CANADIAN FEDERATION
FOR DRONE RACING

2016 OFFICIAL RULES AND REGULATIONS

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Table of Contents

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Introduction

The CFDR rules have been established to deliver a national standardization for competitive Drone racing sports events in Canada. These rules are intended to be used for CFDR Sanctioned events only

Rotor sports are typically outlined as contests involving unmanned aerial vehicles (UAVs) with one or more rotors and first person view (FPV) camera systems, also known as drones or wings.

These rules were created with the understanding that rotor sports are rapidly evolving and the rules need to be responsive to the needs of the community. We seek input from all members of the CFDR through the Racing Rules Advisory Committee, Safe Operational Procedures and Specifications Committee and Industry & Transport Canada Advisory Committee.

Definition of Terms

- **DNS**: Did Not Start – Aircraft fails to cross start gate.
- **DNF**: Did Not Finish – Aircraft fails to complete all requirements set out by the respective competition guidelines.
- **DQ**: Disqualified – Disqualification parameters outlined below.
- **OOB**: Out of Bounds – The aircraft exceeds the specified area for each respective track design.

General Piloting Rules

- All pilots must have a current insurance and organizational membership to the CFDR and must meet the specified requirements in order to compete, and all pilots must adhere to the rules and regulations of safe operation and flight as defined by the CFDR.
- All pilots must adhere to any applicable regulations set forth by Canadian Federation for Drone Racing (CFDR) and Transport Canada (TC).
- Unlawful flight, such as flights near an event at locations where flying is prohibited, can result in disqualification from the event.
- All pilots must attend a general safety briefing and sign the appropriate waivers from the race organizer and venue.
- All pilots must be able to demonstrate effective Fail-Safe procedures defined by the Race Director. In most cases this is a “Drop” method, where the aircraft will immediately cease flight by stopping all motors and operation if it loses contact with the radio transmitter.
- All pilots must have an “ARMING” position switch or sequence on their radio. The

aircraft should not power up by any accidental controls from the radio. Aircraft arming must be executed via a control switch.

- All pilots must demonstrate an airworthy airframe and pass a general mechanics and electronics test. All testing will be executed by the Race Director
- All batteries must be transported in and stored in LiPo-safe bags or an approved fire resistant container.
- Pilots must use FPV to pilot aircraft. This can be with goggles or a ground station, LCD type display.
- Pilots will not power up video transmitters unless instructed to do so, e.g. Race Director has given approval to take part in a race. Powering up a video transmitter at all other times may result in an immediate disqualification from the event.
- In events where emitter-based timing systems are used, pilots are required to have an available 5v header for the IR Transponder emitter to be properly installed on their airframe for all official lap timing purposes. If your FC has a built in IR unit, please confirm that it is compatible with the iLaps timing system. Pilots are not expected to have their own transponder.
- Approved lap timing systems for CFDR sanctioned events:
  a) FPV Canada IR timing system
  b) Air birds wireless transponder system
  c) My Laps

Venue Operations

- It is the responsibility of the organizing company to inform and educate spectators of all risks and safeguards via signage and or information bulletin at the entrance of the event as well as on event tickets.
- Pilots must adhere to all rules within the competition venue, and will not fly in any other part of the venue unless it is a designated flight zone.
- Pilots must contain all equipment and, airframes within the designated pilot pit area.
- A public charging area will be available and 120v outlets will be supplied. It is recommended that racers bring personal chargers and extension cord.
- General charging of electronic devices including radios or any device with a self-contained power supply is permitted.
- All batteries must be stored in a LiPo-safe bag or in an approved, fire resistant container.

Event Insurance Requirements

All stakeholders, including the organizing company, the site location and venue, sponsors

and participants must have acceptable and adequate insurance policies (General Liability and Aviation/Event Specific) in place before participating in any aspect of the event. These policies have been defined with the various contracts and agreements executed between the organizers and their insurers. For more information please visit: http://canadianfederationfordroneracing.com/insurance/.

Judging and Marshaling

- All races will be managed by an appointed team of judges.
- All races will follow the general rules and regulations of amateur competition, including those of the CFDR.
- Each race will be monitored by judges, cameras, timing/lap systems and/or marshals to maintain fair and accurate competition.
- In the event of a mid-air collision, pilots can resume the race if they are able to take off again without intervention, otherwise their heat is considered a DNF.
- Any practice or behavior deemed unsafe, (i.e. flying above the max ceiling height) will result in an immediate disqualification.

Pilot Responsibilities

- Pilots are responsible for operating and maintaining their own equipment.
- Pilots are responsible for ensuring proper flight operations through timing gates and recording all official times. If timing is not recorded in the official timing system, or inaccurately recorded, it is the pilot's responsibility to prove the accurate time (via an original DVR recording) or other method.

Race Commencement

- Premature start before the official tone: Pilot will lose 1 Lap.
- Non launch on starting tone, arming timeout, flip, etc. – DNF, no rerun.
- Collision with another aircraft before first gate constitutes a re-run: DNS
- Collision with another aircraft after first gate- DNF no re-run
- Pilot Loses Video for Unknown Reason – DNF – no rerun unless evidence can be show via DVR of situation beyond pilots control.

Discretionary Reruns

- Pilots may request a reschedule to another heat due to technical difficulties if the pilot notifies the Race Director prior to the start of his or her heat. Maximum one requests per event.
- Pilot may request a rerun due to losing video or other technical difficulty beyond the pilot's control during qualifying semi-finals and finals only.
- The Race Director has absolute discretion over approval or denial of any request listed above.

Disqualifications

- Any pilot not physically present on the flight line fully prepared to race at the time of their scheduled heat will receive a DNF for that heat and will not receive a rerun. Two or more DNFs for no-shows will result in disqualification of the event.
- Missing a gate, flag or required obstacle: If a pilot misses a gate or obstacle, pilot will receive a DNF. Pilots may have one attempt at retrying the gate or obstacle while race is active.
- Flying out of bounds: any pilot flying out of bounds, including maximum ceiling height will receive a DNF for the current run. Pilots receiving two infractions will be completely disqualified.
- No celebration laps or excessive displays of celebration while race heat is still active. Any interference caused by a pilot or airframe will result in a DNF for that heat. Two or more DNF's will result in disqualification from the event.
- Un-sportsman like conduct will not be tolerated.
- All decisions made by the Race Director or Judge are final.
- Flying above specified celling height will result in an immediate disqualification. Indoor tracks the max celling height is 20 feet or otherwise specified by the race director pending on track design and venue. Outdoor tracks the max celling height is 15 meters or otherwise specified by the race director pending on the track design and venue.

Airframe general guidelines

- All airframes must pass a safety and airworthiness inspection. Once the airframe has been checked and approved, it must not be modified or changed, or it will require to be re-inspected. Airframes should be repaired with equivalent parts that were originally used during check-in. The inspector has the final decision on whether an airframe is accepted and/or requires changes or modifications in order to be approved for racing.
- Airframes must use official video transmitters provided by the event organizers unless otherwise specified.

Craft Size Guidelines

- All airframes must pass a safety and airworthiness inspection. Once the airframe has been checked and approved, it must not be modified or changed, or it will require to be re-inspected. Airframes should be repaired with equivalent parts that were originally used during check-in. The inspector has the final decision on whether an airframe is accepted and/or requires changes or modifications in order to be approved for racing.

Multirotor Racing Class

- 6-inch diameter maximum propeller size (2, 3 or 4 blade propellers allowed)
- 330mm maximum frame size (motor to motor, 130mm minimum frame size)
- Multirotor craft with 3, 4 or 6 motors
- 4S maximum LiPo battery, maximum 4.2 volts per cell

Wing Racing Class (To be reviewed by Committee)

- Between 30 inches (762 millimeter) and 40 inches (1016 millimeter), measured from the extreme end of one wingtip to the extreme end of the other wingtip
- Limit of one motor for propulsion (does not include servomotors)
- 850 Watt maximum draw from the propulsion motor
- No tail (i.e. “flying wing”)
- Vertical stabilizers permitted
- Pusher propeller(s) only. No “tractor” propellers
- Rudder(s) not permitted
- Vectored thrust not permitted
- 4S maximum LiPo battery, maximum 4.2 volts per cell
- Must be capable of up to 5-minute race durations

Video Transmitters

- Power Outputs: All main tracks: 200mw or switchable.
- Required Channels: Race band capable, 40 channels.

Accepted Video Transmitters

It is required that all racers provide a suitable 200mw VTX. Please note that VTx requirements can change per event. 25mw or 200mw will be used and determined prior to the event.

Recommended Video Transmitters - 200mw + switchable race band 40ch

All pilots must be able to completely understand all operations of their Tx and be able to switch channels and power as required by the track and the race officials. In all non-racing cases, Tx’s must be off. Channels will be pre-assigned before the race. Racers must be able to switch channels on their VTX with relative ease if required by the race director.

NOTE: Powering up at any time when not racing will result in immediate disqualification.

RH and LH Antennas

Recommended Axial ratio: 0.6

It is highly advisable to bring several sets of both right hand and left hand antennas. Also please update your antennas to the latest iterations (axial ratios of .60 or better) to ensure clean signal with higher number of pilots per course on multiple tracks.

Field, Course and Venue Operations

The Field is explicitly controlled by the event's Flight Line Director, as well as the Race Commissioner and the Race Director. These officials have the ability to disqualify any pilot for any reason, and have the ability to stop a race or flight at any time for any reason.

- The field and the venue are governed by the venue's Fire, Security and Police Marshals.
- The field is a restricted grounds and airspace and only authorized personnel are allowed on the flying grounds.
- All flights are grounded while there are personnel actively on the field.
- All personnel in the flight area must wear protective headgear, safety glasses and a high visibility vest.
- Personnel engaged in active recovery of any airframe must wear high tensile gloves, and must immediately remove all battery power from the aircraft upon contact.
- Depending upon the field size, the field must have at least four (4) fire extinguishers on the sidelines, with two, basic first aid kits ready to be immediately deployed.
- Metal covers (such as a trash can lid) should be available for all drone recovery crews to use as a shield if other retrieval methods are unsuccessful.
- A First Aid station is to be located in the Pilot Pit area or an area that is easily and conveniently accessible to the active piloting areas of the event.
- An EMT Station should be located within the immediate vicinity of the field, as defined by the venue's first aid policies.
- Event organizers must have 2-way radios with a specific channel designated for flight operations and first-aid/emergency communications. All directors (operations, flight, judging) must have access to a radio. It is highly recommended that any airframe recovery personnel on the field also have a radio.
- Drone recovery crews must not enter the field until all aircraft have landed. Drone recovery crews must expediently remove all airframe parts, components and various debris from the field and do a quick analysis of the airframe to see if all parts have been retrieved. If an airframe is still powered and props are spinning, crew members must try to safely indicate via hand signals through the pilot camera the Thumbs Down signal to indicate to the pilot to power down their aircraft. In all cases do not attempt to handle an aircraft that has motors engaged, spinning or is on fire. Use the metal plate in order to cover the craft and attempt to neutralize.

Official Course Dimensions and Boundaries

- Course should be contained within an established format, e.g. soccer field, football field or other suitable area.
- Flight path line of fire should shall have a minimum 10 meter safety buffer zone past the safety net from any spectator or building area to reduce the amount of energy force and impact to the netting.
- A minimum of a 1 meter buffer between the safety net and spectator, wherever the flight path is parallel adjacent to spectator.
- Course designs should take into consideration flight and energy direction. Flight paths should not direct 100% energy force of the airframe directly at the audience unless there is substantial distance and barriers to protect the audience.
- Accidents, yaw spinouts and other impacts that cause the aircraft to alter from its flight path should be considered and implemented into the design.
- If spectators are allowed for viewing purposes, there must be netting 30 feet (9.1 meters) high (or as high as necessary to cover the front of a structure that provides an alternate natural barrier) with a minimum of 1meter buffer on each side for impact recovery. Spectators must not stand within 3 feet of the netting.
- Netting must be high tensile weave, with a 45 millimeter maximum weave size (either square or diamond pattern). This is to ensure there are multiple catch points in case one of the squares is breached through impact.

Course Timing Systems

A timing system will be used to officially track the time of each pilot for all official races. If a timing emitter/transponder is not provided on-site by the competition organizers, each pilot must own, rent or purchase a compatible timing emitter with a unique ID and properly install it on the airframe being raced. A backup timing system such as manual timing with stopwatches by judges may be used in the case of failure of the primary timing system.

- Each pilot is responsible for mounting the emitter in a location conducive to the best successful triggers (e.g. don't accidentally block it with a Velcro strap). The mounting location will be inspected during check-in for optimum placement.
- Emitters should be mounted securely to the airframe in a location that will not easily be damaged in a crash. Typically, this is on the top of the airframe.
- Pilot is responsible for the safe powering of the emitter, and failed triggers due to improper operation, overpowering, overheating, improper mounting or failed trigger is the complete responsibility of the pilot and the cost for replacement may be billed to the pilot.
- Any failed non-triggers are the responsibility of the pilot, but judgments for manually adding times or adjustments may be made in some cases.

Race Count-down Procedures

It is recommended that the competitions use a four-stage process for all racing heats, although individual events may elect to use a different process. Each stage is designed to check for the various conditions, prepare video transmitters, and have all pilots organized and ready for racing. Each stage is staffed by a specialist who will review each pilot and airframe. All heats and pilots will proceed together through each stage. The stages for Mini Class racing heats are as follows:

Stage 4 (Three heats from Flight Deck): Pre-flight airworthiness check. All airframes will be checked for valid seals and marks from initial safety checks. If they are not present, the pilot must go through the safety check and receive a new seal or mark. At this time all cables, connectors, props and electronics will be checked by the Stage specialist.

Stage 3 (Two heats from Flight Deck): Pilots will be assigned a race position and receive their video transmitter to attach to the airframe. All cables should be connected and the video transmitter attached by use of Velcro to the airframe. The aircraft should not be powered up at this time.

Stage 2 (Next up on Flight Deck): Pilots will hand over their airframe to their spotter and the spotter will take it to the start/finish area to await the next heat. Pilots may power up their goggles or displays but may not power up their radio at this time.

Stage 1 (On Flight Deck): Pilots will proceed to their assigned seat in the Flight Deck and power up their radios within the specified timeframe. Spotters will power up the airframes, check their video feeds. The spotter will show by the number of fingers in front of the pilot camera to confirm successful and correct video feed. The pilot must give a “Thumbs Up” to the Pilot Line Director when they have successfully powered up and have the correct video feed. Pilots must not arm until directed by the Pilot Line Director.

All pilots not ready within the specified timeframe will receive a DNS designation for the specified heat. Once all pilots have given the Thumbs Up sign, the race start countdown will commence. It will proceed as follows by the Race Announcer:

1. Pilots ready (signaled through pilot thumbs up)
2. Pilots, arm your aircraft
3. Race will begin in less than 5
4. Airhorn short blast or other specified starting announcement will signal commencement of the race
5. If a race is ordered stopped for any reason, pilots will be instructed by the Pilot Line Director and must follow all procedures prescribed. Pilots failing to adhere to Flight Line Director, Race Commissioner or Race Director declarations may result in an immediate disqualification from the event.

Course Rules and Regulations

- Pilots must stay within all prescribed flight paths.
- Pilots must keep all aircraft in the disarmed state until they have been given the “ARM” signal from the Race Director or Announcer. This will happen only when the aircraft has been placed on the starting deck and all field staff have left the area.
- Pilots must adhere to the prescribed launch sequence. No movement before the starting signal. False starts will incur a penalty.
- Pilots must maintain control of their aircraft at all times and only fly within their skill level. Any pilot who exhibits unsafe flying procedures may be disqualified at any time from the event.
- Once pilots have successfully completed all laps, they must return to the start/finish pad, land and DISARM. Pilots must give the Pilot Line Director a “Thumbs Up” that they have completed their flight.
- Pilots that have crashed at any point during the heat and are unable to resume racing must DISARM their aircraft, give the Pilot Line Director a “Thumbs Down” indication and wait until the heat is over. The airframe will be recovered by the field crew.
- Pilots must successfully fly through all gates, flags, and other obstacles on the course. If a pilot misses an obstacle, they must safely turn around and attempt the obstacle again. They will have up to two further attempts before being disqualified from the heat. Judges will ride along via FPV with the pilot, and will indicate immediately to the pilot if they must correct any flight path errors. Additionally, the Flight Line Director may signal to the Pilot Line Director and judges that an obstacle has been missed. In this case the pilot must immediately and safely return to the missed obstacle and attempt to successfully navigate it.
- The default Maximum Ceiling height for these events is 15 meters unless otherwise specified. Any breach of the ceiling will result in immediate disqualification from that heat. If the pilot receives two breaches of the ceiling height or goes out of bounds at any time during the event, the pilot will be completely disqualified from the event. If a pilot has breached the ceiling or has gone out of bounds, the pilot must immediately land their aircraft in a safe location on the field. The Pilot Line Director or a judge will give further instructions.
- In the event of a crash or the inability to resume flight safely, the pilot must immediately DISARM their aircraft and give the Thumbs Down signal.
- The field staff may use various hand signals in the front of the pilot’s camera to indicate airworthiness status to the pilot. Thumbs Up means the pilot is pre-cleared for flight. Thumbs Down means the craft is damaged and is not able to fly. In all cases if you see field staff in the First Person View pilot camera, you must disarm and wait for further instructions.
- Pilots may have multiple airframes, and each airframe must pass all safety and airworthiness checks before flying.
- The Flight Line Director, Race Director or Race Commissioner has the right to

disqualify any pilot for any reason if the pilot or piloting behavior is deemed unsafe or if the pilot has breached any rule or regulation within this document.

Emergency or Fail-Safe Procedures

- Should a pilot lose control of their aircraft, the pilot must attempt a safe landing, fly into a prescribed, crash, 'catch' zone net, cut throttle in a safe area or execute a fail-safe procedure in a safe area.
- If a pilot loses video, they must immediately execute a fail-safe procedure and/or attempt to land the aircraft via Line of Sight. All spotters must assist pilot in determining the location of their aircraft.
- Spotters must maintain visual line of sight of the corresponding pilot's airframe at all times and must provide verbal directions or situational awareness details to the pilot. If the aircraft breaches the max ceiling height or goes out of bounds, a judge will indicate to the pilot the infraction and the spotter must immediately assist the pilot in maintaining control and safely landing the aircraft.

Racing Competition Structure

It is recommended that the competitions use the following structure, although individual events may elect to use a different structure.

Practice

Pilots may practice at the designated practice fields before the event. Practice runs may be timed and may be used for qualifier seeding.

Qualifiers

Competitions may include one or more rounds of qualifiers, with either seeding or advancement as a result of best single lap time or best complete race time.

Mains

Competitions may include one or more rounds of main heats, with best complete race time, finishing order or a points-based system based on finishing order deciding advancement to finals.

Finals

Pilots who advance from the mains compete in finals, with best complete race time, finishing order or a points-based system based on finishing order deciding final results.

From the UAV SFOC, and other areas, here are some cute-and-paste conditions… Please consider adding them into your document,

CANADIAN FEDERATION
FOR DRONE RACING

Transport Canada Regulations (SFOC)

Transport Canada (TC) sets forth rules and regulations for the purposes of safe operation of aerial vehicles. The CFDR strictly adheres to these rules to ensure the safe operations and education to further this new industry. It is our aim have zero injury's or incidents at our sanctioned events. Racing events that have spectators present require the establishing organizers to have a special flight operation certificate (SFOC) from Transport Canada.

Conditions for Flight Locations

- The pilot of the UAV shall give way to manned aircraft at all times.
- The pilot shall only operate the UAV in visual meteorological conditions.
- The pilot shall not fly within 1nm of any Aerodrome. (indoors would be acceptable)
- The Certificate holder shall not require any pilot to operate the controls of the UAV if either the pilot or the Certificate holder has any reason to believe that the pilot is suffering or is likely to suffer from fatigue so that they are unfit to perform their duties.
- No pilot shall operate the UAV system within eight hours after consuming an alcoholic beverage or while under the influence of alcohol or while using any drug that impairs the person's faculties to the extent that the safety of the operation is endangered in any way.
- Every crewmember engaged in the operation of the UAV system shall, during flight time, comply with the instructions of the pilot-in-command, and/or Race Director.
- Only one UAV shall be operated in-flight by a single pilot at any one time.
- No pilot shall operate the UAV unless it is operated in accordance with the CARs (of the Canadian Federal Drone Racing operating limitations).
- The Certificate holder shall not permit the use of a portable electronic device at the control station of a UAV system where the device may impair the functioning of the systems or equipment.
- Prior to conducting flight, the pilot shall ensure that the UAV System is in an airworthy condition.
- The Certificate holder shall not permit UAV operations to be conducted unless the following operational and emergency equipment is immediately available to the appropriate crew member(s):
    a. checklists or placards that enable the UAV system to be operated in accordance with the UAV system flight manual; and
    b. a hand-held fire extinguisher of a type suitable for extinguishing fires that are likely to occur.
- The Certificate holder shall adhere to the security plan in accordance with the information provided in the SFOC application.
- The Certificate holder shall adhere to the emergency contingency plan in accordance with the information provided in the SFOC application.
- The Certificate holder shall maintain an adequate management organization that is

capable of exercising supervision and operational control over persons participating in the event.

- The certificate holder shall ensure that participants are qualified for the type of event to be flown and provided with a briefing that meets the Special Flight Operations Standards. See Appendix A
- The Certificate holder shall ensure UAV systems are properly equipped for the area of operation and the type of operation.
- The Certificate holder shall conduct a safe operation.
- The Certificate holder shall cease operations if at any time the safety of other airspace users or persons or property on the ground is in jeopardy or if unable to comply with the conditions of this Certificate.
- All UAV flight paths shall be designed such as to be parallel or away in respect of the spectator/media viewing area, without creating any “direct” energy vector towards the mentioned viewing area.

Meteorological Conditions.

- For outside locations, visual observer(s) must be continuously scanning the airspace in which the event is operating to decisively see and avoid other air traffic or objects;
- For outside locations, flight paths will be within 50 (15 meters) of the surface of the ground or structure of the building.
- For outside locations, prior to operations, the Certificate holder shall confirm each UAV systems ‘Fail-Safe Drop’ system is functional, and any ‘lost link’ or ‘fly-away’ will automatically terminate flight.
- For outside locations, the Certificate holder shall ensure that the appropriate air traffic service unit(s) is advised immediately anytime the flight of the UAV is no longer under the control of the pilot and inadvertent entry into controlled airspace occurs or is likely to occur.

General Flight Conditions

- No pilot shall operate the UAV system in such a reckless or negligent manner as to endanger or be likely to endanger the life or property of any person.
- The pilot shall follow the normal and emergency procedures in accordance with the Rules and Regulations of the Canadian Federal Drone Racing operating limitations, as set out in the SFOC application.
- The pilot shall follow the lost link procedures in accordance with the information provided in the SFOC application.
- No pilot shall conduct a take-off/launch of the UAV unless the risk involved with lost link circumstances has been assessed and a determination has been made as to when auto-recovery maneuvers or flight termination shall be initiated.
- The pilot shall confirm that no unacceptable radio frequency interference is present prior to flight, nor is likely to be present during flight.

- No pilot shall operate the UAV in known or forecast icing conditions.
- The pilot shall ensure that the appropriate air traffic service unit(s) is advised immediately anytime the flight of the UAV is no longer under the control of the pilot and inadvertent entry into controlled airspace occurs or is likely to occur.
- No pilot shall operate the UAV at a lateral distance of less than 100 feet unless;
    a. the building, vehicle or vessel is the subject of the aerial work, and
    b. only persons inherent to the operation are present.
- No pilot shall operate the UAV at a lateral distance of less than 100 feet from the general public, spectators, bystanders or any person not associated with the operation, unless:
    a. a safety barrier is erected between the area of operation and the general public, spectators and bystanders; and
    b. a notice board is posted at all points of entry detailing the risks and associated hazards of UAV operations.

Personnel Conditions

- The Certificate holder shall ensure that all personnel are appropriately trained and qualified for the area of operation and the type of operation.
- No pilot shall operate the UAV unless they are medically fit to conduct their required duties.

Summary

These rules and regulations are established through the Canadian Federation for Drone Racing Rules Advisory Committee Safe Operational Procedures and Specifications Committee and the Industry & Transport Canada Advisory Committee. It is our intention that these rules will help guide and act as a clear definition for competitive drone racing nationwide.