Integrating Activities for Advanced Communities

D8.2 - Drone legislation guide

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Dissemination Level

PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
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Publishable Executive Summary

There are large potential benefits with using drones in Arctic research, such as efficiency in data collection and increased personal safety. Drones may also be used for transport of goods and assisting tasks.

Almost all countries have laws and regulations concerning the use of drones. It is crucial to be aware of local regulations before engaging in any drone operations.

This document aims to provide the reader with a basic overview of the legal situation in the countries that are home to research stations engaged in INTERACT – a network that promotes communication and scientific collaboration across borders. The document should not be used as a complete guide to drone laws, but as a general guide to the current, and future, legal situation.

The general procedure:

- Most countries require drone operators to have insurance.
- Drone operators must follow the rules of a national Civil Aviation Agency as well as other authorities, such as the European Aviation Safety Agency.
- It is also important to always practice common sense, especially regarding safety, even in the absence of rules.

Some general rules that are shared by many countries and regions:

- Never fly nearby an airport or other restricted areas.
- Keep a safe distance to people, animals and property.
- Fly within safe altitudes, usually below 120 m/400 ft.
- Fly within visual line of sight.

The amount of information available, and the intelligibility of that information, varies greatly between different countries. Some countries provide user-centered websites in multiple language (such as Finland), while others do not provide a clear overview of rules or certificate processes, or do so in just one language (Poland, Russia).

Acronyms

AGL	Above Ground Level
ATC	Air Traffic Control
BVLOS	Beyond Visual Line Of Sight
CAA	Civil Aviation Authority
CTR	Controlled Traffic Region
EVLOS	Extended Visual Line Of Sight
FPV	First Person View
GNSS	Global Navigation Satellite Systems
MTOM	Maximum Take-Off Mass
NPA	Notice of Proposed Amendment
RPAS	Remotely Piloted Aircraft System
SDR	Special Drawing Rights
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
VLOS	Visual Line Of Sight

1. Introduction

In present and future Arctic research, there is a strong potential for drones to play a vital role in data collection, transports and assisting tasks.

1.1. Background

The INTERACT network engages researchers from many different countries and promotes communication across borders. It is, however, important to be aware of the challenges of international collaboration. One such challenge is to have knowledge of drone legislation and permit needs in other countries. It is crucial to be aware of the local regulations of the region where the drone operation will take place, especially as many permits have long application processes and/or require thorough preparation by the applicant.

1.2. Purpose of document

One identified obstacle for applying drones in research activities is the general and local legislation related to flying drones. Laws and regulations differ between countries and thus it might be troublesome for a researcher from one country to be aware of and prepare for applicable legislation in another country where research is about to take place. This document aims to provide the reader with a basic overview of the legal situation in each of the INTERACT-engaged countries.

1.3. Disclaimer

Note that this document should not be used as a complete guide to drone legislation. The contents are interpretations of more extensive texts found in the referenced material. The translation of legal terms in this document is not certified as accurate by any authority and should subsequently not be used for any purpose other than guidance.

2. Basic drone knowledge

This chapter defines different kinds of drones and acronyms that you might encounter in the following chapters. Figure 1 illustrates some examples of the types of drones that you might encounter.

Figure 1. *Three different types of drones. From left: rotor helicopter, multirotor, and fixed-wing.*

2.1.Drone technology

A rotor helicopter usually has one single lifting rotor with two or more blades. Helicopters are generally manually controlled and usually difficult to fly.

A multirotor is a drone with more than one rotor, generally four to eight rotors. The multirotor needs an internal flight controller, a computer that makes it easier to fly the drone. It simply would be too difficult to control the thrust of all the individual rotors in order to maintain the center of gravity meanwhile controlling the different tracks and movements in all axis.
The flight controller takes all the inputs from different sensors, such as altimeters, gyroscopes, magnetometers, etc. and combines it with the input from the operator. The flight controller can also be programmed to perform an automatic flight pattern without any involved operator.

A fixed-wing aircraft must have air moving over their wings to generate lift. This means they must stay in forward motion and cannot hover in one spot in the way a helicopter can. Usually the fixed wing will give you a longer flight time for less energy.
Fixed wings will generally withstand stronger wind than multirotors.

2.1.1.Make sure your equipment is in order

Batteries will lose much of their capacity when exposed to cold climates. This may result in a sudden drop of power to the motors without prior notice, resulting in a crash. Keep batteries warm until the second of take-off. Batteries can be stored inside a pocket of clothing or in insulated boxes or pouches that also might be equipped with extra heating to keep the temperature at a suitable level.

Your UAV will use a compass to navigate. The compass is particularly important for a multirotor, as it will hover in one position. High latitudes, which are common for many INTERACT stations, will alter the angle between the geographical and the magnetic north pole, which may influence the compass and sensors in your UAV. A fixed wing will maintain a continuous motion and can therefore navigate using GNSS.

Reception from the GNSS satellites can be less accurate in the polar region than in other places around the globe, but usually it should be sufficient to allow position lock. Make sure that your UAV can lock to the GNSS before take-off.

2.1.2.How to decide what drone is suitable for my tasks

In general, large drones can cost a lot of money while small drones will be cheaper. Large drones will lift heavy equipment while small ones will not. Everything is a trade-off and it is difficult to give any specific recommendations on what to choose. First of all, start by finding an answer to the question "what do you want to do"? This will hopefully tell you what type of sensor or equipment you want to carry.

Many of the commercial off the shelf drones will come with a camera and will have specific features for using it. This may not be optimal for the type of work you would like to do. Carrying of other sensors might need other types of drones that are custom made for that reason or mission.

Another aspect to consider is the redundancy required for your mission. Depending on your sensors or in what type of environment you are going to fly, different drone types can give you a better redundancy. Technically, this can be achieved by increasing the number of rotors on a multirotor. Four rotors will not give any redundancy in an event of a rotor failure and the drone will crash. A six or eight rotor aircraft will continue to fly with one or even more rotor failures. A fixed wing will also give a sufficient redundancy to perform a controlled emergency landing without any motors, as it will take advantage of the generated lift of the wings as long as it stays in a forward motion.

Flying your drone might also require a certain amount of training and even crashing.

In the end you might realize that buying a drone expert service rather than buying your own equipment is the preferred way to continue.

2.1.3.Payload

As a very rough rule of thumb, on a multirotor drone, one gram extra weight of payload will reduce the flight time by one second.
Small drones will not be able to carry any payload apart from small light devices.

2.2.Drone vocabulary

Here follows a list of some frequently used expressions and acronyms that may require further explanation.

Visual Line Of Sight (VLOS)

VLOS means keeping the drone in visual-line-of-sight at all times. This means that you cannot fly the drone into clouds or fog, 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 drone. Maximum VLOS is typically set to no more than 120 m vertically and 500 m horizontally. (Australian Certified UAV Operators Inc., 2014)

Extended Visual Line Of Sight (EVLOS)

This is the operating method whereby the Remote Pilot in command (PIC) relies on one or more Remote

Observers to keep the drone in visual line of sight at all times, relaying critical flight information via radio and assisting the Remote Pilot in maintaining safe separation from other aircraft (manned or unmanned). (Australian Certified UAV Operators Inc., 2014)

Beyond Visual Line Of Sight (BVLOS)

This means flying a drone without the Remote Pilot having to keep the drone in visual line of sight at all times. Instead, the Remote Pilot flies the aircraft by instruments from a Remote Pilot Station (RPS). (Australian Certified UAV Operators Inc., 2014)

First Person View (FPV)

This refers to a Remote Pilot operating a drone by reference to an on-board video camera, providing the Remote Pilot on the ground with a live 'cockpit-view' from the drone. (Australian Certified UAV Operators Inc., 2014)

Special Drawing Rights (SDR)

The SDR is an international reserve asset created by the International Monetary Fund to supplement other reserve assets. It is often used as a "reference currency" (note that it is not a currency) for international transactions. The SDR's value is calculated daily using a basket of five major currencies: the U.S. dollar, Euro, Japanese yen, pound sterling, and the Chinese renminbi. (IMF, 2017)

The currency value of the SDR is used by companies providing insurances for drones.

3. Preparing for a drone mission

The following generic checklist applies to all drone missions. It is advised to follow this checklist as a general step in the process of preparation for flying drones.

Please note that this is an oversimplification of the procedure required to operate a drone legally. Consult the document section specific to the relevant region, and the sources that it refers to.

Insurance

Most countries require operators to have an insurance that covers any damage or injuries that might occur as a result of a flight operation. A minimum coverage sum is usually specified.

National CAA

Drone operations generally fall under the jurisdiction of a local Civil Aviation Agency, which usually provides online information about rules and permits. In cases where information is sparse or unavailable in the desired language, direct contact may be the best approach.

Restricted Areas

Obtain information on the restricted areas of the relevant region. Restricted areas usually include airports, military bases, national parks, nature reserves and densely populated areas. Acquiring aeronautical charts (or digital alternatives) is recommended.

Local Rules

Each region has its own rules and regulations regarding the use of drones. These rules must be studied and understood before engaging in any flight activities. National legislations of all countries hosting INTERACT research stations are summarized in this document.

Shared Rules

Formal unified rules exist to some extent; in the EU, drones with a MTOM of over 150 kg are subject to EASA rules in addition to national rules. In the near future, new EASA rules will replace national legislations in all EU member states. These rules are described in this document.

Common sense

Aside from following rules and regulations, the operator must always use her/his best judgement to avoid endangering people, animals, nature and property. Avoid unsafe situations through careful planning and rigorous preparation.

3.1.Frequently occurring rules

What follows are frequently occurring rules, found in the legislations of most countries and territories.

Never fly nearby an airport

Manned airports will establish a controlled airspace, which extends from surface to a specified upper limit together with positions in longitude and latitude, forming a protective "box" around the airport. This box is called Controlled Traffic Region (CTR) or control zone in US airspace class D. The CTR is controlled by the air traffic control (ATC) which will coordinate all aircrafts in that airspace. You need to coordinate with and get permission from the ATC in order to fly in a CTR. Unmanned airports usually don't have any ATC and you need to coordinate directly with any manned aircrafts and pilots that are going to use that airport. This can be all from local private licenced pilots to commercial helicopter companies providing air services.

Essential things prior to flight

Get yourself an aeronautical chart. There are online charts or apps that will show no-fly zones but you can also buy a traditional paper printed aeronautical chart.

Aeronautical Information Publication (AIP) is an essential publication, issued by or with the civil aviation authority of state which contains important information about airports, regulations, procedures and so on. Basic information like opening hours or telephone number as well as more advanced information can be found here. The AIP can usually be found on the CAA internet homepage for the specific country.

Notice to Airmen (NOTAM) is another important information to keep track of. A NOTAM is created by government agencies and airport operators and contains for example changes in aeronautical facilities, hazards and restrictions. The NOTAM can usually also be found on the CAA internet homepage.

Insurance

Accidents involving aircrafts can be costly. An insurance covers damage to third party property or persons. Some countries legislation demands a mandatory insurance when operating drones commercially. It is important to sort this out prior to your flight.

Permission from authorities

In many countries, flying a drone for a scientific or commercial business might need a permission from civil aviation authorities (CAA). Make sure that you follow the procedures to obtain a valid license or permission. The authorization sometimes comes with a requirement to maintain a log for all flights performed.

Keep a safety distance

Rotating propellers, even on a small aircraft, may cut off your fingers. Place the drone a few meters away from people, animals or property before take-off.

Fly in a wide and open area away from people, animals and property

A falling or flying aircraft will have a lot of energy in the event of an impact.

Fly within safe altitudes

The height limits in the airspaces nearby INTERACT field stations may differ but usually no flights above 120m/400ft should be performed as this will interfere with regular, manned air traffic. Despite this, many

INTERACT field stations do have regular helicopter or aircraft connectivity flying on low altitudes near ground.

Fly within line of sight (LOS)

Make sure you can see the drone with your eyes at all times. Generally, no regulatory framework on any INTERACT field station allows flying beyond visual line of sight (BVLOS), without a special permission or license.

Follow local rules and regulations

Local rules can apply to national parks, restricted areas, animal preservation areas, military areas, etc. Some of these areas can be marked in an aeronautical chart but some information needs to be obtained from elsewhere. In some countries and stations, there are exceptions for using drones for scientific research within restricted areas, which will make your life a bit easier. Just don't forget to apply for that permission.

4. Legislation guide – country by country

This regulation guide charts the national regulations of countries with the presence of INTERACT stations. Note that drone operations in EU member states are also subject to EASA rules if the weight of the drone exceeds 150 kg.

The amount of information available, and the intelligibility of that information, varies greatly between different countries. Some countries provide user-centered websites in multiple languages (such as Finland), while others do not provide a clear overview of rules or certificate processes, or does so in just one language (Poland, Russia). One could argue that providing users with an English website would be most beneficial in terms of enabling international communication, as the language acts as a global lingua franca in both the research world and the aviation industry. (Research Trends, 2008) (Allied Pilots, 2004)

4.1.Austria

Austro Control is a national agency enforcing the Luftfahrtgesetz (aviation act). A permit from Austro Control is required for the operation of most drones, excluding the models that fall under the "toy" category. Some, but not all, Austro control webpages are available in English. Formal law texts and application forms are available in German only. All Class 1 categories require VLOS, the use of point of view (PoV) video glasses calls for the presence of an additional operator. Class 2 vehicles (BVLOS) are for testing only and no licenses are issued. (UAV Coach, 2017)

4.1.1.Certificate needs

Drones generating kinetic energy up to 79 Joules (equal to a 250 gram mass at an altitude of 30 m) are classified as "toys" and do not need an approval from Austro Control, as long as the drone is operated in a safe manner. Flights above 30 m require a permit for all aircrafts. (Austro Control, 2017) Excluding the "toy" category, there are two categories of drones (RPAS on the Austro website): Class 1 and Class 2 (experimental only).

Class 1 (VLOS)

Class 1 Remotely Piloted Aircraft Systems are only allowed to be operated in the direct (without technical aid) unobstructed line of sight between the pilot and the RPAS with a maximum flight altitude of 150 m above ground level. A data plate is required for identification. (Austro Control, 2017) Class 1 has four drone operation subcategories (A-D), based on the weight of the drone and the population density of the operating location, see Table 1 (Austro Control, translated from German).

Table 1. *Permit matrix for Austrian territory (translated from German).*

MTOM(kg) / Location	Undeveloped	Uninhabited	Inhabited	Densely inhabited
<5	A	A	B	C
5-25	A	B	C	D
25-150	B	C	D	D

Category A permits can be obtained through an online application. Categories B, C and D, however, require advanced technical redundancy as well as an Austrian pilot's license or a specific license for a category C or D. Alternatively, a pilot can undertake an online test in the subject of air law on the Austro Control website.

Class 2 (BVLOS)

Class 2 RPAS are unmanned aircraft that are operated beyond the visual line of sight. They will be certified and operated like manned civil aircraft. Possession of a pilot's license is required for the operation. Class 2 unmanned aircraft can currently only be operated as experimental aircraft. (Austro Control, 2017)

4.1.2.How to obtain a certificate

Applications for operating a Class 1 category A vehicle can be found online on the Austro Control website (in German). The annual license cost amounts to €330. The steps are as follows:

- Complete the application form (in German) (Austro Control, 2017)
- Send the application form together with the following attachments to ulfz@austrocontrol.at
    - Description of the unmanned aircraft (with three-side-view photos)
    - Operating limits (maximum operating mass, maximum ground wind, etc.);
    - Insurance confirmation - Aircraft liability insurance is offered by all major insurance companies (coverage: at least 750,000 SDRs).
    - Official photo identification of the pilot(s) - Minimum age 16 years

Categories B, C and D require an Austrian pilot's license or a specific license for a category C or D.

If the applicant does not have an Austrian pilot's license, the required knowledge for operation can be proved by passing an examination on the subject of air law (in German). (Austro Control, 2017)

Online examination is available. Applications for examination are submitted to examinations@austrocontrol.at at least 10 business days before the desired examination date. Tests are held from Tuesday to Friday between 8:30 and 15:00. A questionnaire with sample questions on airspace is available online on the Austro control website. (Austro Control, 2016)

4.1.3.Future changes

As of the making of this report, no major changes in regulations were planned.

4.2.Canada

Transport Canada is the authority responsible for regulating drone use in Canada. The agency is in the process of proposing new regulations, somewhat similar to the proposed EASA rules.

As of the time of this report, all non-recreational drone use requires the pilot to obtain a special certificate. The application process is decentralized: pilots apply for certificates in the region where they plan on operating their drone.

4.2.1.Certificate needs

If you fly a non-recreational drone for any type of work or research, or if it weighs more than 35 kg, you must get a Special Flight Operations Certificate (SFOC).

Two exemptions allow non-recreational operators to conduct lower risk operation in more remote areas without the need to apply for an SFOC. Lists of qualifications for exemptions for UAVs that weigh one kg or less, and UAVs above one kg (up to and including 25 kg), can be found on the Transport Canada website.

If you have a proven track record of safe operations, you may qualify for a standing, or "blanket" SFOC, which may permit operations over greater geographic areas and for greater validity periods, eliminating the requirement to apply for an SFOC before each flight. (Transport Canada, 2017)

Experienced UAV Operators may gain additional privileges by becoming Compliant UAV Operators. To become a Compliant UAV Operator, one must operate a Compliant UAV, have appropriately trained pilots and meet specific operator requirements.

4.2.2.How to obtain a certificate

To obtain a Special Flight Operations Certificate, send a completed SFOC application form (found on the Transport Canada website) to the Transport Canada Civil Aviation Regional Office in the region where you plan to operate the drone.

4.2.3.Future changes

The new proposed regulation follows the legislation trend of operation-based rule sets. Drones weighing below 1 kg have one set of rules, while heavier drones have two sets of rules, one for rural and one for urban areas.

You will no longer need a Special Flight Operations Certificate (SFOC) if your drone weighs from 250 g to 25 kg and you operate it within visual-line-of-sight. However, you will need to apply for an SFOC for any operations that are not covered by the proposed regulations. For example, you will need an SFOC if you intend to operate a drone out of sight or if your drone weighs more than 25 kg. (Transport Canada, 2017)

According to the new rules, all operators who fly drones that weigh more than 250 g for any purpose, will need to be insured through a liability insurance provider for at least 100 000 CAD.

What follows are the rules set for each category. The descriptions are from the Transport Canada website, where you also find all the documents and application forms listed.

Very small drone operations: 250 g to 1 kg.

Most recreational users will fit into this category. The rules that apply are easy to understand and follow. Pilots must be 14 years old or older and will be required to:

- Mark their device with their name and contact information
- Pass a basic knowledge test
- Have liability insurance
- Fly at least:

- 5.5 km from airports
- 1.85 km from heliports
- 30 m from people

Limited operations: rural, 1 kg to 25 kg

This category is for users operating in rural areas (e.g., agricultural purposes, wildlife surveys, natural resources). Pilot must be 16 years old or older and will be required to:

- Mark their device with their name and contact information
- Pass a basic knowledge test
- Have liability insurance
- Fly at least:
  - 5.5 km from airports
  - 1.85 km from heliports
  - 150 m from open-air assemblies of people (i.e. outdoor concert)
  - 75 m from people, vehicles and vessels
  - 1 km from built-up areas

Complex operations: urban, 1 kg to 25 kg

This category is for users who intend to fly in urban areas, within controlled airspace or close to anywhere where airplanes, helicopters and floatplanes land and take off. The pilot must be 16 years or older and will be required to:

- Hold a pilot permit that is specific to small drones
- Have liability insurance
- Register and mark their device with a unique identification provided by Transport Canada
- Operate a drone that meets a design standard
- Follow a set of flight rules
- Get approval from air traffic control when flying in controlled airspace or near aerodromes
- Fly at least:
  - 150 m from open-air assemblies of people (i.e. outdoor concert) unless at least on an altitude of 90 m
  - 30 m from people, vehicles and vessels

4.3.Czech Republic

Drone operations are regulated by the Czech national CAA, Úřad pro civilní letectví. Information is available (featuring abundant graphics) on the CAA website in Czech, but no other languages.

4.3.1.General rules

As in most countries, flights in close proximity to airports are prohibited. In addition to Airport Traffic Zones, operators must be aware of airspace classes. In Figure 2 you can see a graphic overview of the required safety distances for ATZs and airspace classes E and G. (Úřad pro civilní letectví, 2017)

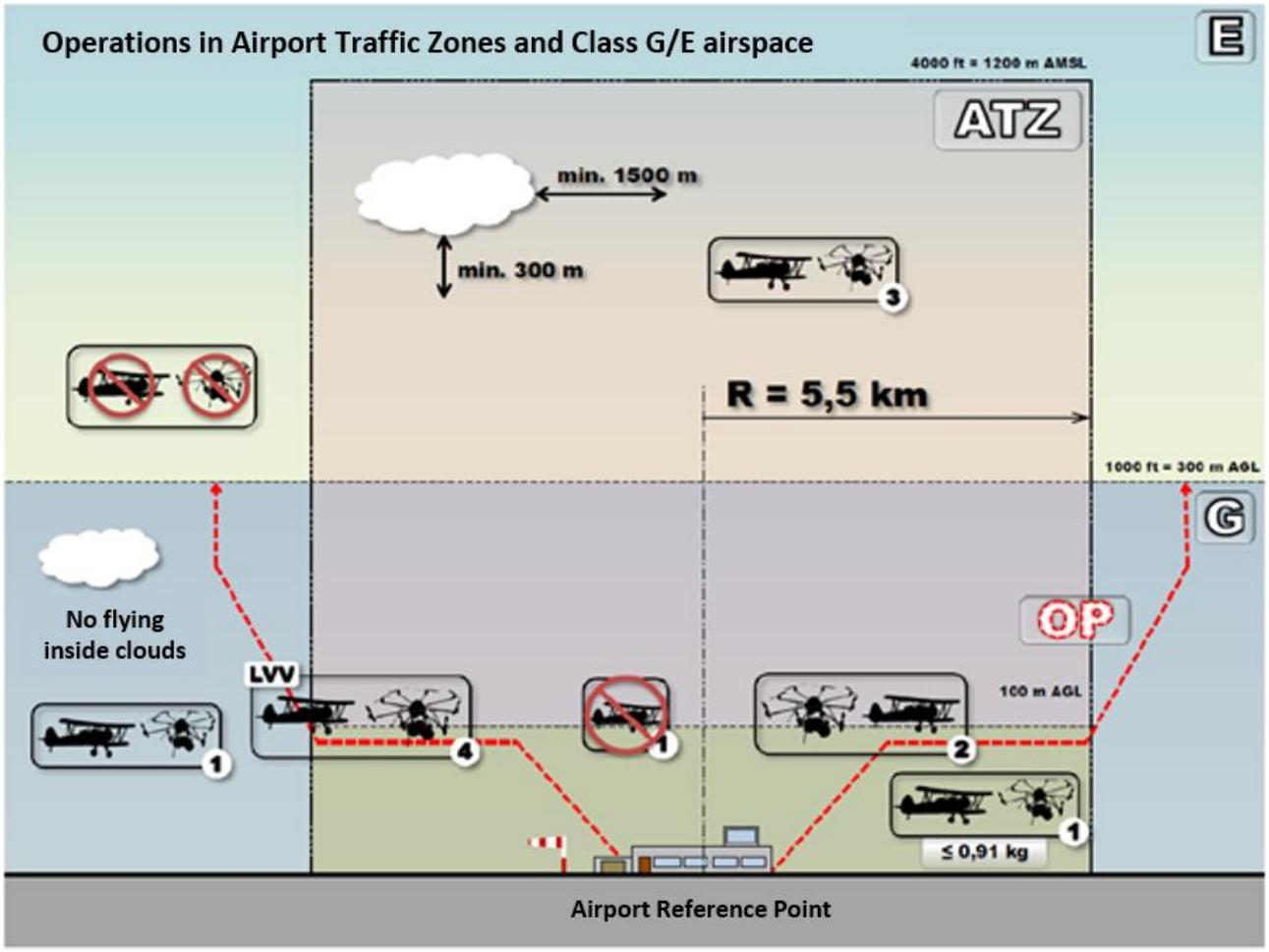

Figure 2. *Graphic overview of airspace boundaries from Úřad pro civilní letectví (translated from Czech).*

Unlike many other countries, the Czech Republic allows FPV-flights if a second person is watching the aircraft and has the capability to take control.

4.3.2.Permit needs

Drones may generally only be operated with CAA authorization. The operation of drones without proper authorizations may be subject to fines up to 5 000 000 CZK. No permission or registration is required for recreational flight of drones weighing below 20 kg (in accordance with Supplement X to the Czech aviation act). For commercial work, a permit is always required. The permits are issued at three levels: a learner's permit, an operator permit and a professional permit. (Úřad pro civilní letectví, 2017) No information was found concerning exemptions for academic or research operations.

4.3.3.Obtaining a permit

The permits are issued at three levels, see Figure 3 with links to applications (in Czech). The graphics are inspired by the CAA's own visual guide, found on their website. (Úřad pro civilní letectví, 2017)

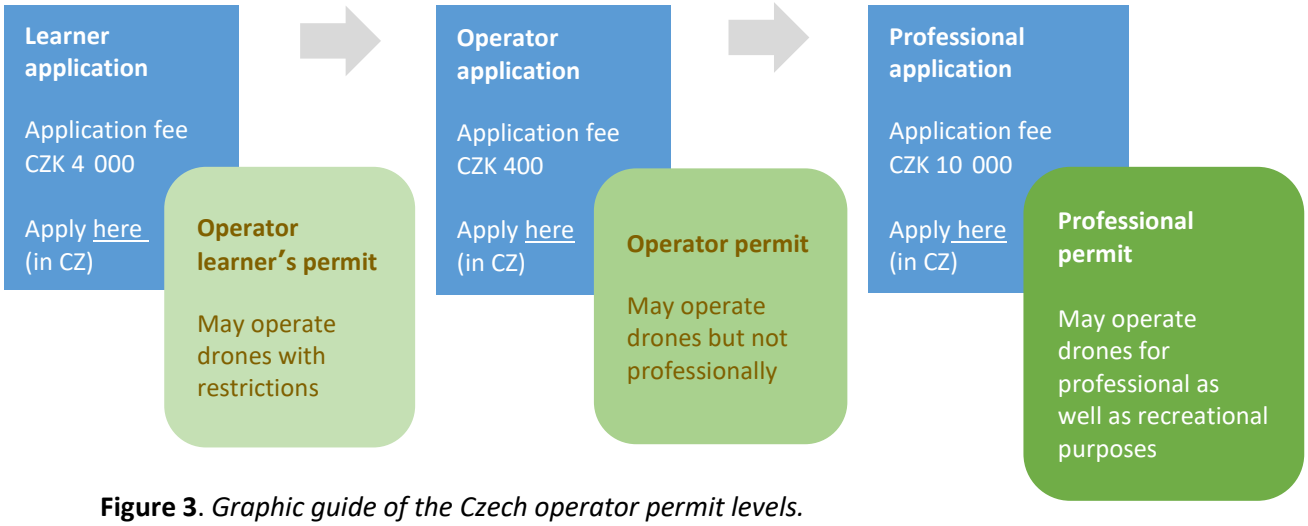

Figure 3. *Graphic guide of the Czech operator permit levels.*

4.3.4.Future changes

There is no information to be found on upcoming changes in legislation.

4.4.Faroe Islands, Greenland (Denmark)

Although the Danish mainland is not home to any INTERACT stations, Danish law applies to the stations in Greenland and on the Faroe Islands. The rules for Greenland and the Faroe Island differ from the mainland rules, which are not covered here. Trafikstyrelsen, the Danish Transport Authority, handles permits and registrations. Information and forms are easily attainable in Danish, but the information provided in English is limited.

4.4.1.General rules for categories 1A and 1B

The following is a translated excerpt from Trafikverket's user manual (UAS drifthåndbog) for drone categories 1A and 1B.

- A drone must be within VLOS of the operator.
- The maximum altitude is 100 meters, except when operating within a 25 meter radius of an obstacle.
- The surrounding airspace must be continuously monitored. Drone operations must be terminated immediately if another aircraft is approaching the area.
- The drone must always be controlled manually.
- The operator must be aware of the challenges of the specific area, such as topography, atmospheric interference, frequency interference, weather effects, etc.

The manual is also part of the permit application (see below).

4.4.2.Permit needs

There are three drone categories under 25 kg: (Trafikstyrelsen, 2017)

- Category 1A 0,25 - 1,5 kg
- Category 1B 1,5 - 7 kg
- Category 2 7 - 25 kg

Pilots of drones in these categories must comply with the "BL 9-4" regulations (in English) from the Civil Aviation Administration. Piloting drones with a weight below 250 grams requires no permit (Trafikstyrelsen, 2004) Ownership of all drones (>250 grams) must be registered to a cost of 15 DKK. Drones shall be marked with the name of the owner (private/business) and the registration number provided by Trafikstyrelsen. Drones with a weight over 25 kg are subject to Luftfartsloven, the Danish aviation act. Businesses and institutions can apply for exemptions from both the "BL 9-4" and the aviation act, if the drone is used for research or commercial purposes. (Trafikstyrelsen, 2017)

4.4.3.How to obtain permits and register drones

Applications for permits for categories 1A, 1B, 2, are submitted on the Trafikstyrelsen website (Trafikstyrelsen, 2017) There you can also find the exemption application, and register drone ownership (in English). A complemented user manual (instructions in document) must be submitted with the permit application, coupled with a photograph of the drone. (Trafikstyrelsen, 2017)

4.4.4.Future changes

As of the making of this report, no major changes in regulations were planned for the Faroe Islands or Greenland. The new rules for rural Danish mainland (since July 1st, 2017) do not apply for these areas.

4.5.Finland

Drone operations are regulated by the Finnish transport safety agency, Trafi. A page dedicated to drone information, called droneinfo.fi, provides illustrated guidelines for drone ownership in three languages, including English. (Finnish Transport Safety Agency, 2017) The attitude towards drones is positive, with rules that some call "the most liberal in Europe". (Evers, 2016)

4.5.1.General rules

What follows are general rules for drone operation, as posted by the national transport agency. (Finnish Transport Safety Agency, 2017)

- During flight, always maintain visual contact of your drone.
- Flying closer than 5 km from an airport is not allowed without permission from the air traffic control tower.
- The maximum allowed flight altitude is 150 m. However, the maximum allowed flight altitude in the control zone of an airport (but still further away than 5 km of the airport), is 50 m.
- Flying a drone above a crowd of people is not allowed.

- The flight must not endanger or disturb the operations of an emergency service helicopter.
- You should be extra careful when flying close to small airports or helipads such as Nummela or Meilahti.
- Flying above cities is allowed when the pilot knows the flying area, has made sure that flying safely there is possible and the drone weighs less than 3kg.
- Flights should not cause danger to or disturb other people.
- Drones are responsible for avoiding other aircraft.
- Mark your drone with your name and contact information.
- Taking an insurance against third party damages is recommended.

4.5.2.Permit requirements and procedure, professional operation

Trafi defines *aerial work with unmanned aircraft,* as "any other use than sports or hobby use", and clarifies that no distinction is to be made for academic use. The information in this sub-chapter was gathered from the Trafi webpage. (Finnish Transport Safety Agency, 2017)

Minimum requirements

- Make a Notification on the use of remotely piloted aircraft online and remember to update your information when you change your address or aircrafts. The notification costs 20€ / year.
- Take an insurance against third party damages that fulfills the requirements in regulation (EC) 785/2004.
- Mark all of your drones with a sticker that has the name of the responsible person and their contact information.
- Keep a log of all flights that have the information required by OPS M1-32 (3.1.9). Keep record of the log for at least 3 years.
- Any occurrences involving remotely piloted aircraft, including accidents and serious incidents, must be reported to Trafi. Writing the report will not lead to any legal charges as, according to the Trafis' "Just Culture" principles, the reports are looked at in educational purposes.

Additional requirements when flying above cities or crowds of people:

- The maximum allowable take off mass is 7 kg. The weight of a parachute system is not included in this mass.
- In an emergency situation you must be able to land so that the risk for people and property is minimal. This requirement can be fulfilled using an operational procedure and safety equipment.
- Create an operation type specific safety assessment that includes hazard identification, risk assessment and risk mitigation measures.
- Create instructions for normal operations and emergency procedures.
- Keep records of operational instructions and safety assessments for at least 3 months.
- Instructions for making an operations manual and a safety assessment can be found in the sidebar named "RPAS Operations Manual".

Requirements for BVLOS operations:

- Create an operation type specific safety assessment that includes hazard identification, risk assessment and risk mitigation measures.
- Create instructions for normal operations and emergency procedures.
- Keep records of operational instructions and safety assessments for at least 3 months.
- Reservation of airspace should be sought at least 8 weeks before starting an operation. After the reserved airspace zone has been created, the zone can be activated on the previous work day to the planned start of operations. The airspace reservation will create a temporary danger area that will be published as a map and NOTAM.
- To seek an airspace reservation send a message to ilmatila (at) trafi.fi and ask for more instructions.

Requirements for exemption from maximum mass, altitude limit or other limits:

- Create an operation type specific safety assessment that includes hazard identification, risk assessment and risk mitigation measures.
- Create instructions for normal operations and emergency procedures.
- Keep records of operational instructions and safety assessments for at least 3 months.
- Send an application for exemption to kirjaamo (kirjaamo@trafi.fi), where you should have an operational safety assessment and other possible documents that Trafi requests as attachments.

4.5.3.Future changes

As of the time of this report, no changes in legislation were planned.

4.6.Iceland

The increasing number of inquiries regarding drone operations has led the Icelandic Transport Agency, Samgöngustofa, into the process of developing new legislation for drones. The decision on the new rules will be published on their website. Samgöngustofa are actively involved in the international debate regarding regulations for drones. The rules that are currently in force are also applied to manned aircraft and model aircraft and can be found in the Icelandic Aeronautical Information Publication. (Samgöngustofa, 2016)

4.6.1.Rules

The current rules that apply to drone operations are described as follows:

- No permission is needed for drones with a total weight below 5 kg.
- Operating a drone with a total weight of over 5 kg requires a permit from Samgöngustofa.
- The drone operator must be aware of the limitations of where aircraft may be operated, described in the Rules of the Air Regulation No. 770/2010.
- The maximum flying height is 130 meters, unless a special permission is obtained from the Icelandic Transport Agency. The drone shall include a device that programmes the drone not to exceed the height limit. The flight limits are not as strict when applied to scientific research. (Isavia, 2017)

- No flights are to be conducted within the boundary of an aerodrome, unless the drones are flown below the height of the tallest structure or a special permission is obtained. The distance limit for aerodromes with scheduled air services is 2 km while the limit for other aerodromes is 1,5 km. The approval of an aerodrome operator is always needed when flying within the aerodrome site, regardless of weight.
- The drone operator is responsible for the damage that the drone may cause and must have a relevant insurance. (Isavia, 2016)

4.6.2.Application of permits

An application for the permit to fly drones weighing over 5 kg shall be accompanied by information on the applicant and the individual in control of the drone as well as information on qualifications and training. The application shall also include the following confirmations and descriptions:

- A confirmation of insurance.
- A description of the activities for which the permit is requested.
- A description and chart of the area to be flown over, including the airspace where the flight is to take place.
- A description of the tools and equipment that will be used.
- A risk assessment including a description of the measures and mitigations.
- A conformation that the intended flights do not have objections from the district chief of police or the owner of the territory where the flight is conducted.

The permit is obtained if the risks of the operation are acceptable and not greater than when operating manned aircraft. (Isavia, 2016)

4.6.3.Future changes

The proposition of new rules, published in February 2017, suggests the following changes:

- The rules regarding drone flights will apply to all drones with the MTOM of 250 g.
- The drones shall be identified with the name, address and phone number of the operator.
- It will not be permitted to fly drones with a take of mass of over 3 kg within a residential area.
- The MTOM in urban areas will be 7 kg and these flight cannot be conducted for recreational purposes and require taking specific safety measures.
- The restricted area around the airports of Reykjavik and Keflavik will be extended to 4 km.
- It will not be permitted to fly within 150 m distance to official buildings such as the parliament, police stations and prisons.
- Operating drones with a take of mass of over 25 kg will require a special license from Samgöngustofa.
- All non-recreational flights must be documented in a flight diary and saved for at least 3 years. (Isavia, 2017)

4.7.Norway

The Norwegian CAA (Luftfartstilsynet) is working towards having similar national regulations to the ones adopted in other countries. The CAA also cooperates with the drone industry in order to keep up with its rapid evolvement and not to hinder its development. The goal with the regulations is that the risk level for drones should not be higher than for manned aircraft. The permits are given on a case by case basis. (AMAP Unmanned Aircraft Systems Expert Group (UASEG), 2015). The following regulations also apply to Svalbard (Luftfartstilsynet, 2015).

4.7.1.Rules

The following points are general rules that apply to all drones, except model airplanes that are flown for recreation and obey simpler rules:

- The operation must have an accountable manager, an operation manager and a technical manager, although one person can fulfill all of these functions. An operator's manual shall be present.
- Transportation of people or goods is not permitted, unless there is a specified license regarding goods from the CAA.
- The maximum flying height is 120 meters above ground or water level, making an altimeter (or similar) necessary.
- The drone shall be able to land automatically in case it loses contact with the pilot. As an alternative, a second pilot can control the aircraft with a secondary radio controller.
- No landing or take-off is allowed at aerodromes, unless there is an agreement with the local air traffic services.
- The flight operator is responsible for the damage caused by the aircraft and therefore also for having insurance cover for third party liability.
- Drone flights are not allowed under the influence of alcohol or other intoxicating substances.

In case the flight is conducted for the purpose of research and development of drones, the CAA may authorize operations that do not follow the legislation.

The Norwegian CAA has divided different types of drones and operations into three operation categories, namely RO1, RO2 and RO3, the following subchapters describe the regulations applicable to each category.

RO1

The RO1 category includes drones with a maximum take-off mass of up to 2,5 kg and a maximum speed of 60 knots. An RO1 operation must be preceded by notifying the Norwegian CAA before startup and new undertakings. The category also implies that the flight is operated within VLOS, during daylight hours and in line with the following safety distances:

- The flight is not carried out closer than 150 meters from a gathering of more than 100 people.
- The flight is not carried out closer than 50 meters to people, vehicles or buildings that are not under control of the operator, unless the mentioned have given their consent.
- The flight can be carried out with EVLOS and BVLOS with a maximum height of 50 meters.

RO2

The RO2 category requires a license from the Norwegian CAA together with a risk analysis and an operation manual. The license has an application fee and a yearly fee and is acquired when passing an electronic examination given by the CAA. RO2 pilots must be able to demonstrate sufficient skills and to maintain these through refresher courses. The category includes aircraft with a maximum takeoff mass of up to 25 kg and a maximum speed of 80 km. RO2 undertakings imply slightly stricter rules regarding the manager-functions and the operating manual mentioned earlier.

The flights can be conducted within VLOS and EVLOS during daylight hours and follow the same safety distances as RO1. BVLOS operations can be conducted, if they are covered in the license from the CAA, within active danger areas or restricted areas, unless there is a clearance from the traffic control service. BVLOS flights also require a NOTAM issued at least 12 hours prior to the flight and the aircraft must be equipped with lights.

RO3

RO3 undertakings differ from RO2 as they have an MTOM of 25 kg or more or are driven by a turbine engine or will be operated above an altitude of 120 meters or over the vicinity of crowds of people. The operator must also apply for an approval of the drones airworthiness by the CAA Norway. In case take-offs and/or landings are to be performed on aerodromes, the pilots must hold an LAPL, PPL,CPL or ATPL (different levels of pilot certificates) and a radio telephony certificate in order to have sufficient knowledge to communicate with the air traffic service.

4.7.2.Obtaining a certificate

No certificate is needed for the RO1 category, however, one must send a declaration to the Norwegian CAA to confirm that he or she is familiar with the current legislations regarding the category. The declaration form is available under “skjema” on the website of the CAA (www.luftfartstilsynet.no), with the reference number NF-1114E. The website also provides a template for the operators manual, this document is not subject for approval but required to be available for inspection.

A permit is needed in order to operate in the RO2 and RO3 category, in order to receive the permit, one must have an operating licence from the CAA and a passed operator exam. The first step in receiving the license is to prepare a customized operating manual, a template for the document is provided at the website of the CAA. The next step is to seek approval from the CAA, using the form NF-1113E, which is also available at the same website.

The Norwegian CAA provides an online training course for RO2 and RO3 operators, although the course is only available in Norwegian. The theory exam for the two categories can be taken online at all traffic service offices that are run by Statens vegvesen, the Norwegian Public Roads Administration, that also provides “drop-in theory”.

The exam consists of 40 multiple choice questions and to pass the exam, one needs to answer 30 questions correctly within a time limit of 80 minutes. The results are given immediately and if the exam is failed, one can sign up for a new exam the following day. Under the current legislation, a passed exam does not have a time-limit validity. The exam is available in both Norwegian and English. (Luftfartstilsynet, 2015) The current fee for the exam, as of September 2017, is 1010 NOK.

Additionally, if the drone operation is to include photographing and filming, a permission from the Norwegian National Security may be required (www.nsm.stat.no). If the photographs or films are to be published, a permission might be required regarding the Personal Data Act from the Norwegian Data Protection Authority (www.datatilsynet.no).

4.7.3.Additional regulations on Svalbard

In addition to the national drone regulations in Norway, special rules apply to Svalbard. Operating drones do not require a permission from the governor of Svalbard, however, all operations must follow the general rules that are described in the Svalbard Environmental Protection Act – Act of 15 June 2001 No. 79 relating to the protection of the environment in Svalbard. Generally the act prohibits any disturbance or damage to the natural environment, cultural heritage, humans or animals. Nor should there be any signs of the drones presence after the flight is conducted. (Sysselmannen på Svalbard, 2016)

The landing of aircraft, as well as overflight at altitudes below 300 meters, is prohibited in the national parks of Svalbard; Sør-Spitsbergen, Forlandet and Nordvest-Spitsbergen. The same prohibition, but 500 meters, applies to the nature reserves; Nordaust-Svalbard and Søraust-Svalbard. The access to the bird reserves of Svalbard is prohibited in the period of 15 May to 15 August. However, the governor may permit scientific studies, providing that these will not conflict with the purpose of the parks and reserves. The areas are marked in Figure 4. (Sysselmannen på Svalbard, 2014)

Additionally, the area around the centre of Ny-Ålesund, with a radius of 20 km, has a frequency ban in the range of 2-32 GHz. There are RC-controls for drones that operate within the banned range, making it important for the operator to be aware of the frequencies used in their equipment and to adapt it accordingly. However, in case the frequency in question is outside the banned range, one must consider whether the operation is necessary anyway, since a goal for the area is to avoid as much electromagnetic pollution as possible. For using frequencies within the banned range, an application has to be sent to Nkom, the Norwegian Telecommunications Authority. (Kings Bay AS, 2017)

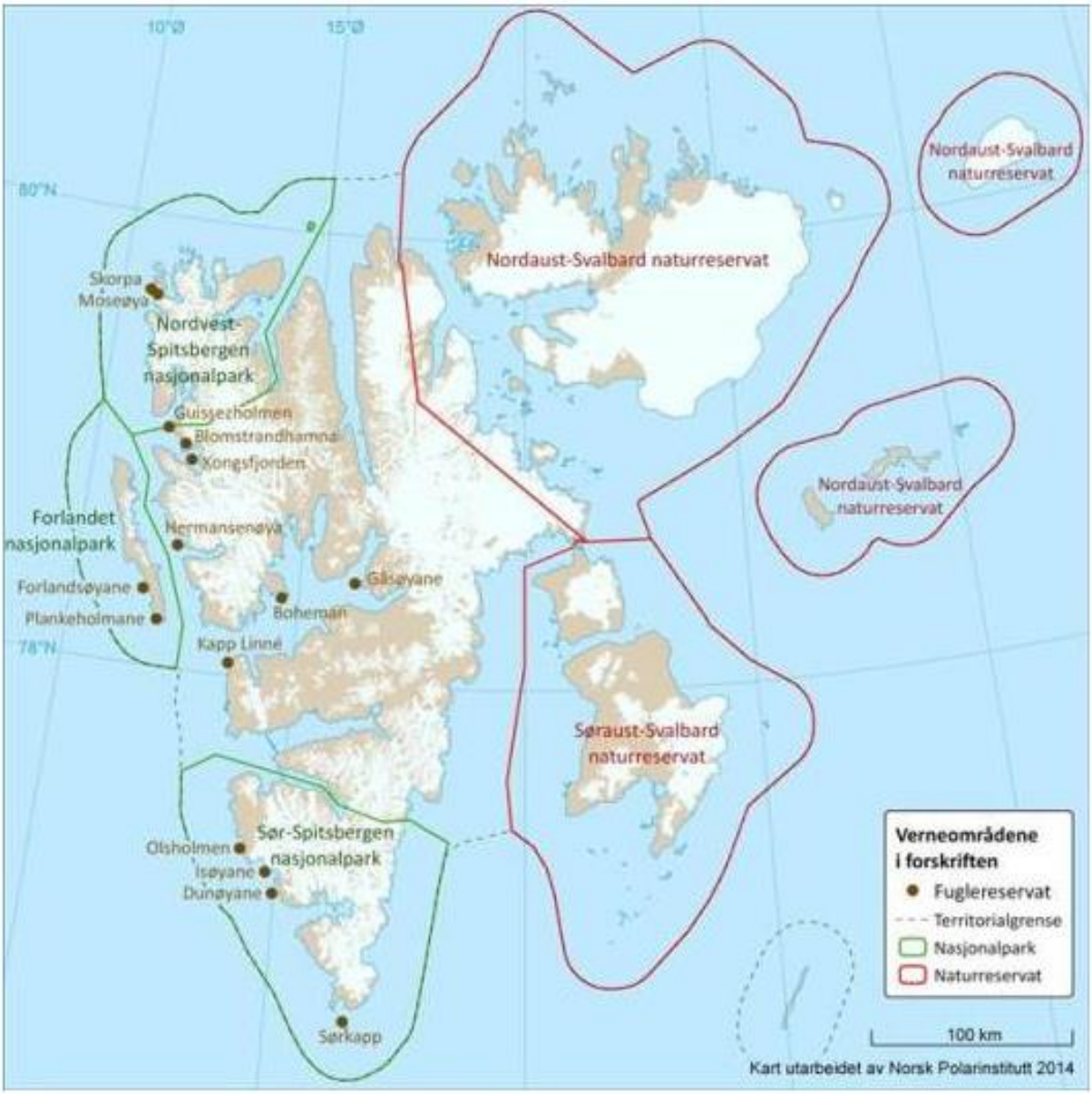

Figure 4. *The national parks are circled in green, nature reserves in red and bird reserves are marked with black dots.*

4.7.4.Future changes

As of the making of this report, no major changes in regulations were planned.

4.8.Poland

The Polish aviation act is enforced by the national CAA, Urząd Lotnictwa Cywilnego. The information is mainly in Polish. English translations of some webpages are provided by the CAA. However, the translation quality is questionable throughout the documents. A full list of regulations is available in Polish only. Instructions on how to obtain certificates are sparse and unclear. To compensate for this, this section

features excerpts from an email conversation with Jarosław Rupiewicz, Position for the Safety of Unmanned Aircraft Operations at the CAA.

4.8.1.General regulations

Flights must be conducted outside the controlled zones (CTR or controlled traffic regions), military airport zones and other specific zones: R (Restricted Area), D (Danger Area) and P (Prohibited Area). For flights in airport controlled zones, permission from the airport or aerodrome manager must be obtained at least 7 days prior to the flight. (Urząd Lotnictwa Cywilnego, 2015)

You must maintain horizontal distance of no less than 100 meters from the boundaries of buildings, towns, settlements or gatherings of people in the open air. You must also keep a horizontal distance of no less than 30 meters from people, vehicles, buildings not under your control or the operator. (Rupiewicz, 2017)

Flying BVLOS is only allowed in closed-off areas. A full list of regulations is available online [PDF, Polish]. (Republic of Poland, 2013)

4.8.2.Certificate needs

To operate drones for non-creational purposes, the operator must hold the following documentation:

- Drone certificate
- Aero-medical certificate
- Insurance

Commercial drone operations require a *certificate of competency* issued by the President of the Civil Aviation Authority after passing a theoretical and practical exam. (Urząd Lotnictwa Cywilnego, 2015)

People taking part in practical activities at colleges with use of unmanned aerial vehicles and organized by colleges do not need certificate of qualifications. There is a condition that these activities cannot be commercial and are made in compliance with applicable regulations. (Rupiewicz, 2017)

4.8.3.How to obtain a certificate

Fees (amount unknown) apply for courses and certificates, which are valid for 12 months. (UAV Coach, 2017)

If You want to obtain a certificate of qualifications (for commercial applications), first You have to receive a medical certificate (domestic class) in Aeromedical Center. Then You proceed to an authorized training organization (69 in Poland now with drone training ability). After the course (for rating VLOS or BVLOS), You have to pass internal exams (practical and theoretical) and also state examination (practical and theoretical). With course certificate and positive exams results You have to submit an application to Urząd Lotnictwa Cywilnego with a 201 PLN fee. Within up to 30 days, You will receive a certificate of qualifications. (Rupiewicz, 2017)

4.8.4.Future changes

There is no information to be found on upcoming changes in legislation.

4.9.Russia

40% of the arctic region airspace is controlled by Russia, making the Russian regulations regarding drones important for arctic research. There is no collection of regulations that specifically applies to drones in Russia, however, the operation of unmanned aircraft is mentioned in several paragraphs among regulations regarding all aerial vehicles and their operations. Consequently, a drone operator must observe regulations applied to manned aircraft as well, these regulations are found in six different aviation regulation sources. (AMAP Unmanned Aircraft Systems Expert Group (UASEG), 2015) The regulations regarding aircraft in Russia are not provided in English by the authorities in charge.

4.9.1.Rules

The operation of drones weighing 30 kg or less is permitted in the presence of a certificate. A certification for the drones airworthiness must be issued by the institution in charge in the county in which the drone is registered. Requirements for the airworthiness are determined by the federal aviation regulations as well as executive authorities of the Russian federation. The airworthiness of the drone can also be confirmed in case the drone is mass-produced in accordance with the established technical requirements.

All drone operations must be approved pre-flight by the Russian military (AMAP Unmanned Aircraft Systems Expert Group (UASEG), 2015). Additionally, a flight plan must be submitted to the Transport Agency, including the model of the drone, purpose of flight, time and area. (UAV Systems International, 2016) The drone operator is then free to make decisions regarding take-off and landing as long as the appropriate air traffic services are notified. (The Federal Air Transport Agency of Russia, 2017)

Other general rules that apply are the following:

- All drones weighing over 250 grams must be registered with the transport agency.
- Each drone operation requires a pilot and a watcher who stands by to monitor the flight.
- It is not allowed to fly drones over crowds of people, military installations, power plants or other areas that may cause concern from authorities. The latter areas include the proximity of airports or areas where aircraft are operating.
- The flights must be conducted during daylight hours and good weather conditions.
- The pilot must respect the privacy of other people while flying the drone. (UAV Systems International, 2016)

4.9.2.Future changes

Proposals for establishing a body of regulations regarding drones uniquely has been offered some time ago but has not come into force yet. (AMAP Unmanned Aircraft Systems Expert Group (UASEG), 2015)

4.10.Sweden

The legal situation of drones in Sweden is complex and evolving. New, more drone-liberal, regulations are expected to be implemented in January 2018. (Transportstyrelsen, 2017)

4.10.1.Certificate needs

It is legal to operate a drone for personal use in Sweden without any permits, as long as the user adheres to recommendations set by Transportstyrelsen, the Swedish Transport Agency, and does not intrude on restricted airspace. However, a permit is required in the following cases (Transportstyrelsen, 2017):

- The drone is operated with commercial intent
- Flying as part of a "mission" (clarified to mean non-recreational use)
- Flying for testing/research purposes
- Flying BVLOS

The permits are issued in four categories: 1A, 1B, 2 and 3, see Table 2. It should be noted that, as of August 2017, no category 3 permits had been issued.

Table 2. *Current Swedish permit categories.*

Permit	MTOM (kg)	Max. kinetic energy (J)	Visual contact
1A	1,5	150	VLOS
1B	7	1000	VLOS
2	>7	No limit	VLOS
3	No limit	No limit	BVLOS

4.10.2.General rules

The following list of rules is made up of information from Transportstyrelsen's information poster "Flying your drone safely". (Transportstyrelsen, 2017)

- Fly within visual line of sight. To avoid other aircraft and not cause a risk to anybody on the ground, do not fly a drone higher than 120 metres or more than 500 metres away from you.
- Check airport control zones. You need a permit to fly within an airport control zone, which sometimes extends many kilometres from the airport. See all Swedish control zones on the drone map at www.lfv.se.
- Make sure you keep a good distance from people and animals, and never fly over crowds. The basic rule is not to expose others to danger.
- Drones can be noisy and may disturb other people. Do not fly where you may disturb anyone and only share photographs of people who have consented to being photographed.

4.10.3.How to obtain a certificate

Permit applications are submitted through the Transportstyrelsen website.

4.10.4.Related regulations

What follows are regulations that are not specific to drone flights but required for drone pilots to be aware of.

Restricted airspace

Air traffic is restricted in large areas of Sweden. Civil airports and locations of interest for national defence are common restricted air spaces, usually including a wide radius buffer zone surrounding the area in question. An interactive map of the Swedish airspace, a "drone chart", is available for drone pilots from Luftfartsverket online.

To operate drones in close proximity of an airport, one needs special permission from the relevant air traffic control, issued for each individual flight. The pilot must also keep contact with the traffic control during the entire duration of the flight (Sandén & Gunnarsson, 2016).

The ATC in small airports will usually permit drones operating within their airspace as long as agreed upon prior to take-off.

Aerial photography

To publicize and distribute aerial photography and geographical information, all published information must be reviewed and approved by Lantmäteriet, the Swedish National Land Survey. Decisions are made based on the imagery's compliance with "Lag (2016:319) om skydd för geografisk information" (Lantmäteriet, 2017), the law of geographical information protection. A general rule of thumb is that photographs that feature the horizon must be approved, while top-down photos must not. It is possible to request exemptions from the law by contacting Lantmäteriet. Some general exemptions include golf courses and crop-yielding fields.

Radio transmitters

Certain types of radio transmitters must be limited in their output capacity to comply with regulations from PTS, the Swedish Post and Telecom Authority (Sandén & Gunnarsson, 2016).

4.10.5.Future changes

New regulations are expected to be implemented September 2018. Regulations will only apply to outdoor flight activities. Indoor flights will not be regulated. Five new categories will replace the current four, see ***Table 3***. The category parameters will consist solely of MTOM and visual contact, eliminating limits on kinetic energy. Three new VLOS categories replace the current categories 1 and 2. The new Category 4 is equivalent to the old Category 3.

The new regulations will also allow some exemptions to allow operating drones within CTR's under specific circumstances. This includes not flying above a certain altitude (50 meters nearby civil airports and 10 meters nearby military airports) within a distance greater than 5 km from any part of the runway.

Category 5 (A/B/C) is a new category for mission-specific permits. A Category 5 permit is limited to specific activity/activities and applications are assessed accordingly. This can be inspection of buildings, towers or masts where the overall height is more than 120 meters or specific rescue missions. For example, an applicant in need of BVLOS flight for recurrent rescue mission activities may acquire a 5C permit (which allows BVLOS flight), if he/she does not qualify for a Category 4 permit. The 5C permit holder may, however, not fly BVLOS for purposes other than the applied-for rescue missions. The CAA Transportstyrelsen will handle individual applications for category 5.

***Table 3**. Future Swedish permit categories.*

Permit	MTOM (kg)	Visual contact	Permit required
1	<7	VLOS	No
2	7-25	VLOS	Yes
3	>25	VLOS	Yes
4	No limit	BVLOS	Yes
5(A,B,C)	*Specific mission types*		Yes

4.11.Switzerland

The Swiss agency responsible for regulating drones is The Federal Office of Civil Aviation (FOCA). Information about regulations and permits is very accessible on the FOCA website in several languages, including English and the Swiss national languages.

4.11.1.Permit needs

For the operation of drones and model aircraft with a weight of over 30 kg, a permit has to be obtained from the FOCA. The operation of drones weighing l 30 kg does not require a permit (assuming VLOS and no special circumstances). You must, however, follow the criteria specified in the DETEC Ordinance on Special Categories of Aircraft. (Swiss federal council, 2017)

Operating in close vicinity (<100 m) of people, BVLOS or EVLOS (use of remote observers to relay information), requires a FOCA permit (or exemption, see below), regardless of vehicle weight.

A permit does not have to be obtained from the FOCA for public air shows at which exclusively model aircraft and drones are on show. (Swiss federal council, 2017)

In close vicinity of people

Operators applying for special permits (exemptions) from the FOCA have to undergo a comprehensive safety assessment (standard procedure). Simplified procedures apply for applications for permits to operate drones or model aircraft above private gatherings of people (e.g. wedding parties) or tethered drones in the vicinity of gatherings of people. Permit types for operating drones in close vicinity (100 m) to people are based on the MTOM of the drone and the two operating cases “SIDE” (i.e. not operating directly above gatherings of people, but within a radius of less than 100 metres from them), and “ABOVE” (i.e.

directly above gatherings of people). Most permits require an approved tether. Untethered drones may only be operated in close vicinity to gatherings of people if the MTOM is <3.5 kg.

There are four simplified permit types:

- MTOM <30 kg, “SIDE”, with tether.
  In addition to the proof of suitability of the tether (as specified above), an analysis of the energy of the rotating parts (i.e. propeller blades) has to be provided, from which it can be ascertained that, in the event that the propeller blades should become detached from the device, no risk of injury would arise for third parties.
- MTOM <1 kg, “ABOVE”, with tether.
  The device must be fitted with an engine-kill function, which in the event of a failure or malfunction of the primary control system must be capable of stopping all engines. It must also be possible for the remote control operator to activate this function manually. Proof must be provided, based on an analysis or test report, that the impact energy arising from a free fall from the maximum permissible operating altitude does not exceed 66 joules.
- MTOM >30 kg, “SIDE”, with tether.
  An operating concept must be submitted to the Federal Office of Civil Aviation (FOCA) for approval. In this concept, it must be demonstrated that sufficient attention has been paid to safety in the context of the entire operation. The terrain over which the device is to be operated must be fenced or the tether must be short enough and be attached at a sufficiently high point in order to ensure that, in the event of loss of control over the device, it cannot land within 5 metres of the highest location at which third parties are located and could be at risk of injury.
- MTOM <3,5 kg, “SIDE”, without tether.
  Special form on the FOCA website. (Federal Office of Civil Aviation, 2017)

4.11.2.General regulations

The following regulations are specified on the federal council website. (Swiss federal council, 2017) Note that all pilots must also adhere to the DETEC ordinance.

- Automated flights (autonomous operation) within the visual range of the pilot are permitted as long as the latter is able to intervene if necessary in the operation of the device at any time.
- Without exception, the operation of drones and model aircraft is strictly prohibited within game reserves and bird sanctuaries.
- The recording of aerial images is permitted as long as the operator duly observes the regulations governing the protection of military installations. The operator must also observe the principle of protection of privacy and the provisions of the Federal Data Protection Act.
- In principle, drones may not be operated above, or within a radius of 100 meters from gatherings of people (Further information and licensing procedure).
- Anyone who operates a drone or model aircraft with a weight of more than 500 grams is required to take out liability insurance cover in the amount of at least 1 million CHF to cover any damages that may be caused.

- Restrictions apply with respect to the operation of drones and model aircraft in the vicinity of airfields and airports. For example, it is prohibited to operate such devices at a distance of less than 5 kilometers from runways.
- Cantonal and municipal authorities may impose additional restrictions on the use of unmanned aircraft (Such as the Canton of Geneva).
- No labeling is required.
- The maximum flight altitude for drones is 150 meters.

4.11.3.How to obtain a permit

Applications for both the standard procedure safety assessment, as well as the special permits (exemptions) for operating drones BVLOS or in close vicinity of people, can be found on the FOCA website. (Federal Office of Civil Aviation, 2017)

Depending on how much processing is required, a permit costs between 50 and 5 000 CHF. Due to the high demand for permits, applicants should allow for a processing time of at least three months.

4.11.4.Future changes

As of the making of this report, no major changes in regulations were planned.

4.12.United Kingdom

The Civil Aviation Authority is responsible for regulating drones in the UK. In addition to the standard CAA website, the agency has created a more informal, easily accessible website called Dronesafe. Dronesafe compiles and illustrates the most basic UK drone regulations (here called “drone code”) using graphics. It also encourages drone owners to download a safety-promoting app called “Drone Assist”, which provides users with an interactive map of UK airspace and its restrictions. (Dronesafe, 2017)

The regulations for recreational drone flights are contained within the Air Navigation Order 2016 (ANO) which is the primary document for all aviation regulations within the UK. In order to keep the regulations at a proportionate level for these small drones, a set of specific, simpler, regulations apply to aircraft that have a mass of 20 kg or less (which are termed ‘small unmanned aircraft’ within the ANO). (Civil Aviation Authority, 2017)

4.12.1.General regulations

All drone pilots must adhere to the following rules from ANO Article 94.

- A person must not cause or permit any article or animal (whether or not attached to a parachute) to be dropped from a small unmanned aircraft so as to endanger persons or property.
- The person in charge of a small unmanned aircraft may only fly the aircraft if reasonably satisfied that the flight can safely be made.
- The person in charge of a small unmanned aircraft must maintain direct, unaided visual contact with the aircraft sufficient to monitor its flight path in relation to other aircraft, persons, vehicles, vessels and structures for the purpose of avoiding collisions.

- The person in charge of a small unmanned aircraft which has a mass of more than 7 kg excluding its fuel but including any articles or equipment installed in or attached to the aircraft at the commencement of its flight, must not fly the aircraft:
    a) In Class A, C, D or E airspace unless the permission of the appropriate air traffic control unit has been obtained
    b) Within an aerodrome traffic zone during the notified hours of watch of the air traffic control unit (if any) at that aerodrome unless the permission of any such air traffic control unit has been obtained
    c) At a height of more than 400 feet above the surface unless it is flying in airspace described in sub-paragraph (a) or (b) and in accordance with the requirements for that airspace.
- The person in charge of a small unmanned aircraft must not fly the aircraft for the purposes of commercial operations except in accordance with a permission granted by the CAA.

4.12.2.Permit needs

You do not need a permit for general drone flight. You must, however, comply with the general regulations. If your drone is fitted with a camera, there are also a number of additional limitations surrounding where you can fly it, and how close you can fly it to other uninvolved people or objects. In order to fly within these areas, or closer than the minimum distances specified in the regulations, you must obtain prior permission from the CAA to do so. Article 95 of the ANO states that, if you wish to fly your camera fitted drone:

- Within 150 m of a congested area or an organized open air crowd or more than 1000 persons and/or
- Within 50 m of people or properties/objects that are not under your control.

You will need to obtain a Permission from the CAA in order to do so legally.

FPV flight is allowed under a so-called general exemption from the ANO, on the condition that the pilot complies with the rules specified in publication ORS4 No.1226, found on the CAA website. (Civil Aviation Authority, 2017)

4.12.3.How to obtain an exemption from camera regulations

To be exempted from the regulations for camera-fitted drones, you will need to:

- Demonstrate your 'piloting competence' to the CAA
    - Demonstrate a sufficient understanding of aviation theory (airmanship, airspace, aviation law and good flying practice).
    - Pass a practical flight assessment (flight test).

  The full requirements for pilot competence are covered in the guidance document CAP 722, found on the CAA website. (Civil Aviation Authority, 2015)
- Develop basic procedures for conducting the type of flights you want to and set these out in an Operations Manual.
- In addition, you will also need to provide the CAA with an Operating Safety Case (OSC) to demonstrate that the intended operation is safe.

4.12.4.Future changes

New changes to drone laws were announced by the UK Department for Transport on July 22nd, 2017. Owners of drones weighing 250 grams and more will in the future have to register details of their drones to improve accountability and act responsibly. Users may be able to register online or through apps, under plans being explored by the government. The move follows safety research that concluded drones could damage the windscreens of helicopters. In addition, a new drone safety awareness test means owners will have to prove that they understand UK safety, security and privacy regulations. (Department for Transport, 2017) As of the time of this report, the timeline for implementation was to be determined.

4.13.USA

When you fly a drone in the US, it is your responsibility to understand and abide by rules set by the Federal Aviation Administration, FAA. Recreational flight is regulated by the same rules as model aircraft, while pilots flying non-recreationally (research/business) must adhere to more strict regulations, some of which you can obtain exemptions for as a government entity/organization.

4.13.1.Pilot Requirements

The following list describes the requirements put on drone pilots:

- The pilot must be at least 16 years old
- The pilot must pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center. A person who already holds a pilot certificate issued and has successfully completed a flight review within the previous 24 months can complete a ”part 107” online training course at www.faasafety.gov to satisfy this requirement.
- The pilot must be vetted by the Transportation Safety Administration (TSA)

For more information, read about Remote Pilot Certification. (Federal Aviation Administration, 2017)

Government entities or organizations (e.g. law enforcement agencies, public universities, state governments, local municipalities) have the following two options for flying drones:

- Fly under the small Unmanned Aerial System (UAS) rule – follow all aircraft and pilot requirements listed in the previous section.
- Obtain a blanket public Certificate of Waiver or Authorization (COA) – permits nationwide flights in Class G airspace at or below 400 feet, self-certification of the drone pilot, and the option to obtain emergency COAs (e-COAs) under special circumstances.

4.13.2.General regulations for non-recreational use

Aircraft Requirements:

- The mass of the aircraft must be less than 55 lbs (25 kg).
- The aircraft must be registered on the FAA website. (Federal Aviation Administration, 2017)

Operating Rules:

- Keep within class G airspace. US airspace Class G includes all airspace below 14,500 feet (4,400 m) mean sea level not otherwise classified as controlled.
- Keep the aircraft in VLOS
- Only fly under 400 feet (120 meters)
- Fly during the day
- Fly at, or below, 100 mph (160 km/h)
- Yield right of way to manned aircraft
- Do not fly over people
- Do not fly from a moving vehicle

Exemptions from the rules may be granted by applying for a waiver.

4.13.3.How to obtain a certification

A full list of the several tests and forms necessary to attain the so-called Remote Pilot Certification can be found on the FAA page "Becoming a pilot". (Federal Aviation Administration, 2017) One of those tests is the aeronautical knowledge test, which must be completed at an FAA-approved knowledge testing center. You can find a list of the locations (USA only) of these centers on the FAA website. (Federal Aviation Administration, 2017) Commercial pilots must receive a Security Threat Assessment (STA) from the TSA before receiving certification from the FAA. This does not require any action from the applicant. If you wish to apply for exemptions from certain operating rules, or operate a drone weighing more than 55 lbs. (25 kg), navigate to the FAA website "Beyond the basics". Drone registration must be completed on the FAA website. (Federal Aviation Administration, 2017) Only US citizens may register drones.

If you are operating as a government entity, contact 9-AJV-115-UASCOA@faa.gov to learn more about, or obtain, a blanket public Certificate of Waiver or Authorization (COA). (Federal Aviation Administration, 2017)

4.13.4.Future changes

As of the making of this report, no major changes in regulations were planned.

5. Upcoming unified EU legislation

The regulation of drones with a maximum take-off mass (MTOM) of less than 150 kg falls within the competence of the European Union (EU) Member States. This leads to a fragmented regulatory system hampering the development of a single EU market for drones and cross-border drone operations. (EASA, 2017) A wish for harmonized flight regulations across the EU is prevalent among politicians and other parties. The European Aviation Safety Agency (EASA) is currently engaged in the process of proposing such regulations.

What follows is a description of the classification categories proposed by EASA. For more detailed information of the proposal, consult the most recent Notice of Proposed Amendment (NPA), at the time of this report called *2017-05: Introduction of a regulatory framework for the operation of drones*. (EASA, 2017)

5.1.Proposed categories

There are three proposed categories, namely *open*, *specific* and *certified*, these are described in the following subchapters.

5.1.1.The open category

The open category is the most attainable operation category, meant for aircraft that imposes a very low risk for people and the surrounding environment. No license is needed, but an online course grants the pilot permission to fly up to altitudes of 120 meters (compared to 50 meters without the course).

The “Open” category is divided into three subcategories that impose different rules based on attributes of the drone, pilot, and situation. The subcategories are labeled intuitively: “fly over people”, “fly close to people”, “fly far from people”; and are described in detail in the NPA. (EASA, 2017)

Pilots in the “Open” category (all subcategories) must comply with the following rules:

- All drones with a mass of over 250 g must be registered
- Flights must be conducted within sight or Extended Visual Line Of Sight (EVLOS)
- The MTOM must be under 25 kg
- The maximum operating height is 120 m (+50 m for obstacles)
- The drones must have CE markings
- Give way to manned aircraft
- Do not fly where emergency response is ongoing

5.1.2.Specific

“Specific” indicates that the operation constitutes a risk for other people, animals or property. The risks must be evaluated and compensated for. Standardized risk analyses will be available for common tasks, called “standard scenarios”. Low-risk standard scenarios can be declared by an operator with a “Light Unmanned Aircraft Operator Certificate” (LUC). High-risk scenarios require operation authorization using a “Specific Operation Risk Assessment” (SORA). New standard scenarios may be proposed to the EASA

Agency by competent authorities, by UAS operators, by manufacturers or by standardisation bodies. (EASA, 2017)

5.1.3.Certified

The "Certified" category is reserved for drone operations that impose a high risk for other people, animals or property. Requirements for this category are "comparable to those for manned aviation", (Rémi Vesvre, Swedish Transport Agency) with a multitude of licenses relating to pilots, aircraft and organizations.

5.2.Estimated timeline

Based on the comments received, regarding the 2017-05 NPA prior to deadline August 12th, 2017, EASA will develop an opinion containing a new proposed draft. (EASA, 2017) The opinion is planned to be submitted to the EU Commission by the end of 2017. EASA expects a Commission ruling on the opinion during Q1 2018. Given a positive ruling by the Commission, gradual implementation of approved regulations will commence in 2020, see Figure 5.

Figure 5. *Timeline for harmonized EASA rules.*

6. Online tools and mobile apps

There are many websites and apps to help users operate drones in a safe manner. Mobile applications for keeping track of restricted areas are available for devices on all platforms, many of them free of charge. Some are nation-specific, while others cover the territories of multiple nations.

The websites and mobile apps listed in this section are not endorsed in any way, and should only be seen as examples of available services.

6.1.Airmap web app

The Airmap web app provides aeronautical data & services to unmanned aircraft, or drones. The user can access low-altitude airspace advisories, create flights, file digital notices, manage aircraft, among other things. Airmap covers multiple territories worldwide. A screenshot from the app is provided by Figure 6.

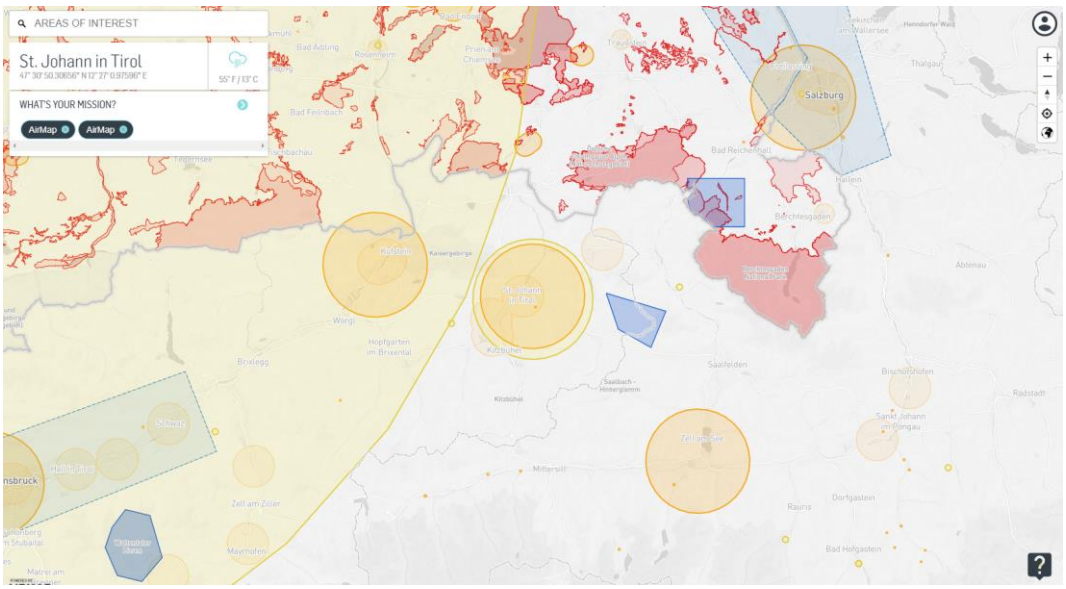

Figure 6. *Screenshot from the Airmap web app.*

6.1.1.Airmap for drones

There is also a mobile version of the Airmap web application (Android, iOS). Like the website, the application provides aeronautical data & services to unmanned aircraft, or drones. The user can access low-altitude airspace advisories, create flights, file digital notices, manage aircraft, among other things. Airmap covers multiple territories worldwide.

6.2.B4UFLY

Similar to Airmap, B4UFLY (Android, iOS) helps unmanned aircraft operators determine whether there are any restrictions or requirements in effect at the location they are flying and also helps them plan their flights. The app is limited to US territory. A screenshot of B4UFLY is presented in Figure 7.

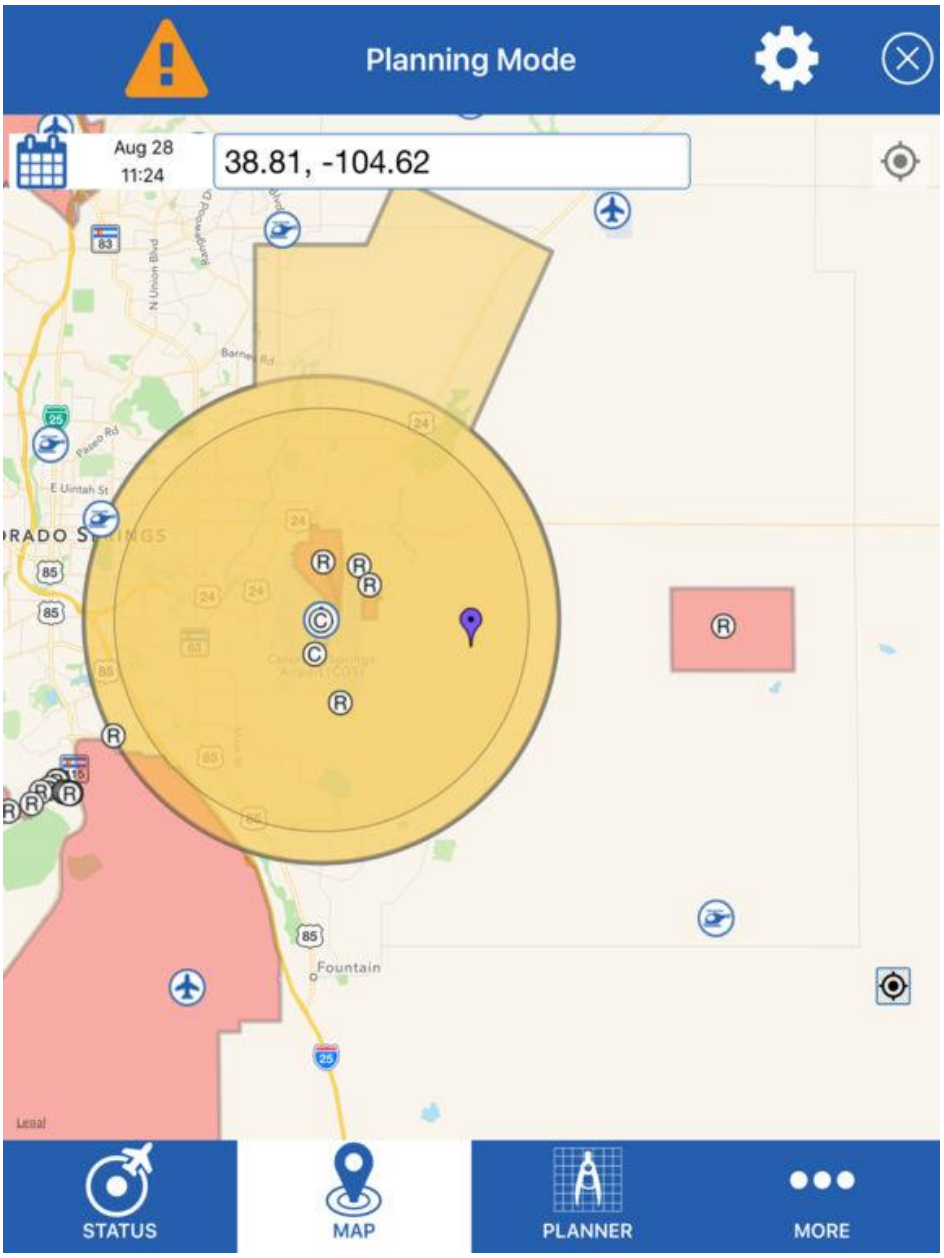

Figure 7. *Screenshot from the B4UFLY mobile application.*

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