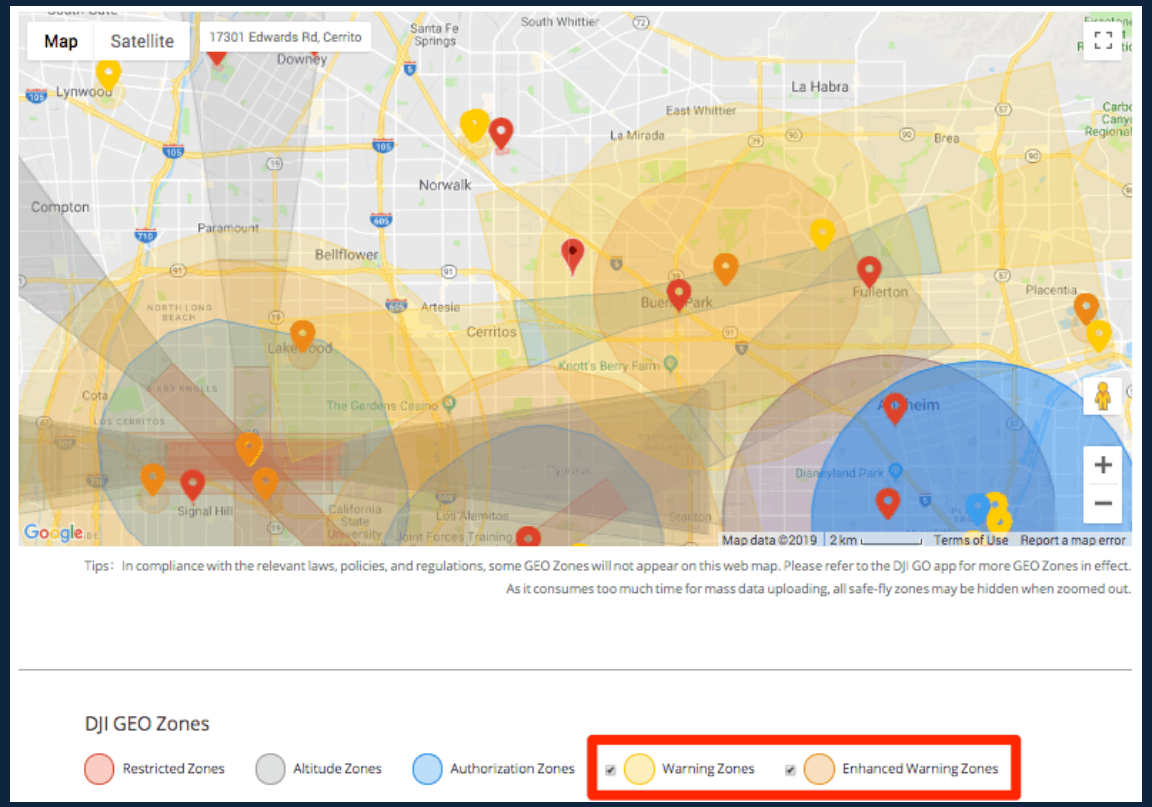
- Perform the following tasks without undue delay:
  - Identify and record their present position
  - Identify and record the direction and altitude the sRPAS was last seen travelling
  - Estimate the approximate available flight time that will remain with the fuel/power on board upon arrival at the destination (Example: 15 minutes)
- Without delay contact the appropriate facility to provide information on the “fly away” if needed.

Flight Planning

- It's very important that you plan your flight weather it is for a commercial or recreational flight. Understanding the obstacles and terrain you will be flying in will make you a better and safer RPAS pilot.
- In the second part of this program you will learn to use a special aviation maps called VNC and VTA's.
- These maps will give you insight into the area you're flying in with regards to obstacles, terrain, airspace and a variety of other conditions in the area your flying in.
- There are a variety of tools you can find on-line free and pay apps that can be very helpful when planning your flight. These range from simple cost-effective software to Enterprise level depending on your specific requirements.

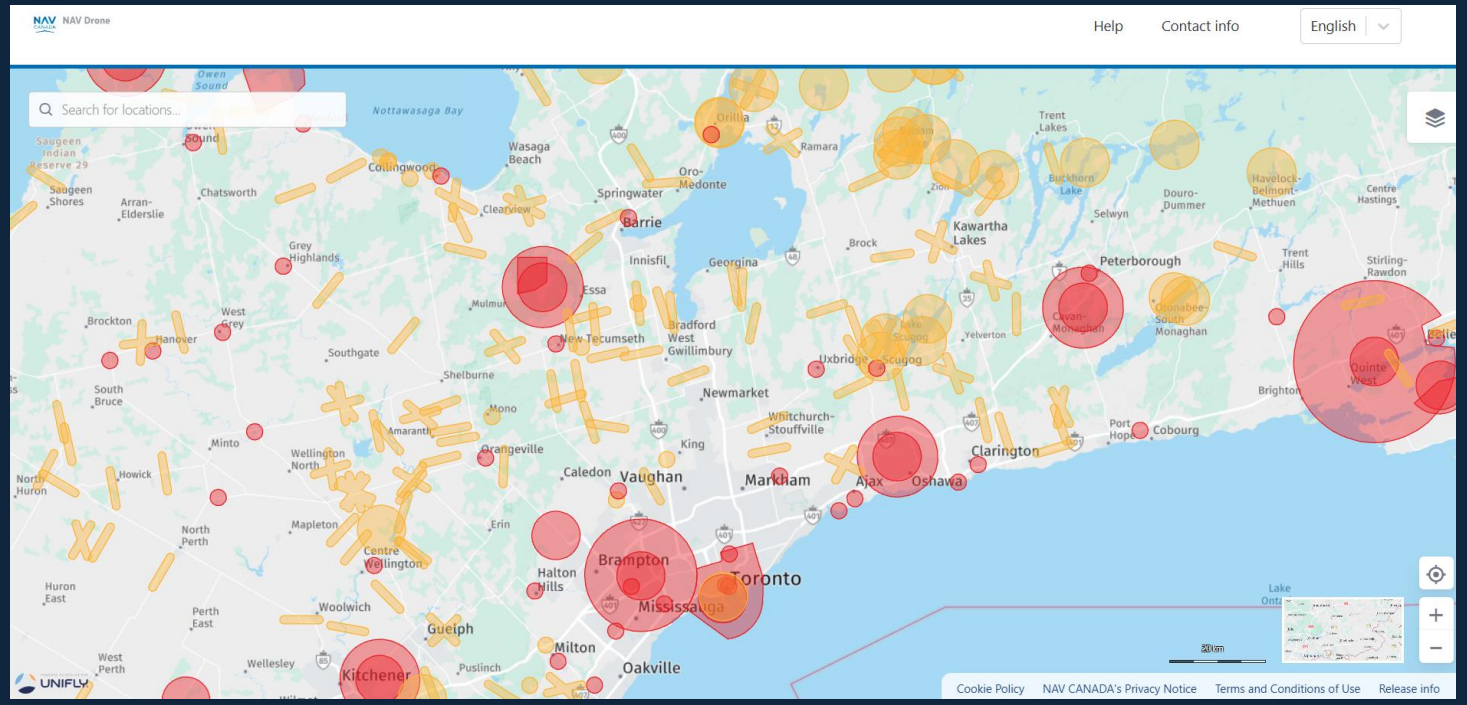
Flight Planning

- Check https://fly-safe.dji.com/home prior to flight to unlock your drone in proximity to certain aerodromes as required.



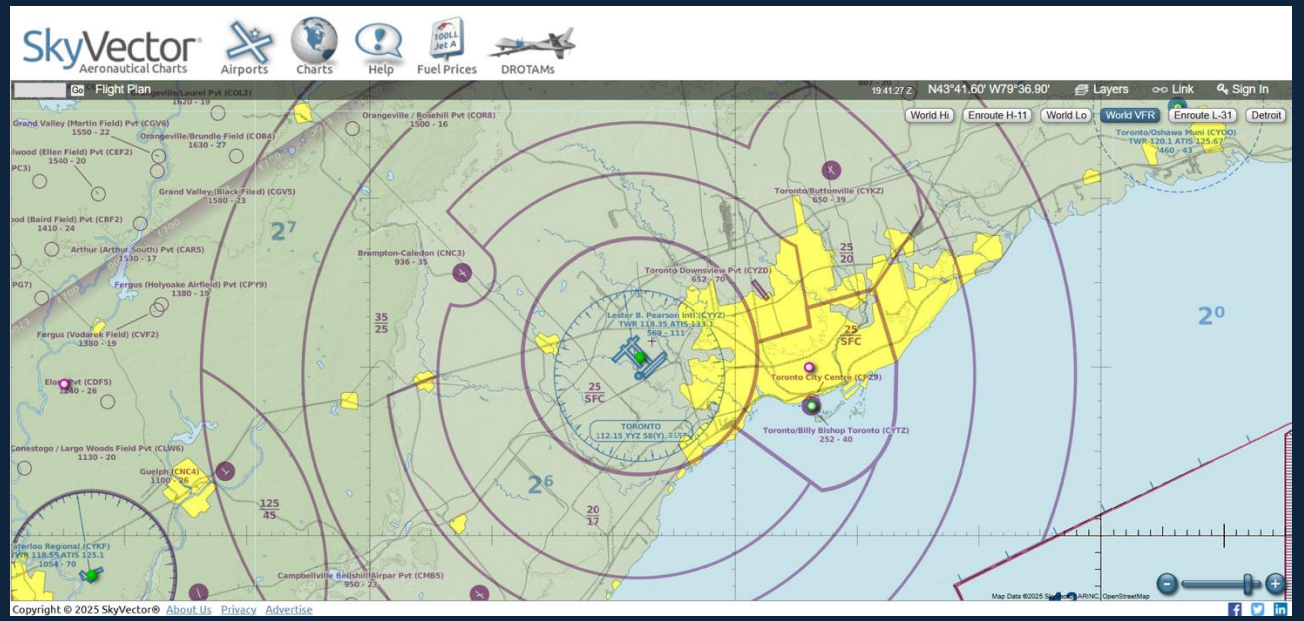
Flight Planning

- Check https://map.navdrone.ca/ prior to flight to request authorization for your drone in proximity to certain aerodromes as required.



Flight Planning

- Check https://skyvector.com/ prior to flight to view airspace near your takeoff.



Flight Planning

- Check https://www.uavforecast.com/ prior to flight for weather forecasts

UAV Forecast ® FAQs Apps Hobbies Language API Register Login

Source: Automatic - Choose the recommended forecast source. Currently using UAV Forecast.

Max Wind (mph): 20 Wind Altitude (feet): 33 Include Gusts

Min Temperature (°F): 32 Max Temperature (°F): 95 Adjust For Wind Chill

Show Humidity Max Humidity (%): 75 Humidity Mode: Dew Point

Max Precip Prob (%): 40 ? Max Precip Intensity (in/h): 0.1

Min Cloud Cover (%): 25 Max Cloud Cover (%): 75 Min Visibility (miles): 3

Min GPS Sats Visible: 9 GPS Elevation Mask (°): 15 ?

Include GPS Sats Include GLONASS Sats Include Galileo Sats Include Beidou Sats

Min Est. GPS Sats Locked: 12 ? Max Kp: 4 ? Kp Source: Automatic

Show Daylight Hours Only Show Cloud Base (subscribers only) Show Max Wind Altitude (subscribers only)

Wind mph Altitude feet Temperature F Precipitation in/h Distance miles

This preview shows the 15-day forecast at another location and time.

Current Conditions as of Friday 2024-02-16 13:02 PST

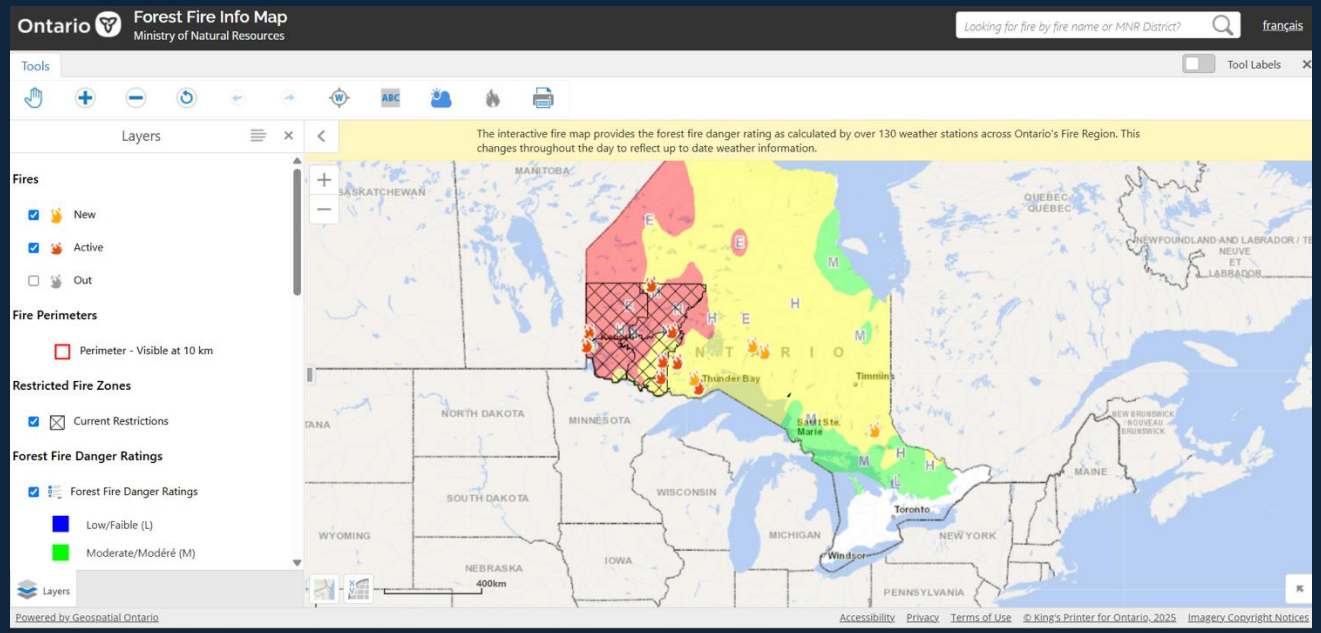
Time	Wind	Gusts	Max Altitude	Temp	Humidity	Precip Prob	Precip	Cloud Cover	Cloud Base	Visibility	Visible Sats	Kp	Est. Sats Locked	Good To Fly?
1[illegible]2	6 mph↗	13 mph↗	4,900+ ft	60°F	54°F	-	-	64%	1,500 ft	10 miles	22	1.67	21.6	yes

Friday 2024-02-16: sunrise 06:38, solar noon 12:09, sunset 17:39

Time	Wind	Gusts	Max Altitude	Temp	Humidity	Precip Prob	Precip	Cloud Cover	Cloud Base	Visibility	Visible Sats	Kp	Est. Sats Locked	Good To Fly?
00:00	4 mph↓	8 mph↓	4,900+ ft	54°F	50°F	-	-	57%	900 ft	10 miles	24	1.33	23.5	yes
01:00	4 mph↙	8 mph↙	4,900+ ft	53°F	49°F	-	-	57%	1,000 ft	9 miles	25	1.33	24.5	yes

Flight Planning

- Check https://geohub.lio.gov.on.ca/datasets/forest-fire-information-map (or similar) prior to flight for wildfires near your location



Clubs & Organizations

- More than likely somewhere near you there is a Radio control flying club that can direct you to safe places to sly your RPAS.
- You should seriously consider joining a club as there is a lot of people there with a wealth of experience and a passion for the hobby.
- Visit https://www.maac.ca/en/clubs.php for a MAAC club near you

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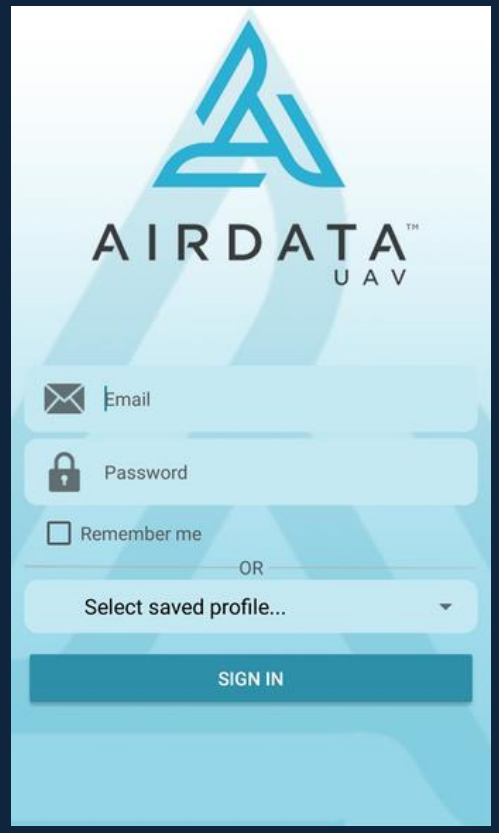
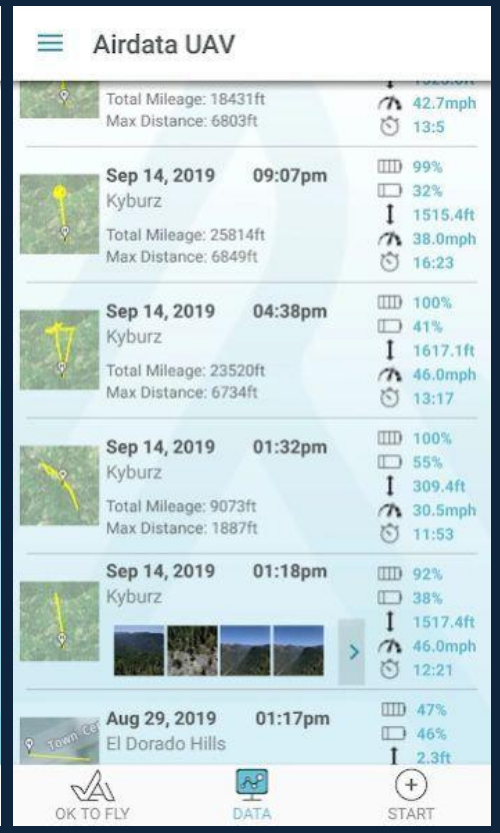
No Drone Zones

- There are certain locations classified as “No Drone Zones”. Typically, these are at airports, power plants and other critical infrastructure.

Useful Apps - AirData

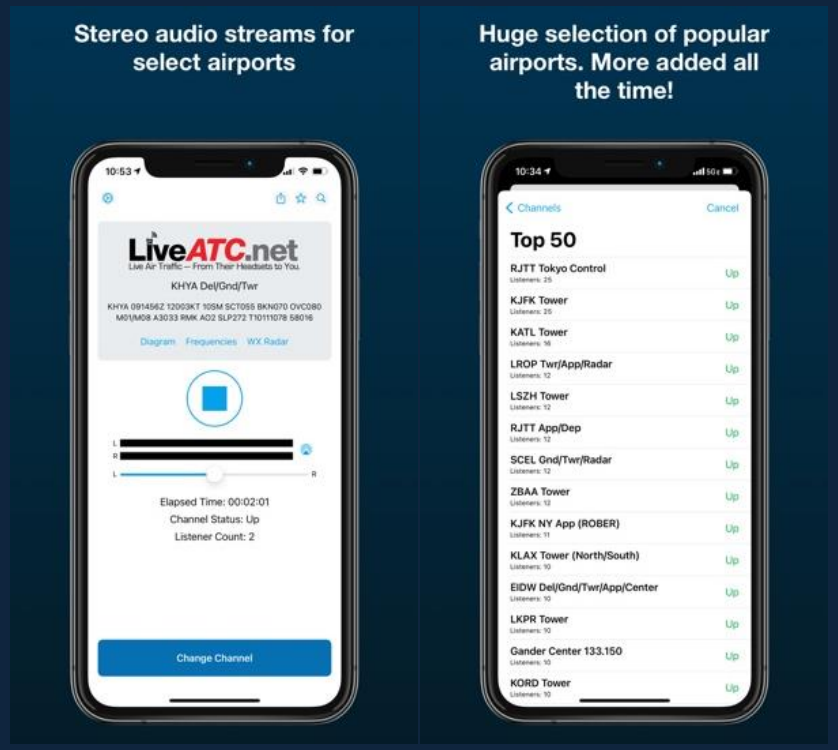
- Airdata syncs with your DJI account to automatically log ancillary data along with your flight telemetry





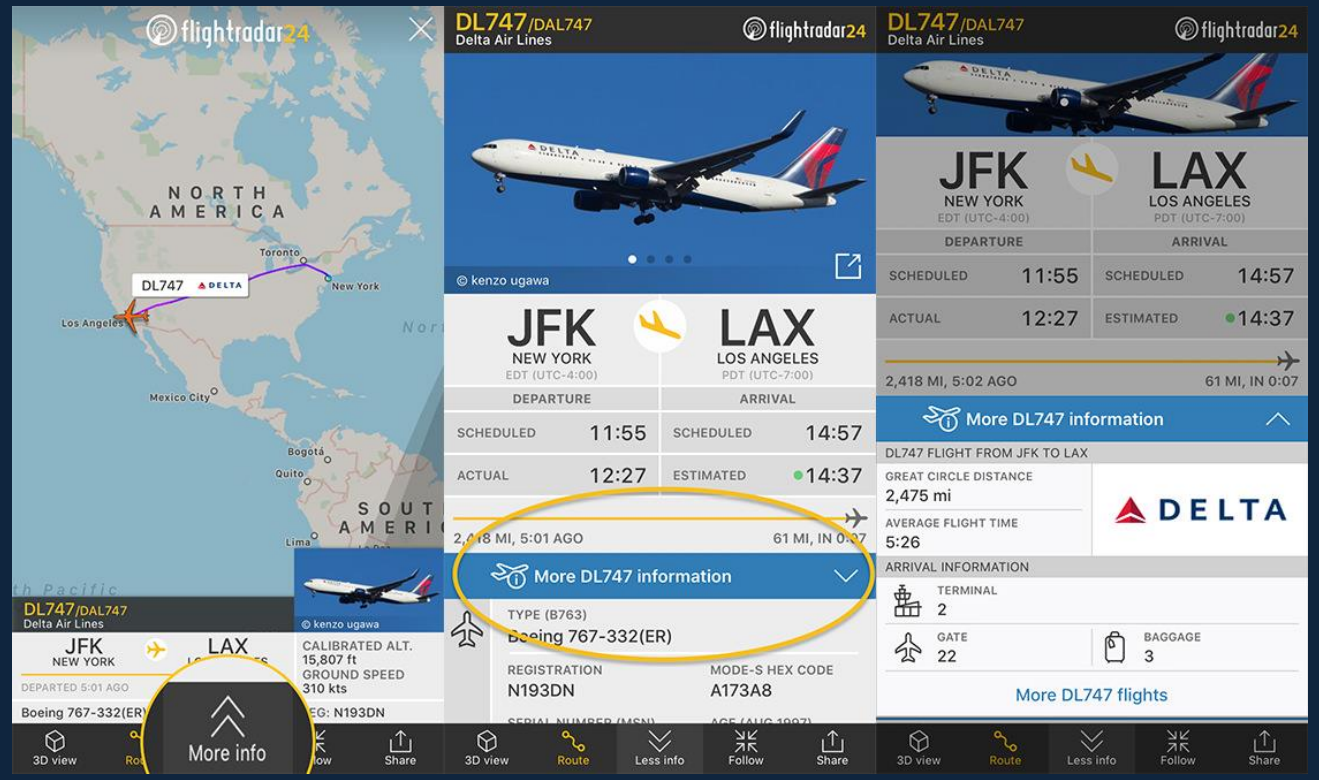
Useful Apps - LiveATC

- Liveatc.net lets you listen to the required frequency for your operation



Useful Apps – FlightRadar24

- Flight radar lets you view all transponder aircraft in your airspace



Useful Apps – UAVForecast

- UAV forecast gives detailed weather forecasts with threshold-based Go/No GO

Beyond Visual Line of Sight

- Beyond visual line-of-sight (BVLOS) operations are for specific and defined operating environments. We can authorize these operations when an operational risk assessment has been completed to mitigate potential risks to people and aircraft sharing that airspace.
- This allows operators to explore new drone applications that can take advantage of Canada's vast geography. Drones have the potential to serve isolated regions, lower population densities, and large pockets of uncontrolled airspace with minimal airspace traffic.
- Level 1 Complex Operations is required for BVLOS flights (outside an SFOC).
- More information on BVLOS operations is provided in the BFCRPAS Level 1 Complex 20hr Ground School.

Know Your Drone

- This is a big area of weakness for many people, it's not enough to know the model of your aircraft and that you have an “Ops Manual”!
  - What do your status lights mean?
  - How do you check if the aircraft is safe to fly?
  - What are its operating limitations?
  - What external factors can affect aircraft performance?
  - What are your setup procedures?
  - What are your emergency procedures?

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