

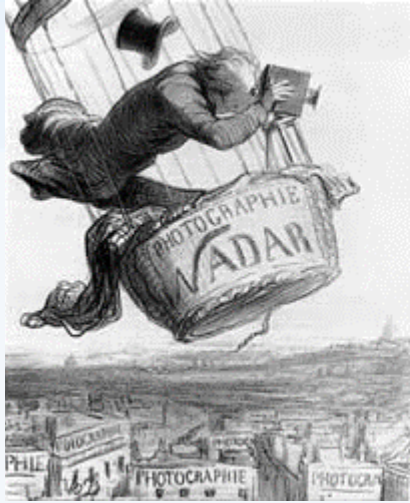
The Future in the Environmental Field is Looking Down



NS Lands
nova scotia lands



Aerial Photography's Origins

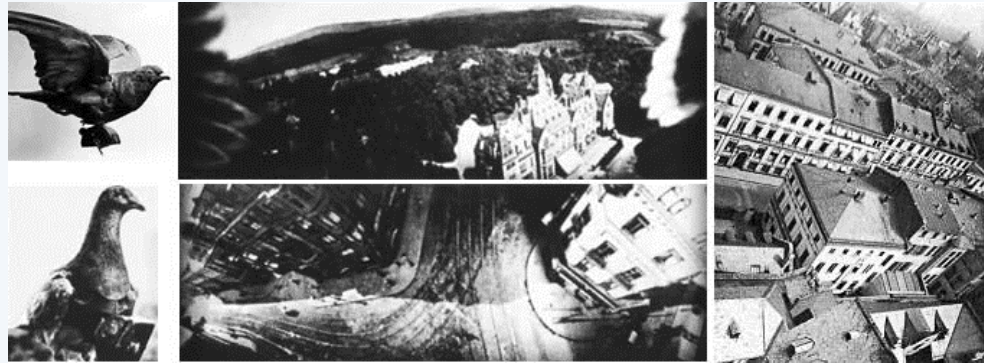


The first known aerial photograph was taken in 1858 by French photographer and balloonist Gaspar Felix Tournachon (aka- Nadar). Nadar patented the idea of using aerial photographs in mapmaking and surveying, but it took him 3 years Of experimenting before he successfully produced the very first aerial photograph.



Aerial Photography's Origins

Kites used in 1882



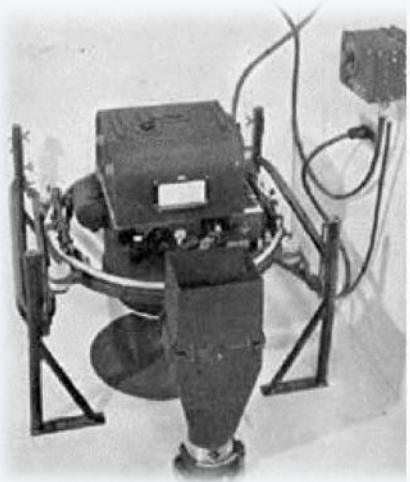
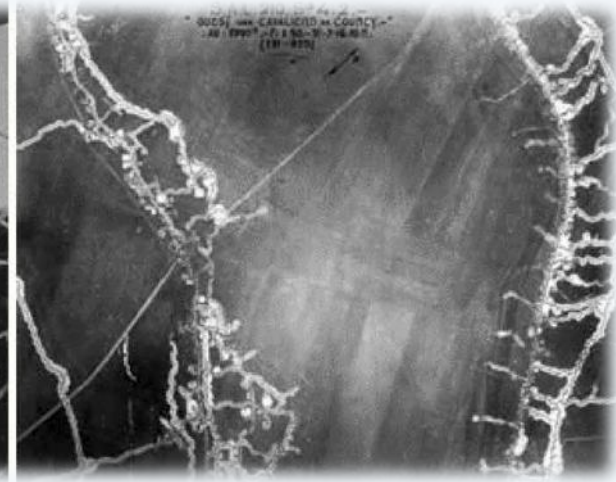
Pigeons used in Germany in 1903



Rockets used in 1897 by Alfred Nobel

Aerial Photography's Origins

First photograph from an airplane
in 1909 by Wilbur Wright



Fairchild created first aerial map of
Manhattan Island in 1921. First non-
military purpose aerial photograph with
Widespread commercial success.

The Future in the Environmental Field is Looking Down



Drone Technology

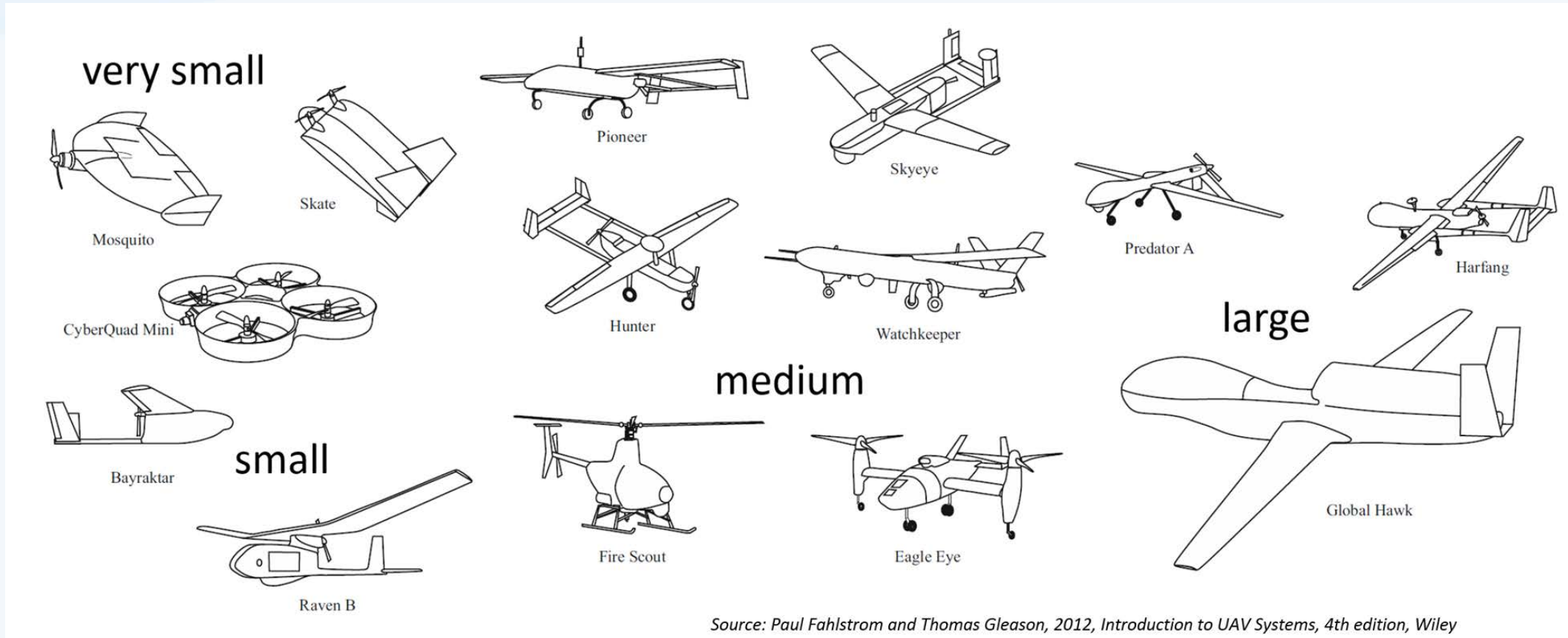
Drones have become the newest, fairly low-cost and effective tools for environmental practitioners and property managers.

What are drones?

- Unmanned aerial vehicles (UAVS), also known as drones, are aircraft either controlled by 'pilots' from the ground or increasingly, autonomously following a pre-programmed mission. While there are dozens of different types of drones, they basically fall into two categories: those that are used for reconnaissance and surveillance purposes and those that are armed with missiles and bombs.

A British Military Magazine "Dronewars.net" Definition

Different Sizes



Different Shapes



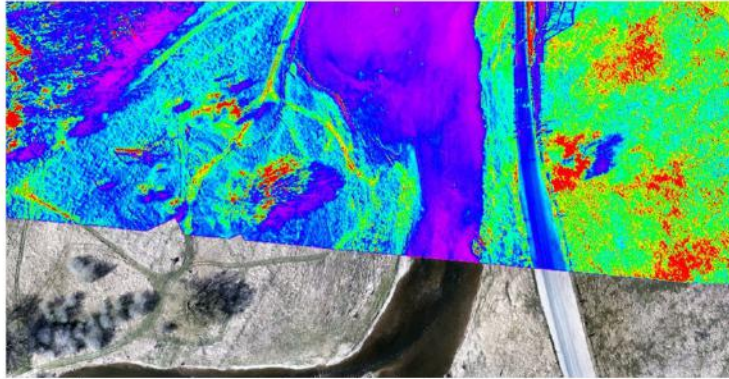
Different Sensors

Electro optical



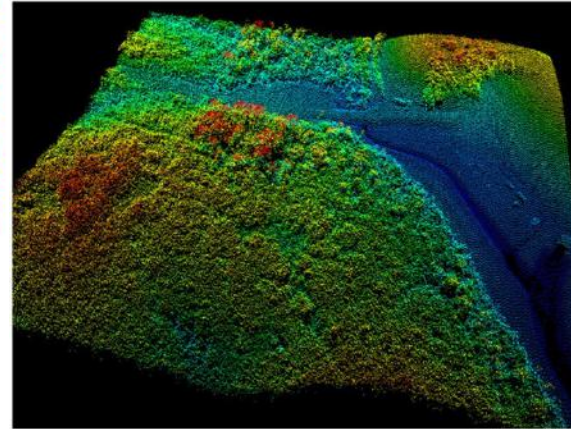
http://www.militaryaerospace.com/content/dam/mae/online-articles/2013/03/MIST-IR_10_March_2013.jpg

Infrared



<http://www.monadrone.com/wp-content/uploads/2014/11/uav-false-color.jpg>

Light detection and Ranging (LIDAR)



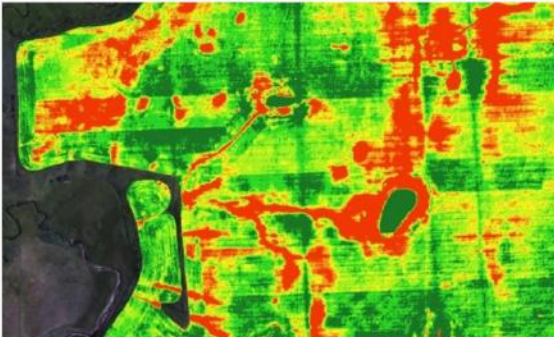
https://farm5.staticflickr.com/4153/5178117620_406a57730f_z.jpg

Synthetic Aperture Radar



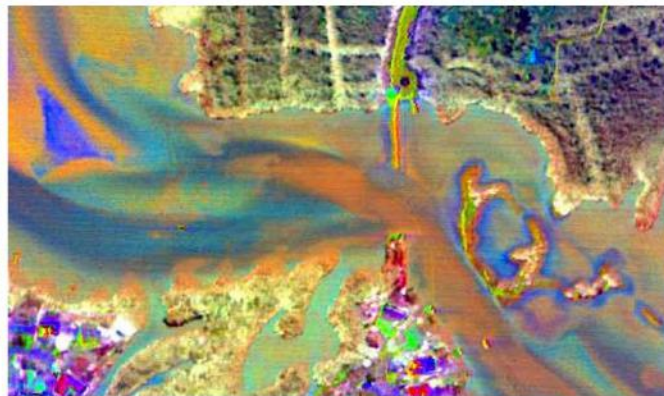
http://images.gizmag.com/gallery_lrg/9007_19030820818_5.jpg

Multispectral imaging



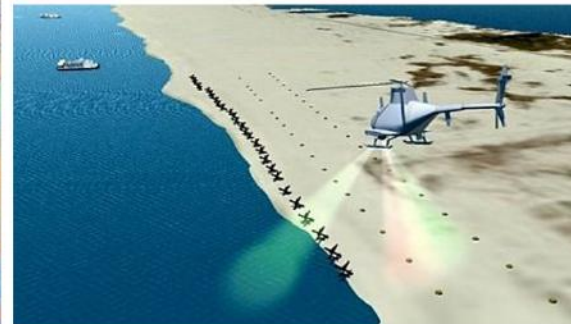
http://www.skymatics.ca/wp-content/uploads/bfi_thumb/Sample1_20100709_NDVI-1024x653-m3qj6a1sbt3q91hc8acc2cj9byrbnu8z9cee6tj54c.jpg

Hyperspectral imaging



<http://www.suasnews.com/wp-content/uploads/2012/11/hyper1.jpg>

Laser radar



http://images.gizmag.com/gallery_lrg/9007_19030820818_5.jpg

Chemical, Biological and Radiological & Nuclear (CBRN) Detection



http://www.cyberfed.eu/cn/wp-content/uploads/2014/03/drone_naso3.jpg

What we've mostly heard about drones before today?

- Drones have been used as effective military weapons
- Military reconnaissance
- Delivery to your door!!



Recreational Aircraft Do's and Don'ts

Do's

- Fly your aircraft during daylight and in good weather (not in clouds or fog).
- Keep your aircraft in sight, where you can see it with your own eyes – not only through an on-board camera, monitor or smartphone.
- Make sure your aircraft is safe for flight before take-off. Ask yourself, for example, are the batteries fully charged? Is it too cold to fly?
- Know if you [need permission to fly](#) and when to apply for a Special Flight Operations Certificate
- Respect the privacy of others – avoid flying over private property or taking photos or videos without permission.

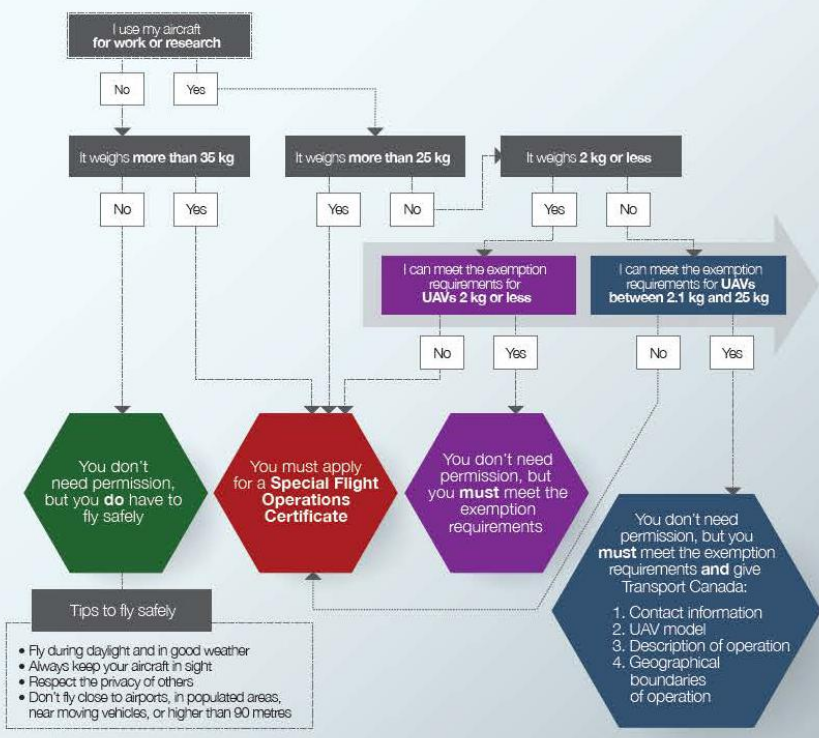
Recreational Aircraft Do's and Don'ts

Don'ts

- Closer than 9 km from any airport, heliport, or aerodrome.
- Higher than 90 metres from above the ground.
- Closer than 150 metres from people, animals, buildings, structures, or vehicles.
- In populated areas or near large groups of people, including sporting events, concerts, festivals, and firework shows.
- Near moving vehicles, avoid highways, bridges, busy streets or anywhere you could endanger or distract drivers.
- Within restricted airspace, including near or over military bases, prisons, and forest fires.
- Anywhere you may interfere with first responders

Flying an unmanned aircraft?

You may need permission from Transport Canada



tc.gc.ca/safetyfirst

Canada

Exemption requirements for operating UAVs without permission

THIS INFOGRAPHIC IS FOR EASE OF REFERENCE ONLY. YOU MUST CONSULT THE OFFICIAL EXEMPTIONS.

UAVs 2 kg or less

- Be safe, well trained and know the rules of the sky
- Be 18 years old, or at least 16 years old to conduct research under academic supervision
- Have at least \$100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Inform Air Traffic Services if your UAV enters controlled airspace
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather
- Keep your aircraft in direct line of sight and always be able to see it with your own eyes
- Verify that radio frequencies/transmissions won't affect control of your UAV
- Have an emergency plan ahead of time
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and aircraft system limitations
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Respect laws from all levels of government
- Operate only one UAV at a time, with a single remote control
- Immediately stop all operations if you can no longer meet the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 30 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

UAVs between 2.1 kg and 25 kg

- Be safe, well trained and know the rules of the sky
- Be 18 years old
- Have at least \$100,000 liability insurance
- Be alert—not tired or under the influence of alcohol or drugs
- Inspect your UAV and site before flight to ensure they are safe
- Get permission before you go onto private property
- Carry a copy of your UAV exemption, proof of liability insurance, contact information, and UAV system limitations
- Respect laws from all levels of government
- Keep your UAV in direct line of sight and always be able to see it with your own eyes
- Operate only one UAV at a time, with a single remote control
- Give right-of-way to manned aircraft
- Fly during daylight and in good weather (no clouds, snow or icy conditions)
- Create and follow procedures for landing and recovering your UAV and for contacting emergency responders and air traffic control
- Have an emergency plan ahead of time
- Follow the manufacturer's operating and emergency procedures, including those if the remote control loses contact with the aircraft
- Verify that radio frequencies/transmission and electronic devices won't affect control of your UAV
- Assess the risk of losing connection with the UAV and decide when to use the flight termination setting
- Have a fire extinguisher on site
- Inform Air Traffic Services if your UAV enters controlled airspace
- Follow the manufacturer's maintenance/assembly instructions
- Ensure the UAV does not have an emergency locator transmitter
- Report accidents to Transport Canada and stop operations until you have addressed the risks
- Immediately stop all operations if you can no longer respect the exemption requirements or if the safety of a person, property or other aircraft is at risk
- Stay at least 150 metres away from people, animals, buildings, structures, and vehicles not involved in the operation

DO NOT:

- Fly closer than 9 km from forest fires, airports, heliports, aerodromes, or built-up areas
- Fly over military bases, prisons or in controlled or restricted airspace
- Fly over crowds or higher than 90 metres
- Participate in special aviation events, air shows or system demonstrations
- Carry dangerous goods or lasers

tc.gc.ca/safetyfirst

Canada

Qualifying for an exemption

Our [FAQs](#) will help you understand if the exemptions apply to you or if you need permission to fly.

Most UAV operators must get Transport Canada's permission to use a UAV for any kind of work or research. However, under very specific, low-risk circumstances, you may qualify for an exemption if you meet all the safety conditions outlined in one of the two exemptions for the:

- [Exemption for UAVs that weigh less than 2 kg](#)
- [Exemption for UAVs above 2 kg up to and including 25 kg](#)

If you cannot meet any of the requirements, such as flying at least nine km (five nm) away from a built-up area and airports, you need an SFOC. Exemptions are not suitable in many areas and should only support low-risk operations in more remote areas. SFOCs are the primary means to work legally with your UAV.

Training required to fly a UAV under the exemptions

Each exemption contains specific training requirements. For example, to fly a UAV that weighs above 2 kg up to and including 25 kg without an SFOC, the UAV pilot must be trained to understand:

- airspace classification and structure
- weather and notice to airmen (NOTAM) reporting services
- aeronautical charts and the Canada Flight Supplement
- relevant sections of the Canadian Aviation Regulations

For more information on training requirements, read the [knowledge requirements for UAV pilots](#).

Exemption for	How to qualify?
UAVs that weigh less than 2 kg	<ol style="list-style-type: none">1. Read Exemption for UAVs that weigh less than 2 kg.2. Ensure you can meet all safety conditions outlined in the exemption. You don't need to notify Transport Canada if you qualify under this exemption.3. Fly safely!
UAVs that weigh above 2 kg (up to and including 25 kg)	<ol style="list-style-type: none">1. Read Exemption for UAVs above 2 kg up to and including 25 kg.2. Ensure you can meet all safety conditions outlined in the exemption.3. Notify Transport Canada that you qualify under the exemption for UAVs above 2 kg (up to including 25 kg). How? Complete this notification form below.4. Fly safely!

Notification form - exemption for UAVs from 2 kg up to and including 25 kg

To qualify to operate under the exemption for UAVs from 2 kg up to and including 25 kg, you must comply with all the safety conditions contained in the exemption and provide Transport Canada with the following information:

Name:	<input type="text"/>
Address:	<div><input type="text"/> <input type="text"/> <input type="text"/></div>
Phone number:	<input type="text"/>
E-mail address:	<input type="text"/>
UAV model and serial number:	<input type="text"/>
Description of the operation:	<div><input type="text"/> <input type="text"/> <input type="text"/></div>
Geographical boundaries of the operation:	<input type="text"/>
	<input type="button" value="Submit"/> <input type="button" value="Clear"/>


Related links

- [Flying your drone safely and legally](#)
- [No Drone Zones](#)

Date modified: 2016-06-10


[Terms and conditions](#) | [Transparency](#)



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Transport Canada



Canada

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[Home](#) → [Organization](#) → [Organizational Chart](#) → [Safety & Security Group](#) → [Drone Safety](#) → No Drone Zones

No Drone Zones

Flying a drone for fun, work, or research

When you operate a drone for any reason, you must follow these rules for where to fly.

Aerodromes

For safety purposes, we recommend you fly at least nine kilometres (five nm) from aerodromes (airports, heliports and seaplane bases) in order to remain clear of manned aircraft and most control zones. All aerodromes should be considered "No Drone Zones" if you do not have permission from Transport Canada.

National parks

Canada limits and controls the use of manned and unmanned aircraft such as drones in our national parks. The Field Unit Superintendent may authorize their use in some special situations. Please contact [Parks Canada](#) for more information.

Outside Canada

Rules for drones are not all the same. Cross border flights of drones are not permitted. Always check a country's aviation regulations before you fly in that country.

Other no drone zones

Without Transport Canada permission, we recommend that you don't fly your drone over populated areas, moving vehicles, highways, bridges and busy streets. Always follow the basic [Do's and Don'ts for flying your drone safely and legally](#). Think safety first!

Flying a drone for work or research only: additional rules

When you fly an unmanned air vehicle (UAV) for work or research, the following rules also apply.

Flying indoors

If you want to fly within a structure where people are present (e.g., at a sporting event, trade show, or demonstration), you must apply for a [Special Flight Operations Certificate](#) (SFOC).

You do not need an SFOC to fly indoors when only the UAV crew or people directly participating in the UAV operation (e.g., actors on a movie set) are present. The UAV operator should ensure that everyone present understands any possible hazards or risks.

Before you fly indoors, you also need the property owner's consent.

Foreign operators


Foreign UAV operators may only operate a UAV in Canada with an approved SFOC. To apply for an SFOC, a foreign UAV operator must already be approved/authorized to perform the intended operation in their home country. The operator must include the country's approval/authorization as part of their SFOC application.

Related links

- [Flying your drone safely and legally](#)
- [Getting permission to fly your drone](#)

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Emerging Regulations

Executive Summary Update to Stakeholders on Unmanned Air Vehicles June 2016

Following the consultation on the Notice of Proposed Amendment for small Unmanned Air Vehicles (UAVs), weighing 25 kg or less and operated within visual line-of-sight, Transport Canada has been finalizing the policy and regulatory framework.

The Department is currently developing proposed regulations that are expected to be made public in the *Canada Gazette*, Part I in spring 2017. Stakeholders and Canadians will have the opportunity to provide comments as part of the consultation period.

For stakeholders who may not be familiar with the process for making regulations, regulations are pre-published in the *Canada Gazette*, Part I for a formal comment period. Adjustments are made as required based on the comments received and the regulations are then published in the *Canada Gazette*, Part II and considered final. A transition period is normally provided prior to the coming into force of a new regulation. For more information about the *Canada Gazette* process: <http://www.gazette.gc.ca/cg-gc/lm-sp-eng.html>.

At this time, the regulatory exemptions ([exemption for under 2 kg](#) / [exemption for 2 kg to 25 kg](#)) remain valid and will be updated prior to their current expiry date of December 16, 2016. For those that cannot meet the conditions of the exemptions, until such time as the final regulations are published, you can apply for a [Special Flight Operations Certificate](#).

Transport Canada continues to seek a balanced and risk-based approach to both safely integrate UAVs into Canadian airspace and encourage innovation within this important new subsector of civil aviation.

Here are some highlights of the updated proposed policy and regulatory framework based on feedback received from stakeholders on the Notice of Proposed Amendment, industry growth, risk analysis and, where possible, discussions with international partners.

- Removing the regulatory distinction between recreational and non-recreational users.
- Exclusion to be made for modelling associations with robust safety guidelines. Introducing an “unregulated” category with a threshold of 250 g or less.
- Reducing the “very small” weight threshold to 1 kg based on a risk assessments, safety analysis and ongoing research.
- Marking and registration now for “small complex” only. Identification for other regulated categories.
- UAV Design Standard now for “small complex” only (higher risk environments).
- Pilot permit requirement for “small complex” UAVs. Knowledge requirements for “very small” and “small limited” UAVs commensurate to category.
- Adjusting minimum age requirements to mirror manned aviation licensing requirements.
- Regulating some tethered UAVs as obstacles and not regulating indoor operations.
- Requiring liability insurance for all categories of UAVs.

Transport Canada would like to reiterate that these are only proposed changes and are not yet currently in place. The formal consultation period along with the actual text of the proposed regulations will be communicated to all stakeholders for consultation when ready and published in the *Canada Gazette*, Part I, in spring 2017.

Thank you for your interest on this file.

- **[UAV Pilot Training Certificate](#)**

A stylized, colorful illustration of a landscape. The foreground features rolling green hills with varying shades of green. On the left, there is a green tree with a brown trunk, a purple flower-like bush, and some orange foliage. A small red bird is flying in the sky above the tree. The background consists of light blue and white wavy bands representing the sky and distant hills.

The sky's the limit!

What uses do you
envision?

Environmental, Engineering, Property Management,
Construction, Disaster Response

How do they fit our field?

- Drones are now at a price point that makes them economically efficient
- Geo-referencing and landmarking makes pictures more technically useful
- Easy to use safely and effectively within established guidelines

Lightweight

Take video and still photography

Purchase for under \$1,500

Max. Height light commercial 500 meters

2 km range on small commercial

Easily controlled with GPS reference (home)

Some present uses

• Environmental

- + Land cover mapping
- + Carbon capping
- + Renewable energy
- + Environmental Monitoring (dumping)
- + Waterway Monitoring
- + Ice Flow Monitoring
- + Parks (Asset management)
- + Wildlife Conservation
- + Conservation drones
- + Wildlife counts / Mapping of animal population
- + Anti-Poaching
- + Marine Biology – Whale health monitoring

Disaster Response

- + Search and Rescue
- + Marine Search and Rescue
- + Wildfire
- + Flooding
- + Damage assessment
- + Rapid response / 911
- + Emergency Uses (delivery of equipment e.g. Defibrillator)
- + Surf Lifesaving (floatation delivery)
- + Fire Detection (e.g. fire towers)

Construction / Pre-construction

- + Virtual view from new construction (Vantage Point)
- + Aerials documenting whole site
- + Construction Planning – Identify potential issues.
- + Construction Progress Monitoring
- + Marketing for Construction
- + Surveying

Engineering

- + Civil Engineering Design Mapping
- + Asset monitoring (Bridge maintenance needed?)
- + Photogrammetry Services
- + Measurements (Lidar Services)
- + Digital elevation modeling
- + 3D Feature extraction / Contour generation
- + Thermographic Imaging
- + Lidar Services

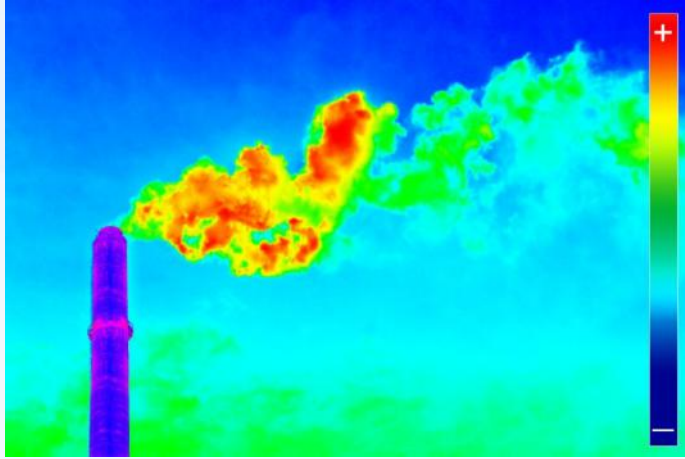
Mining / OIL & GAS

- + Oil spill tracking
- + Pipeline monitoring
- + Environmental assessment
- + Pit Survey

Miscellaneous

- + Natural History Surveys GPS/time/mapping.
- + Image Geo-referencing
- + Google map & Google earth mapping
- + Marine Algae bloom and Proliferation Detection

Thermal Imaging by Drone



Plume Monitoring



“Wilder” Life Surveillance



Wildlife Surveillance



Fire “Hot Spots”

Environmental Monitoring



Pollution Monitoring



Nest Relocation

Our UAV

- Need – Initial uses were primarily promotional and marketing
- Search – Staff researched what was out there and at what cost. DJI Phantom 3 Professional was determined best bang for buck for us. Examined issues like fly-aways; ease of use; technical requirements; etc...
- Budget - Established a preliminary budget of \$1500 to get us into market
- Sourcing – Fairly soft market, locally. Priced online through three local large chain outlets.
- Procured – Purchased our through Staples based on cost/availability and supplier



Our UAV

- Technology– Purchased IPOD Mini with WiFi & Cellular Ability
- Pilots – Staff had to train via DJI Users Manual
- Insurance - \$100,000 liability insurance required
- Manual – Includes Transport Canada Exemption; Insurance Verification; Release Notes/Update Records; Quick Start Guide; User Manual; Pilot Training Guide; Key literature
- Reference – NAV Canada “Canada Flight Supplement”
- SFOC Applications



Our uses to date!



Resource Monitoring



Cap Monitoring



Property Inspection

Event Planning/Marketing



Island Aerial Media©

Sydney RibFest



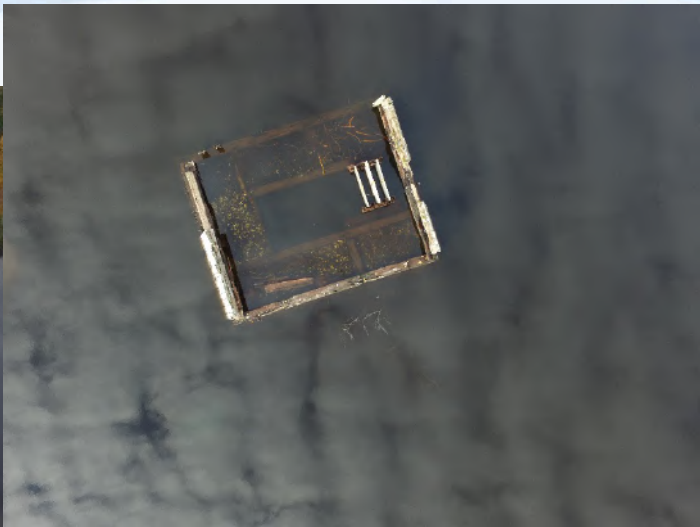
Flags of Remembrance



Action Week Fireworks OHP



Sydney River Dam



Wharf Inspections



Pictou Wharf

Tank Inspections



Harbourside Commercial Park Standpipe



Grand Lake Water System Tank



TIR Tank Marconi Campus

Port Mersey



Boat Harbour



The Future in the Environmental Field is Looking Down

Questions/Comments

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