

Hummingbird Drones

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Kamloops, B.C.
Canada
V2C 5V9

April 2, 2015

Dave Marek
Superintendent, Aviation Management
3080 Airport Drive
Kamloops, B.C.
V2B 7X2

Mr. Marek,

Re: Unmanned Aerial Vehicle Flights Over Wildfires for the Wildfire Management Branch

Hummingbird Drones (Hummingbird) is a Kamloops based company providing unmanned aerial vehicle (UAVs or Drones) services to industry and government. Hummingbird will be submitting an Expression of Interest to the Wildfire Management Branch (WMB), as part of the upcoming REI on BC Bid, to supply real time aerial data collection and mapping services on wildfires.

In order to provide such services, Hummingbird needs a Special Flight Operations Certificate (SFOC) from Transport Canada. Transport Canada is willing to issue a SFOC to Hummingbird for the entire 2015 fire season (May 1 – November 30, 2015) to allow us to fly UAVs within the Class F restricted airspace above a wildfire, with the WMB's permission. The extensive SFOC application is near completion. As part of the application, Transport Canada requires a letter from the Wildfire Management Branch stating *'the WMB will consider using Hummingbird Drones to conduct unmanned aerial vehicle flights within Class F restricted air space above wildfires on an as required basis.'*

This letter does not place the WMB under any obligation to use Hummingbird, nor does it give permission to Hummingbird to operate above wildfires. It is simply an acknowledgement that the WMB may use or test these services during the 2015 wildfire season. An SFOC will not be provided to Hummingbird by Transport Canada without a letter from the WMB. The SFOC process will take 30-60 days to complete, so a timely decision is required to move this process forward in preparation for the 2015 fire season.

Hummingbird Drones has proven UAVs and technology that will greatly enhance the ability of the Wildfire Management Branch to safely and efficiently manage B.C.'s wildfire suppression activities through a wide range of real time digital mapping services. To test and prove the value of these services, the WMB needs to acknowledge in writing that they are willing to allow Hummingbird to operate in the restricted airspace above a wildfire subject to the WMB's own policies and procedures.

This will allow Hummingbird to apply for and receive a SFOC from Transport Canada to legally carry out flight operations.

I am requesting a letter, as described above, from the WMB that will allow us to move forward with our SFOC application so we can demonstrate our high quality services under actual wildfire conditions.

Thank you for your consideration.

A handwritten signature in black ink, appearing to read "R Atwood". The signature is stylized with a large, looped "R" and a cursive "Atwood".

Robert Atwood
President & CEO
250.877.7082

**RESTRICTED OPERATOR
COMPLEX APPLICATION PROCESS**

**FOR A SPECIAL FLIGHT OPERATIONS CERTIFICATE FOR THE
OPERATION OF UNMANNED AERIAL VEHICLES BY HUMMINGBIRD
DRONES UNDER THE JURISDICTION OF BRITISH COLUMBIA'S
WILDFIRE MANAGEMENT BRANCH WITHIN RESTRICTED
AIRSPACE FOR THE DURATION OF THE 2015 WILDFIRE SEASON
(MAY 1ST – NOVEMBER 30TH)**

Submitted to Transport Canada:

April 13th, 2015



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Purpose I

This document was produced by Hummingbird Drones in order to supply Transport Canada with an operating procedure that is in compliance with Unmanned Aerial Vehicle (UAV) regulations. The purpose of the operations manual is to provide a detailed description of standard operating procedures (SOPs) for fire-line operations conducted by Hummingbird Drones under the jurisdiction of the Wildfire Management Branch (WMB) between the months of May 2015 to November 2015. The details herein are for operations throughout the fire season in restricted airspace.

The prepared documentation herein follows the guidelines set forth by Transport Canada to be granted a Special Flight Operations Certificate (SFOC); it is adherent to all requirements of the *Canadian Aviation Regulation standard (CARs) 623.65(d)*.

Part 1: Review Checklist – (SI 623-001, Section 8)

Applicant Name 8.1 – [CARs 623.65(d)(3)(a)]

(1) Name of Applicant

Hummingbird Drones

Telephone

Primary: 250.877.7082

Alternate: 250.842.8052

Alternate: 250.571.9840

Address

Hummingbird Drones

s.22

Kamloops, B.C.

Canada

s.22

Operations Manager 8.2 – [CARs 623.65(d)(3)(b)]

(1) (a) Name of Operations Manager

Robert Atwood

Telephone

250.877.7082

E-mail

s.22

r.atwood@hummingbirddrones.ca

info@hummingbirddrones.ca

Address

s.22

Kamloops, B.C.

Canada

s.22

Qualifications of Operations Manager 8.2 – [CARs 623.65(d)(3)(b)]

- (1) (b) Robert Atwood is qualified to oversee all aerial operations pertaining to this project. He has three (3) years of fire line experience in different roles with the Wildfire Management Branch. He is aware of both the technological and regulatory limitations of UAVs on the fire-line. He understands the communication structure of the Wildfire Management Branch (WMB). He understands how aircraft are currently used on the fire-line and the protocols surrounding aerial operations within the Wildlife Management Branch. He understands the safety protocol of the Wildfire Management Branch.

s.22

Means of contacting the Operations Manager during flight operations 8.3 – [CARs 623.65(d)(3)(c)]

- (1) The Operations Manager can be contacted at all times during flight operations via a dedicated WMB radio and frequency. The dedicated frequency will be established by the WMB representative in control of air operations on the specific fire. Backup cellphone or e-mail contacts will also be available during operations. Robert Atwood's phone number is 250.877.7082 and may be contacted via e-mail by s.22 or r.atwood@hummingbirdrones.ca. If consistent cell coverage is not available as a backup contact system, a satellite phone will be used as the backup contact method. The satellite phone number will be provided to Transport Canada before specific operations commence.

Type and purpose of operation 8.4 – [CARs 623.65(d)(3)(d)]

- (1) This SFOC seeks authorization from Transport Canada to conduct aerial operations throughout the 2015 fire season within British Columbia. Under the jurisdiction of the MoFLNRO's Wildfire Management Branch and within the controlled airspace above a wildfire as per CARs 601.15 and 16

Forest Fire Aircraft Operating Restrictions

601.15 No person shall operate an aircraft

- (a) over a forest fire area, or over any area that is located within five nautical miles of a forest fire area, at an altitude of less than 3,000 feet AGL; or
- (b) in any airspace that is described in a NOTAM issued pursuant to section 601.16.

Issuance of NOTAM for Forest Fire Aircraft Operating Restrictions

601.16 The Minister may issue a NOTAM that relates to restrictions on the operation of aircraft in the case of a forest fire and that describes

- *(a) the location and dimensions of the forest fire area; and*
- *(b) the airspace in which forest fire control operations are being conducted.*

(2) Hummingbird Drones will operate under VLOS conditions under this SFOC certificate. The purpose of the operations is to provide the Wildfire Management Branch with real-time data acquisition services for the purposes of fire line mapping, hot-spot locating and area of interest reconnaissance. Hummingbird Drones will provide the services of acquiring the aerial data necessary to produce georeferenced maps in order to help Incident Command Teams and Fire-line Managers better plan fire line tactics and geolocations of smoldering fires to help crews more efficiently extinguish fires. Hummingbird Drones will be responsible for both data acquisition and post-processing activities. All operations will be conducted in airspace under the jurisdiction of the Wildfire Management Branch. Both daytime nighttime operations may be conducted.

(1) (c) Hummingbird Drones will utilize UAVs on the fire line in three capacities.

1. Hot-spot locating

This is the process of locating smoldering embers on the landscape after the fire has moved through an area. We will be using UAVs equipped with infrared sensors in order to locate heat. The data will be processed and coordinates will be supplied to ground crews to locate the hot-spots on the landscape.

2. Fire-line mapping

This process involves flying grid patterns and collecting vertical photographs in order to create a map. Having up-to-date visuals of the landscape will greatly enhance the ability of the Incident Command Team or Fire-line Manager in drawing up effective fire suppression tactics.

3. Photograph and video acquisition

This is will entail taking pictures or videos of areas of interest within the controlled airspace, as decided upon by the Incident Command Team or Fire-line Manager.

Associated Risk Mitigations

Primarily, Hummingbird Drones will be conducting fire-line operations during periods of the day in which there are no other aircraft or fire-line personnel on site such as just after first light and in the evening hours after fire-line air operations have ceased. Manned aerial operations do not occur during the night. These times coincide with very limited fire-line activity and ground personnel. As such, there will be little to no risk to either fire-line personnel or aircraft. Nonetheless, the following protocol will be followed to ensure the highest degree of risk mitigation of UAV operations on the fire-line.

Hummingbird Drones would like to gently remind the reader that sometimes fire landscapes extend for hundreds of thousands of hectares or hundreds of kilometers. Fire-line operations are often divided into geographic areas called Branches for both aerial and ground operations. While aircraft may not be active in one Branch of the fire, they may be present in another. Because Hummingbird Drones will never work in the direct vicinity of other aircraft, when references are made to other airborne aircraft below, it is strictly to those aircraft which are operating at such great distances from Hummingbird Drones' operations that it is reasonable to conclude that they are not, in any way, threatened by the presence of Hummingbird Drones' UAVs. Branch by Branch aerial fire-line operations will be coordinated through the Wildfire Incident Commander or designated WMB fire-line personnel.

a) Aircraft

Hummingbird Drones will perform the tasks of hot-spot locating, fire-line mapping and photograph and video acquisition operations with the permission of the Incident Commander or designated fire-line staff. Hummingbird Drones will conduct aerial operations based on a direct request by the designated on site personnel from the WMB or Fire Centre Staff as per the WMB standard procedures. Permission to conduct the UAV operations within Wildfire Management Branch controlled airspace will be confirmed with the Incident Commander before actual operations begin.

Fire Centre Dispatch and the Incident Commander or his designate will both grant or deny permission to Hummingbird Drones' request to conduct aerial operations. They will confirm that there is no other aircraft within the active operations area of Hummingbird Drones' prior to granting permission as per WMB standard procedures.

Once granted permission, Hummingbird Drones' personnel will conduct a visual and auditory scan of the airspace ensuring that there are no other aircraft in close vicinity of their proposed area of operation. Upon commencement of aerial operations, Hummingbird Drones' personnel will inform the Incident Commander, and/or the on-site WMB representative as agreed upon, that aerial operations have commenced. Upon termination of operations, Hummingbird Drones' personnel will inform the Incident Commander and/or the on-site WMB representative as agreed upon, that aerial operations have terminated.

In the event of a fly-away, the Incident Commander (or designate) and Transport Canada will all immediately be contacted. WMB standard procedures will be followed regarding the contact of other aircraft and fire-line personnel in the area.

i. Aircraft not involved with fire-line operations

All aerial operations conducted under this SFOC pertain to operations within airspace under the jurisdiction of British Columbia's Ministry of Forests, Lands and Natural Resource Operations - Wildfire Management Branch. As such, no aircraft not directly related to fire-line operations and in contact with both Hummingbird Drones and the Incident Commander will be operating within this airspace. In the event of unauthorized entry into the airspace by other aircraft, Hummingbird will immediately cease all aerial operations and wait for permission from designated on site WMB personnel before continuing with aerial operations.

b) Fire-line personnel

All fire-line personnel working in proximity of Hummingbird Drones' will be briefed on the hazards of UAVs during the daily safety meeting prior to operations. A standard safety briefing will be provided to the Incident Commander or his designate before aerial operations commence. This briefing will be placed in the fire Incident Action Plan (IAP) when provided by the WMB, available to all fire-line personnel. Hummingbird Drones' will be in radio contact, on designated WMB frequencies, with all fire-line personnel throughout the duration of their aerial operations. Fire-line personnel will be privy to communication between Hummingbird Drones and the Incident Commander and as such will be informed on the current status of flight operations.

In the event of an emergency, Hummingbird Drones will contact the crew supervisor, crew leader or squad boss or whomever has been charged with overseeing the ground crews adjacent to the aerial operations area and inform them of the emergency event. Hummingbird Drones' personnel will do their best to advise the ground crews as to the best course of action (i.e. seek cover). Hummingbird Drones' personnel will inform ground crews supervisor when the emergency event is over.

All fire-line personnel have been certified with their Occupational First-Aid Level 1 and Transportation Endorsement. It is a requirement that a percentage of fire-line personnel have their Occupational First Aid Level 3 training. Furthermore, all fire-line personnel are outfitted with extensive Personal Protective Equipment (PPE). This includes equipment which protects against falling objects (i.e. hard-helmets), protects against dangers to the eyes (e.g. face-shield visors) and protects against dangers to the skin (e.g. gloves, Nomex clothing).

i. Non-fire line personnel

Areas in which fire-line activity are being conducted is closed to the public and all non-fire-line personnel. Any no-fire-line personnel permitted on site, such as media or local ranchers, will be briefed on the use of UAVs on the fire-line and provided with basic safety procedures.

c) Visual contact

While all operations described herein pertain to those conducted under VLOS, Hummingbird Drones may extend a particular operation under Operational VLOS. A flight may be conducted outside of the line-of-sight of the Pilot provided the UAV is always in line-of-sight of at least one (1) personnel designated as a Spotter who is in direct communication via a two-way radio on a designated Wildfire Management Branch radio frequency with the Pilot. Such operations will be coordinated ahead of time and when involving non-Hummingbird Drones' personnel the extension spotters will be trained on the operational language, operational expectations, hazards to the operation, purpose of the operation, operational safety procedures etc.

i) Night operations

Night operations will be conducted in accordance with all operational guidelines set-forth within this SFOC. In addition, any craft used for night operations will be properly outfitted with lights to ensure visual contact with the craft is maintained at all times.

Dates, alternative dates and times of the proposed operations 8.5 – [CARs 623.65(d)(3)(e)]

Hummingbird is requesting permission to fly between the dates of:

May 1st 2015 – November 30th 2015

It is understood by Hummingbird Drones that the sanctions granted by this SFOC from Transport Canada during this time frame will only pertain to operations which occur in airspace under the jurisdiction of the Wildfire Management Branch.

A complete description of the aircraft to be flown 8.6 – [CARs 623.65(d)(3)(f)]

(1) Hummingbird Drones will use light, multi-rotor quadcopters for all fire-line operations outlined in this SFOC. Currently, Hummingbird Drones only employs craft from the manufacturer DJI. Hummingbird Drones' current fleet consists of three craft:

- Phantom 2
- Phantom Vision 2+
- Inspire 1

A complete description of the craft may be found at the manufacturer's website

www.dji.com/products

Hummingbird Drones will ensure that the acquisition of new craft to be employed on the fire-line for the 2015 fire season will not deviate substantially in size or type from the currently used craft.

All aircraft will have undergone testing to prove airworthiness prior to being engaged on the fire-line. This will include:

- Minimum of five (5) logged flights
- Functionality of return-to-home feature will be confirmed
- Functionality of on-board GPS trackers will be confirmed

Flight logs will be maintained for each craft and a daily pre-flight checklist (included in Appendix B) will be performed by the pilot to further ensure airworthiness of the UAV. These checklists will be conducted by the owner or operator of the UAV.

In the event that Hummingbird Drones is required to seek a sub-contractor due to high demand to help fulfill contract obligations, Hummingbird Drones acknowledges that the sub-contractor will be operating as their employee under the conditions outlined in this SFOC. While Hummingbird Drones believes a higher utility may be derived from smaller UAVs than larger ones and are committed to maximizing their functionality, they acknowledge too that the ideologies of UAV applications that sub-contractors may possess may not be the same as theirs. Regardless, All Hummingbird UAVs will be in the small UAV category of less than 25 kg take-off weight.

Security plan for areas of operation 8.7 – [CARs 623.65(d)(3)(g)]

(1) As described in **Associated Risk Mitigations** (p. 7 – 8) Hummingbird Drones will adhere to number of safe practices designed at mitigating factors of risk. They include:

1. Primarily conducting aerial operations during periods of low activity by fire-line personnel and aircraft such as during the early morning or late in the evening.
2. All aerial operations will be conducted under Visual Line Of Site (VLOS) procedures. A pilot and visual observer will be present on all VLOS flights.
3. Ensuring that Hummingbird Drones has the permission of the wildfire Incident Commander or designate each and every time they enter the airspace.
4. Operate on a dedicated WMB frequency during aerial operations. Have a backup communication system in place and tested before operations begin.
5. Communicating the status of each aerial operation to the Incident Commander and all nearby ground crews as per WMB procedures.
6. Ensuring through confirmation of the Incident Commander that there are no other aircraft operating in the direct vicinity of the operation.

7. Visually and audibly scanning the airspace for aircraft prior to taking off in the event of unapproved aircraft within the forest fire operations airspace.
8. In the case of an emergency, the Incident Commander and all nearby ground crews will be informed. Hummingbird Personnel will advise these parties as to the best course of action.
9. In the case of an emergency in the form of a fly-away, the Incident Commander, all nearby ground crews and Transport Canada will be informed. WMB standard procedures to cover this eventuality will be followed until such time as the UAV has been located and the threat mitigated or until the time that it can reasonably be assumed that the aircraft has ran out of battery.
10. Fire-line personnel working in the vicinity of UAV operations will be informed of the potential hazards that UAVs pose, the possible course of actions that crews may have to take in the event of an emergency, and the proposed operations of the UAV for that day during their daily pre-work safety meeting, and the Incident Action Plan when provided.
11. Hummingbird Drones will never intentionally fly aircraft directly overhead of fire-line personnel.
12. This SFOC permits Hummingbird Drones to conduct fire-line operations only within airspace controlled by the Wildfire Management Branch as per 605.15 and 16. This means that civilian aircraft or aircraft that are not in radio contact with each of the Incident Commander and Hummingbird Drones will not be present in the airspace in which Hummingbird Drones will be conducting operations.
13. Members of the public are restricted from entering areas in which wildfire suppression activity is being undertaken and as such, Hummingbird Drones UAV operations pose no threat to members of the public.
14. Take-off and landing sites will be identified to all fire-line personnel, marked with appropriate signage and blocked off from vehicle and personnel traffic during the duration of the aerial operations. Locations of these sites will be on Crown land designated by the Incident Commander or Forest Officer or on private land with the written permission of the landowner.
15. All aerial operations will be conducted with at least two Hummingbird employees or sub-contractors on site. An operator or 'pilot' plus a visual observer to support Visual Line Of Site (VLOS) operations.
16. To re-iterate most fire-line operations conducted by Hummingbird Drones will occur during periods of inactivity by both fire-line personnel and aircraft in order to maximize site safety.

Furthermore, security plans for areas in which Hummingbird Drones is going to be operating will be further enhanced by:

17. Internal philosophy that the highest aerial utility can be derived from a small, lightweight UAVs.
18. Employing individuals with wildfire suppression experience, past Wildfire Management Branch employees. Hummingbird Drones' fire-line operations will be conducted by those with a detailed understanding of the complexities of wildfire suppression aerial and

ground operations. The Incident Command System that the Wildfire Management Branch employs to govern fire-line operations, the communication structure of fire-line operations and safety the protocol of fire-line operations is well understood by both members of management and flight crew personnel within Hummingbird Drones.

19. A designated individual within the fire-line organization will be tasked with coordinating UAV operations. This individual will be in direct contact with Hummingbird personnel during all aerial operations.
20. Pre-flight checklists will be filled out by Hummingbird Drones' personnel prior to each day's operations to ensure airworthiness of the UAV.
21. In the event that Hummingbird Drones has been requested to fly over an area which has private structures beneath, they will ensure through the Wildfire Management Branch chain of command that permission to undertake wildfire suppression activity on the property has been approved by the landowner or other approved individual, and that all risks inherent to wildfire suppression including UAV operations have been accepted.

Emergency Contingency Plan 8.8 – [CARs 623.65(d)(3)(h)]

- (1) While emergency procedures have been touched-upon in **Associated Risk Mitigations** (p. 7 – 8) and ***Security plan for areas of operation 8.7 – [CARs 623.65(d)(3)(g)]*** (p. 10 – 11) a thorough contingency plan is covered herein.

A) Non-hazardous crash

A crash is considered to be non-hazardous when the UAV crashes but does not pose a threat to fire-line personnel, fire-line aircraft or fire-line operations in any way. For example, if a UAV crashes into and gets stuck in a tree. In this case, once the motors have been disengaged and an area around the tree has been cordoned off, the UAV ceases to pose a threat to fire-line personnel and aircraft. In a scenario like this, Hummingbird Drones' protocol will be to contact the Incident Commander to inform of the crash and to let them know that the UAV does not pose a threat to continued fire-line operations. Hummingbird Drones' personnel will then inform on-site fire line personnel of the downed UAV and begin recovery efforts of the UAV provided it is safe to do so. Hummingbird Drones will cease operations until it has been declared safe by the Incident Commander, or his designate, to recommence.

B) Hazardous crash

In the event that the UAV crashes and endangers fire-line personnel, fire-line aircraft, fire-line equipment or any aspect of a fire-line operation, Hummingbird Drones will immediately contact the Incident Commander Director and inform them of the incident. While reactions and protocol will vary depending on the incident. Hummingbird Drones will conduct themselves in a way that is in accordance with Wildfire Management Branch procedure as well as the legal responsible duties of the UAV's pilot, visual observer, ground manager and operations manager. Provided the incident is not considered severe (i.e. dented a truck, frightened fire-line personnel), Hummingbird Drones will cease operations and review safety

and operating procedure. They will identify the shortcomings in their operational procedure, rectify it, and with permission of the Incident Commander, resume operations.

In the event of a severe crash (i.e. striking of fire-line personnel, striking an airborne manned aircraft) the response would be one in which Wildfire Management Branch would assume control of the emergency situation and Hummingbird personnel would conduct themselves accordingly. As such events have the potential to be catastrophic, the likelihood that Hummingbird Drones will be working around wildfire personnel is low and the likelihood of Hummingbird Drones' working around approved airborne aircraft is zero. Hummingbird Drones realizes that despite the very unlikely possibility of a severe hazardous crash occurring due to the standard operating procedures they have implemented, it must be planned for. Hummingbird Drones' personnel will ensure that they conduct themselves and their aerial operations in such a way that risk is minimized.

C) Fly away or loss of visual contact

In the event that an onboard computer malfunction occurs and the UAV ceases to respond to the commands issued by the receiver, Hummingbird Drones' personnel will immediately contact the Incident Commander or his designate. We will request that all other aerial operations on the fire-line cease until the incident is over and follow standard WMB procedures. They will also inform all on-site fire-line personnel and make recommended action based on the flight trajectory of the UAV. The grounding will remain in effect until it can reasonably be assumed that the rogue UAV has crashed and/or run out of batteries. Hummingbird Drones will contact Transport Canada and inform them of the fly-away.

Ground Supervisor 8.9 – [CARs 623.65(d)(3)(i)]

(1) The contact information for the Ground Supervisor of a particular operation will be available to both the Operations Manager and the Incident Commander. For the purpose of this SFOC, that person will be;

Robert Atwood

Telephone

250.877.7082

E-mail

s.22

r.atwood@hummingbirddrones.ca

info@hummingbirddrones.ca

Address

s.22

Kamloops, B.C.

Canada

s.22

- (1) (b) The Ground Supervisor will be someone who has completed the required flight certification course that is compliant with Hummingbird Drones' internal operating procedure, is well-versed in Wildfire Management Branch fire-line operations and has established themselves as a credible and safety-oriented leader within the management team of Hummingbird Drones. The training will include a review of;

Knowledge Requirements for
Pilots of Unmanned Air Vehicle Systems
UAV 25 kg or less,
Operating within Visual Line of Sight
First Edition
August 2014

Detailed Operations Plan 8.10 – [CARs 623.65(d)(3)(j)]

- (1) Due to the unpredictable nature of wildfire occurrences, Hummingbird Drones is requesting blanket permission from Transport Canada to fly UAVs as part of British Columbia's Wildfire Management Branch fire-line operations for the duration of the 2015 fire-season (May 1st, 2015 to November 30th, 2015) with the controlled airspace as per CARs 605.15 and 16.
- (a) Upon approach and departure of the particular flight operations area, Hummingbird Drones will ascend and descent vertically to ensure nobody enters the flight path. They will ascend to heights which exceed all obstacles in the vicinity. This height will be established as part of a site survey utilizing the best available maps as part of our pre-work operations planning. Hummingbird Drones will always choose approach and departure paths which maximize the safety of fire-line personnel in the vicinity.
- (b) Site specific site surveys will be conducted before aerial operations on all wildfires. The site survey will include geographic and structural conditions, and the location of fire-line resources. As such, these site surveys will have to be re-visited before each aerial operation. Confirming with the WMB staff that there will be no aircraft in the vicinity during the maximum time frame established for the aerial operations will be part of this procedure.
- (c) The boundaries of each operations area will not exceed the limits of the controlled airspace as specified in CARs 605.15 and 16.
- (d) When conditions are suitable, Hummingbird Drones is requesting permission to fly to altitudes of up to 500 m above ground level. Minimum height above ground level will be fifty meters to avoid all vertical structures such as trees and low voltage transmission lines.
- (2) Hummingbird Drones will only be conducting the aerial operations within controlled airspace under the jurisdiction of the Wildfire Management Branch and in accordance with the directions of the Incident Commander.

Part 2: Complex Operator Checklist (SI 623-001, Section 10)

10.4 (2)

(a) Personnel Qualifications

(i) Hummingbird Drones' Chief Pilot

Richard Sullivan – Richard Sullivan has been designated Hummingbird Drones' Chief Pilot for 2015. He has demonstrated proficiency at planning and conducting piloting activities for UAV operations for nearly a year. Prior to the commencement of 2015 fire-operations he will have completed the Canadian Centre for Unmanned Aerial Systems ground school. He will also have obtained a Canadian Restricted Radio Operator's License (Air).

He has spent two years serving as an Initial Attack Crew Leader and five years as a Unit Crew Member within British Columbia's Wildfire Management Branch. He has experience coordinating aerial operations on the fire-line and understands the language and procedural requirements necessary to safely work on a fire-line.

His contact information is as follows:

Name: Richard Sullivan

Phone: 250.877.7082

E-mail: s.22 or r.sullivan@hummingbirddrones.ca

(i) (a) Hummingbird Drones' Pilots

All Hummingbird Drones' Pilots for the 2015 fire-season covered under this SFOC will have met the following training criteria:

1. Certificate of ground school completion from the Canadian Centre for Unmanned Aerial Systems or an equivalent ground school
2. Canadian Restricted Radio Operator's License
3. Review of: Knowledge Requirements for **Pilots of Unmanned Air Vehicle Systems**
UAV 25 kg or less,
Operating within Visual Line of Sight
First Edition
August 2014
4. Having demonstrated proficiency handling airborne UAVs in front of Hummingbird Drones' personnel
5. Familiarity with employed aircraft
6. Five (5) logged flights using Hummingbird Drones' equipment prior to flying on the fireline

7. Minimum of 18 years of age
8. Proficient English language abilities
9. Demonstrated a level of physical fitness suitable to strenuous outdoors activity

A working knowledge of:

- a. Transport Canada policies, guidance material and the applicable UAV related regulations in the CARs.
- b. The class of airspace in which they intend to operate including the vertical and horizontal airspace boundaries and determining adjacent classes of airspace .
- c. Air Traffic Control (ATC) services and procedures (where the operation is conducted in, or near, controlled airspace).
- d. Wildfire Management Branch aerial communication services and procedures.
- e. The effect of weather on UAV performance and the ability to identify critical weather situations.
- f. The identification of hazardous in-flight situations and collision avoidance requirements and procedures.
- g. Ability to accurately conduct site surveys and pre-flight checklists.
- h. Type specific UAV systems, limitations, normal procedures and emergency procedures

(ii) Hummingbird Drones' Payload Operators

Hummingbird Drones will not have designated Payload Operators. Operations personnel will not adjust the payload of the UAV after take-off. The UAV payload will be adjusted on the ground prior to the commencement of operations. It is Hummingbird Drones' desire to ensure the pilot has the fewest distractions possible while the UAV is airborne.

(iii) Hummingbird Drones' Visual Observers

Hummingbird Drones' Visual Observers for the 2015 fire-season covered under this SFOC will have met the following training criteria:

1. Minimum 18 years of age
2. Visual acuity sufficient to meet their duties
3. They will have undergone Hummingbird Drones' training for the following aerial operations and hazard mitigations techniques:
 - a. Visual Scanning techniques
 - b. Inter-crew communication requirements
 - c. Hazardous in-flight weather conditions
 - d. The actions to be taken in the event in the event of a risk of collision develops
 - e. The vertical and horizontal boundaries of the operation

- f. Right of way rules as specified within this SFOC
- g. The UAV system limitations

(iv) Hummingbird Drones' System Maintainers

Hummingbird Drones will employ three methods of system maintenance:

Pre-flight Inspections – These will be performed by the flight crew on a daily basis prior to aerial operations. The flight crew will be trained on the basic maintenance of the UAV based on the manufacturer's guidelines.

Preventative Maintenance Inspections – After each operational period preventative maintenance will occur which will more thoroughly examine the integrity of the aircraft.

Annual Maintenance Inspections – Hummingbird Drones will have their aircraft inspected once annually by an external organization whose primary business is the development and production of UAV systems.

Hummingbird Drones' System Maintainers for the 2015 fire-season covered under this SFOC will have met the following training criteria:

1. Minimum 18 years of age
2. Trained on basic craft maintenance

(b) UAV System Airworthiness and Continuing Airworthiness

(i) UAV System Airworthiness

(A) Description of how aircraft and systems will be deemed airworthy

I. UAV system designed to facilitate control of the UAV by the pilot and that will provide clear indications of UAV flight status will be used. An example of a UAV system designed to perform these operations and likely to be used by Hummingbird Drones is:

1. DJI Ground Station. Details outlining all DJI Ground Station specifications has been included, See [PC DJI Ground Station Specs](#).

II. To ensure UAVs are operated within flight envelope:

All company UAVs function under the integrated GPS Atti. Mode software which limits the craft to certain flight parameters to ensure safety. Integrated GPS Atti. Mode limitations include:

- (a) Command Stick meaning: Helicopter attitude control; Stick center position for 0° attitude, its endpoint for 45° which is a fixed limit.
- (b) Command Linearity: Yes

- (c) Stick Released: Lock the position when GPS signal is adequate
- (d) Altitude lock: Maintain the altitude best above 3 meter
- (e) GPS lost: After 10 seconds when GPS signal lost, system enters Atti. Mode automatically
- (f) Attitude & speed mixture control ensures stability
- (g) Enhanced fail-safe featured, auto hover or Go-Home if transmitter signal lost

III. Redundancy of flight critical components to ensure safe recovery of the UAV include:

- (a) Flight termination system features will be utilized in the event of a flyaway or if the aircraft is operating questionably. This feature will shut down the engines of the aircraft.
- (b) A live feed will be transmitted back to the operator and visual observer and will be monitored continuously.
- (c) While the aircraft is in flight FLYTREX will record and transmit flight paths. Recorded flight paths in conjunction with the last known location of the UAV and the live video feed from the craft will be used to determine location of missing UAV.

IV. Operational history

- (a) Hummingbird Drones have not had any aircraft malfunctions, flyaways, or crashes.

V. Authorization of government body

- (a) The Wildfire Management Branch will issued authority to Hummingbird Drones to operate UAVs prior to aerial operations.

(i) UAV System Maintenance

(A) Description of maintenance

VI. Maintenance and inspections manuals

- (a) Maintenance and inspection manuals have been completed and will be included in the on-site operational/legal documentation. UAV hardware inspections will be completed once a year or after an aviation incident by Heli Video Pros out of Vancouver, British Columbia.

VII. Maintenance and inspection plan/schedule:

Pre-flight Checklist

- (a) Check condition of props (run finger along leading and trailing edges, flex both blades to check for hairline cracks)
- (b) Check motor shafts have no free play (missing E clip? Loose bell housing screw? Bad bearings?)
- (c) Check motors move freely when spun by hand

- (d) Check condition of battery spade connectors and data pins (level, free movement, clean)
- (e) Check camera mounts are secure (and any other attachments, e.g. Flytrex core)
- (f) When powered up and idling confirm no unusual noise or vibration from motors.

Preventative Maintenance Inspections

- (a) Visual inspection of shell and other plastic components for cracking/damage (landing skids, camera mounting plates, etc.)
- (b) Check tightness of motor retaining screws and shell retaining screws (both 2.0mm hex)
- (c) Clean data spring pins and battery contact pads with alcohol and swab or proprietary electrical contact cleaner and cycle spring pins several times to check for spring weakness and full unimpeded travel

Annual Maintenance Inspections

- (a) Annual maintenance will be out-sourced to private contact companies

VIII. Who established the maintenance schedule?

- (a) Hummingbird Drones’ Chief Pilot Richard Sullivan established the maintenance schedule outlined herein after extensively researching the DJI Manufacturing Recommendations, online expert opinion and online resources.

IX. Keeping of maintenance records

- (a) Maintenance records will be kept in a binder with the crew conducting the aerial operations at all times. A second copy of the maintenance record will be kept at the Hummingbird headquarters and will be accessible at any time.

(c) Operations

(i) Operational flight rules

(A) As unmanned aerial vehicles may become a flight risk to operation personnel, uninvolved personnel, and other airspace users, specific flight conditions are required to ensure safety. Specific flight conditions required by Transport Canada includes information detailed in Section 6.20 of the Staff Instructions (SI) No. 623-001.

1. Right of Way

- (a) The person in command (PIC) of the small UAV will give way to manned aircraft at all times.
- (b) Section 602.19 of the CARs will not apply within this SFOC; shall the UAV become at risk to collision, or if another aircraft enters the same airspace class as the UAV under this certificate, the UAV shall land as soon as possible under safe conditions.

- (c) Working within Class F airspace during forest fire operations can involve multiple aircraft; under these conditions, the UAV shall be coordinated to fly during times with no or minimal manned aircraft operations, controlled by the corresponding Fire Center Control Dispatch, coordinated by the Incident Commander or Aerial Branch Director on the fire.

2. Weather Requirements

- (a) Operations of the UAV in VFR within controlled airspace will occur under minimum visual meteorological conditions, including:
 - (b) UAV operated with visual reference to the surface; Flight visibility is not less than three miles,
 - (c) The distance of the aircraft from cloud is not less than 500 feet vertically and one mile horizontally,
 - (d) Where the aircraft is operated within a control zone, when reported, ground visibility is not less than three miles ,
 - (e) all other requirements met through the control space director, including the distance of the aircraft from the surface (usually not less than 500 feet for manned aircraft).
 - (f) For extending VLOS operations with visual observers, conducted under Visual Flight Rules (VFR), the visual meteorological conditions in Part VI, Subpart 2 of the CARs (602.114 – 602.117) will be applied,
 - (g) All extended VLOS portion of the operations will be contained wholly within restricted airspace,
 - (h) Visual observers will be able to communicate with each other and WMB staff using dedicated WMB frequencies on 2-way handheld radios,
 - (i) UAV operated with visual reference to the surface
 - (j) Flight visibility is not less than three miles
 - (k) The distance of the aircraft from cloud is not less than 500 feet vertically and one mile horizontally
 - (l) Where the aircraft is operated within a control zone,
 - i) When reported, ground visibility is not less than two miles, and
 - ii) All other requirements met through the control space director, including the distance of the aircraft from the surface (usually not less than 500 feet for manned aircraft).
 - (m) Extended VLOS operations, conducted under IFR, have specific weather requirements for IFR operations and are determined on a case-by-case basis. Pilots will be trained in determining when IFR are necessary over VFR.
 - (n) Operations will be conducted only when the forecast /actual wind speed and direction are within operating limitations of the aircraft.

3. Operations in Icing Conditions

- (a) Flight into known or expected icing conditions will only be conducted when the UAV system is appropriately certified and equipped to operate in icing conditions and the UAV flight crew is current and qualified in cold weather operations.
- (b) If (a) above has been met, the PIC will be trained to identify when not to conduct a take-off/launch or continue a flight of a UAV where icing conditions are reported to exist or are forecasted to be encountered along the route of flight unless PIC determines that the aircraft is adequately equipped to operate in those icing conditions.
- (c) If the aircraft is not equipped to operate in icing conditions, the PIC will prohibit operations until weather conditions permit
- (d) If the PIC determines that the UAV is adequately equipped to operate in icing conditions without de-icing or anti-icing equipment a request to operate will be submitted to a Transport Canada Inspector outlining meteorological conditions, UAV operational limitations, and he/she will demonstrate that the flight is planned and conducted such that persons or property on the ground and other airspace users are not endangered.

4. Emergency Locator Transmitter (ELT)

- (a) ELT will not be equipped to Hummingbird Drone UAVs

5. Radio Frequency Interference

- (a) The PIC shall not operate a UAV until it has been confirmed that no radio frequency interference that will affect safety of flight is present prior to flight, nor is likely to be present during flight.

6. Operations in Built-up Areas

- (a) Hummingbird Drones understands the additional risks associated with operations conducted in built-up areas. The following, but not limited to, will be considered when operating in built-up areas:
 - i. Airspace considerations: All operations will WMB will be conducted in controlled airspace in conjunction with existing WMB aviation safety requirements. (Additional ATC coordination, communications requirements, weather limits, lost link/fly-away procedures, etc.)
 - ii. Greater risk of radio frequency interference due to higher density of:
 - (i) Physical objects i.e. masonry, buildings, and other physical structures
 - (ii) Radio frequency interference i.e. cordless phones, microwaves etc.
 - (iii) Electrical interference i.e. devices such as computers, refrigerators, fans, lighting fixtures, or any other motorized devices

- iii. Ensuring a sterile operating areas (e.g. distances to people and property may need to be increased)
- iv. Additional security requirements (physical and electronic);
- v. Municipal/city restrictions and bylaws
- vi. Challenges to aircraft performance in urban meteorological conditions; and
- vii. Ability to remain within visual line-of-sight given the predominance of obstacles.

7. National, Provincial and Municipal Parks, Reserves and Refuges

- (a) The Wildfire Management Branch rarely perform fire suppression operations with in National or Provincial parks. Written permission to perform aerial operations over these parks will be received before operations are undertaken.

(b) Right of Way

All Hummingbird Drones operations shall be conducted in accordance with section 602.19 of the Canadian Aviation Regulations. All Hummingbird Drones' operations will be conducted in Class F airspace where there will be aviation operations being conducted will be under the jurisdiction of the Wildfire Management Branch. Wildfire Management Branch's Aviation Branch in conjunction with Fire Centre Dispatch communicate with all manned and unmanned aviation crews to ensure proper communication and safe distances are maintained.

(ii) Weather limitations

- (a) Hummingbird Drones will operate in accordance with section 6.20 (see Operational Flight Rules, Weather requirements). In the event of adverse weather conditions prohibiting safe flight during the proposed flight date and times, operations will cease and not continue until weather conditions improve. If proper weather conditions do not allow operations on the proposed date, alternate flight date and times will be used. The conditions needing to be met prior to commencement of operations include:
 - i. Winds (maximum): 16 knots
 - ii. Visibility (minimum): 2 statute miles ground visibility.
 - iii. Cloud ceiling (minimum): 2000 feet AGL
 - iv. Precipitation (maximum): none
- (b) Wind Direction: Due to diverse conditions Hummingbird Drones will be operating under for the Wildfire Management Branch wind direction will vary and a no limitation can be placed upon it.
- (c) Temperature: Hummingbird Drones will operate within the manufactures specifications for all crafts and equipment

- (d) (B) To assess weather conditions before and during flight operations, the operations team will use a number of weather sources to monitor and ensure adherence to the applicable weather minima described above. These include, but are not restricted to:
 - i. NAV CANADA flight planning website:
<http://www.navcanada.ca/EN/products-and-services/Pages/flight-planning.aspx>
 - ii. Local Weather Networks
 - iii. An anemometer or hand-held device to determine wind speed, temperature, relative humidity and dew point.
- (e) Operating in Icing Conditions – See Operational Flight Rules subsection Operations in Icing Conditions

(iii) Air Traffic Service Provider Coordination

- (a) The air traffic service provider within Wildfire Management Branch controlled Class F airspace will be Fire Centre Dispatch and the aerial branch director. All air traffic coordination will be done through them.

(iv) Inadvertent Flight into Controlled Airspace and Fly-away

- (a) All Hummingbird Drones aerial operations during the 2015 wild fire season will be conducted within wildfire Management Branch controlled airspace as per CARs 605.15 and 16, and as such this section does not apply.

(v) UAV System Security

- (a) Hummingbird Drones procedures/processes that are utilized to manage physical and technical security of the UAV system include:
 - (b) Physical Security
 - i. Hummingbird Drones hardware will be stored (at all times) either with personnel or in a locked compartment to avoid physical tampering with company hardware. Access will only be granted to authorized personnel and pre-flight check lists will be completed before each operation to ensure the aircrafts are safe-to-fly.
 - (c) Technical Security
 - i. Hummingbird Drones will make all efforts to minimize the susceptibility of the C2 link to unintentional or malicious interference on both a software and hardware level
 - ii. Hummingbird Drones company policy states Hummingbird Drone pilots will avoid aerial operations in areas of high radio frequency contamination.

(d) UAV Operator Requirements

- (a) All Hummingbird Drones' operators will be 18 years of age or older
- (b) Hummingbird Drones will deploy two (2) person teams to the fire-line. One of these team members will be designated as team-leader and will be responsible for all actions of Hummingbird Drones' personnel. They will oversee communications with the Incident Commander or designate, and Hummingbird Drones' Operations Manager. It will be part of the team leader's duty to maintain a daily phone correspondence with the Operations Manager in order to be informed of new Transport Canada regulations, alterations in fire-line protocol for UAVs and a debrief of daily events to ensure the deployed crew is conducting the safest operations possible.
- (c) Operating procedures
 - (A) Flight release/authorization – Hummingbird Drones' will commence aerial operations only when they have received authorization from the designated Fire Centre Dispatch and the Aerial Branch Director or other designated fire-line personnel.
 - (B) Pre-flight preparation planning
 - I. Checking NOTAMS – All aerial operations covered within this SFOC will be conducted within controlled airspace under the jurisdiction of the Wildfire Management Branch. As such, communication with external aircraft follow internal Wildfire Management Branch procedure and are handled by the Incident Commander or designate.
 - II. filing ATC flight plan – All aerial operations covered within this SFOC will be conducted within controlled airspace under the jurisdiction of the Wildfire Management Branch as per CARs 605.15 and 16. As such, all necessary communication between wildfire personnel and ATC is handled by the Incident Commander.
 - III. weather briefing – Weather briefings will occur every day and flight crews will receive the most up-to-date meteorological data available from Wildfire Management Branch Weather Services. In the event of adverse weather conditions prohibiting safe flight, operations will cease and not continue until weather conditions improve. The conditions needing to be met prior to commencement of flight operations include:
 - 1. Winds (maximum): 16 knots
 - 2. Visibility (minimum): 2 statute miles ground visibility.
 - 3. Cloud ceiling (minimum): 2000 feet AGL
 - 4. Precipitation (maximum): none

To assess weather conditions before and during flight operations, the operations team will use a number of weather sources to monitor and ensure adherence to the applicable weather minimums described above. These include, but are not restricted to:

1. NAV CANADA flight planning website:
<http://www.navcanada.ca/EN/products-and-services/Pages/flight-planning.aspx>
2. Local Weather Networks
3. An anemometer

- IV. fuel/energy and oil requirements – Hummingbird Drones’ will check the energy levels of all power sources prior to take-off. If energy levels are insufficient to perform a required task, they will not embark into the airspace.
- V. weight and balance calculations – as part of the daily pre-flight checklist (see Appendix B) aircraft balance calibration will be performed routinely.
- VI. securing of cargo – as part of the daily pre-flight checklist (see Appendix B) the security of UAV payloads will be checked prior to take-off.
- VII. radio frequency interference check – UAV pilots will ensure that they are isolated from other wavelength sources which may interfere with the transmission and reception link of the UAV. The spotter will remain close enough to communicate verbally with the pilot so as the pilot may be contacted by external personnel at any time, if necessary. While conducting aerial operations, the pilot will not be in possession of a cellphone, two-way radio or any other device which may cause interference.
- VIII. carriage of dangerous goods – no operations will be conducted under this SFOC which will require the transportation of dangerous goods.

(C) Take-off/Launch, Flight and Landing/Recovery

- I. aborted take-off/launch – in the event that Hummingbird Drones aborts take-off procedure, they will immediately inform Fire Centre Dispatch of the decision and provide a reason why.
- II. landing/recovery procedures – Hummingbird Drones’ will ensure that there are alternative landing pads in case of having to re-route landing in case of an emergency. Hummingbird Drones’ will use add-on navigational systems such as FlyTrex to locate lost UAVs.
- III. use of checklists – Hummingbird Drones will utilize checklists for daily maintenance procedure (see Appendix B)
- IV. crew coordination – briefings between the Operations Manager and Team Leader will occur on a daily basis. Hummingbird Drones’ personnel will partake in daily safety briefings to outline potential risks and hazards of the upcoming day. If a crew is replaced, they will provide a thorough overview of their operations to date to the incoming crew.

- V. operating in hazardous conditions – As outlined above, Hummingbird Drones will not partake in aerial operations in conditions which do not meet their allowable flight minima. As such, none of the hazardous conditions outlined by Transport Canada will be environments in which Hummingbird Drones will be operating within.
- VI. preventing incidents of interference with UAV system command and control links – Hummingbird Drones will ensure that there are no sources of interference near to the Pilot operating the UAV. It will be the duty of the Visual Observer to isolate the pilot from possible sources of frequency disturbance while staying in range of verbal communication.
- VII. ensuring that the UAV pilot maintains the UAV within the prescribed altitude and distance limitations – Hummingbird Drones will ensure that their pilots are trained to know the distances and elevations to which they permitted to fly under the exemptions outlined in this SFOC. These include restrictions to controlled airspace under the jurisdiction of the Wildfire Management Branch and a flight ceiling of 500 meters above ground level within this airspace.
- VIII. Hummingbird Drones’ will not conduct BVLOS operations
- IX. the use of automation and when to discontinue use of automation – the use of automation will occur under the same circumstances in which Hummingbird Drones’ personnel would launch their aircraft regularly but may enhance the quality of data they collect by automating the process. Hummingbird Drones will terminate the automation of the UAVs flight under the following circumstances:
 - 1. Sudden change in environmental conditions
 - 2. Unknown aircraft enters the airspace
 - 3. The UAV suddenly poses a threat or becomes hazardous to anyone or anything

(D) Post flight

- I. Accident/incident reporting procedures
 - 1. Non-hazardous incident: A incident is considered to be non-hazardous when the UAV crashes but does not pose a threat to fire-line personnel, fire-line aircraft or fire-line operations in any way. For example, if a UAV crashes into and gets stuck in a tree. In this case, once the motors have been disengaged and an area around the tree has been cordoned off, the UAV ceases to pose a threat to fire-line personnel and aircraft. In a scenario like this, Hummingbird Drones’ protocol will be to contact the Incident Commander to inform of the crash and to let them know that the UAV does not pose a threat to continued fire-line operations. Hummingbird Drones’ personnel will then inform on-site fire line personnel of the downed UAV and begin recovery efforts of the UAV provided it is safe to do so. Hummingbird Drones will

cease operations until it has been declared safe by the Incident Commander, or his designate, to recommence. An Incident report form will be completed and submitted to Hummingbird Drones Chief of Aerial Operations and recorded in company records.

2. Hazardous incident: In the event that the UAV crashes and endangers fire-line personnel, fire-line aircraft, fire-line equipment or any aspect of a fire-line operation, Hummingbird Drones will immediately contact the Incident Commander Director and inform them of the incident. While reactions and protocol will vary depending on the incident. Hummingbird Drones will conduct themselves in a way that is in accordance with Wildfire Management Branch procedure as well as the legal responsible duties of the UAV's pilot, visual observer, ground manager and operations manager. Provided the incident is not considered severe (i.e. dented a truck, frightened fire-line personnel), Hummingbird Drones will cease operations and review safety and operating procedure. They will identify the shortcomings in their operational procedure, rectify it, and with permission of the Incident Commander, resume operations. In the event of a severe crash (i.e. striking of fire-line personnel, striking an airborne manned aircraft) the response would be one in which Wildfire Management Branch would assume control of the emergency situation and Hummingbird personnel would conduct themselves accordingly. As such events have the potential to be catastrophic, the likelihood that Hummingbird Drones will be working around wildfire personnel is low and the likelihood of Hummingbird Drones' working around approved airborne aircraft is zero. Hummingbird Drones realizes that despite the very unlikely possibility of a severe hazardous crash occurring due to the standard operating procedures they have implemented, it must be planned for. Hummingbird Drones' personnel will ensure that they conduct themselves and their aerial operations in such a way that risk is minimized. In either case an incident report form will be completed and submitted to Hummingbird Drones Chief of Aerial Operations and recorded in company records.

II. Maintenance discrepancy reporting and requirements

1. In the event that an issue compromising safe operations due to maintenance discrepancies comes to the attention of any Hummingbird Drones personnel, operations will cease and a form outlining the nature of the issue and how it affected

operations (i.e. time lost) will be completed. The company or person that performed the maintenance will be notified of the issue. If on-site personnel cannot address the issue the craft in question will be sent in for proper maintenance and inspection.

(E) Emergencies

- I. Command and control link failure
 1. All Hummingbird Drones UAVs have software built in that, in the event that connection is lost during flight, the system's failsafe protection will activate, automatically telling the UAV to return home and land automatically.
- II. Loss of visual contact
 1. If visual contact is lost and cannot be quickly re-established the "return home" function will be engaged. Once the visual contact is re-established operations will resume.
- III. Operation of the flight termination system
 1. Currently, there are no software functions built into Hummingbird Drones' UAVs that will shut down the motors mid-flight.
- IV. Emergency landing/ditching
 1. If it is required to perform an emergency landing all crews in the area will be notified over the radio and the pilot will retrieve the craft.
- V. Control station failures
 1. All Hummingbird Drones UAVs have software built in that, in the event that connection is lost during flight, the system's failsafe protection will activate, automatically telling the UAV to return home and land automatically.
- VI. Communications failures
 1. In the event that communications are interrupted with ATC, the visual observer, or any other personnel relevant to safe operations the UAV will be grounded until communication is re-established.
- VII. Fly-aways
 1. In the case of an emergency in the form of a fly-away, the Incident Commander, all nearby ground crews and Transport Canada will be informed. WMB standard procedures to cover this eventuality will be followed until such time as the UAV has been located and the threat mitigated or until the time that it can reasonably be assumed that the aircraft has ran out of battery.
- VIII. Notifying of first responders (e.g. post-crash response)
 1. In the event of any incident requiring first-aid Hummingbird Drones personnel will contact WMB dispatch via handheld

radios. WMB Safety protocols will dictate communications with first responders from that point forward.

(iv) Manuals and Records

- (a) Hummingbird Drones' UAV specific manuals will be kept in a binder at the work site and be accessible to the PIC and Spotter. The Chief operator of the UAV for a specific project will be responsible for the maintenance of the following documentation:

Inspire-1

1. operations manuals,
2. maintenance manuals,
3. UAV system flight manuals (for each type of UAV being operated),
4. aircraft checklists.

Phantom 2 vision +

1. operations manuals,
2. maintenance manuals,
3. UAV system flight manuals (for each type of UAV being operated),
4. aircraft checklists.

- (b) The UAV Pilot will be provided with pre-flight checklists that will be completed at the beginning of each new operational period. These checklists will ensure that the pilot and UAV have met the minimum requirements to be fit-to-fly. UAV pilots will also be provided with, and expected to maintain, forms for records of flight operations. These forms will include:

1. Flight records
 - a. location,
 - b. date,
 - c. times,
 - d. crew,
 - e. aircraft type,
 - f. etc
2. Total flight hours accumulated per aircraft
3. Pilot(s) flight hours

These forms will be kept on file by Hummingbird Drones for a minimum of three years.

(v) Flight Duty Time Limitations and Rest Periods

Hummingbird Drones aerial operations shall be in full compliance with the Canadian Aviation Regulations Part VII subsection 720.15 and 720.16

Hummingbird Drones flight duty time record, and time free from duty records have been integrated into daily checklists for each flight crew member present during operations and it is the duty of the team leader to ensure that these documents are completed and submitted at the end of each project or operational period.

(vi) Liability Insurance

Hummingbird Drones has aviation liability of \$2,000,000 purchased through Capri Insurance.
(see Appendix A)

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Appendix A

Proof of existing insurance



ZCOMMERC_10.pdf

Appendix B

Pre-Flight Checklist



Pre-Flight Checklist.pdf

Appendix C

Example Flight Log



Log Book.pdf



Unmanned Aerial Systems for Forestry in Alberta: Kickoff Workshop and Field Demo

Thursday July 17th, 2014

Hinton Training Centre

1176 Switzer Drive

Hinton, AB

For registration, please contact:

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Agenda

Unmanned Aerial Systems (UAS) for forestry in Alberta: Kickoff Workshop and Field Demo
Thursday July 17th, 2014
Hinton Training Centre (room 134) and Cache Percotte Forest

FPIInnovations recently received a grant from Alberta Enterprise and Advanced Education to evaluate forestry applications of UAS in Alberta with the cooperation of Millar Western, Weyerhaeuser, West Fraser and Alberta Environment and Sustainable Resource Development (ESRD). Over the next two years, this project will test at least seven applications of specific interest to the Alberta forest industry with the aim of potentially replacing costly aircraft and ground methods. This workshop will kick off the project by giving cooperators the opportunity to see the technology in action and discuss early results.

Welcome presentation (Mark Ryans, FPIInnovations)	10:00
FPIInnovations program on UAS and Alberta initiative (Denis Cormier, FPIInnovations)	10:15
Early results from Hinton trials (Udaya Vepakomma, FPIInnovations)	10:45
Local solution oriented UAS services (Ellen Christopherson, Elevated Robotic Services Inc.)	11:15
Open discussion on project agenda	11:45
Lunch (provided at the HTC dining room)	12:00
Gathering for UAV demonstration	13:00
UAV demonstration at Cache Percotte Forest (various technologies will be demonstrated by FPIInnovations and Elevated Robotic Services)	13:15 to 15:00

FPIInnovations



Alberta

Innovation and
Advanced Education



Elevated
Robotic Services



National Resources
Canada

Ressources naturelles
Canada



OUR NAME IS INNOVATION

WILDFIRE SAFETY INFORMATION FOR MEDIA

For Immediate Release
[DATE]

Ministry of Forests, Lands and Natural Resource Operations
Wildfire Management Branch

ATTENTION: ASSIGNMENT EDITORS MEDIA SAFETY AT THE SCENE OF A WILDFIRE

The Ministry of Forests, Lands and Natural Resource Operations is committed to keeping the public informed about wildfire activity in the province. When a fire spreads quickly and threatens a community, it is critical that the public has access to current information about the fire and what steps the ministry's Wildfire Management Branch (WMB) is taking to suppress that fire.

News media serving B.C. communities provide essential information to help keep the public informed and safe. The WMB's objective through the fire season is to establish and maintain lines of communication with the public through the provision of timely information to the media.

Please notify a Fire Centre ~~Fire~~ Information Officer if you would like to attend the work site. You will be provided details about the fire, safety restrictions and site access protocols. This information may be provided at the site or by telephone. The WMB understands your need for quick access to a fire site and will attempt to provide you with this access in a safe and efficient manner.

Under the *Workers Compensation Act*, the Ministry of Forests, Lands and Natural Resource Operations is responsible for the safety of all individuals who attend a wildfire work site. If you are planning to arrange a visit to the scene of a wildfire, you should be aware that you will be subject to site safety rules.

1. **In order to be escorted around a fire site, you must wear appropriate clothing.** This includes a hard hat and clothing that fully covers your arms and legs. Avoid highly flammable synthetic fabrics such as nylon and polyester. Tightly woven clothes made from natural fibers are advisable. A high-visibility vest and eye protection may be required. Suitable footwear for rough terrain is essential.
2. **A WMB representative will be assigned to you and safety rules will be discussed.** Please stay with this designated representative at all times at the work site and follow his or her instructions.
3. **On the fireline, you must designate a supervisor from your media organization to brief your workers on safety regulations and ensure that they comply with these rules.**

To ensure your compliance with health and safety regulations, the WMB requires you to adhere to the rules listed below.

General Guidelines

- Your appointed supervisor has the authority and responsibility to correct any unsafe activity.
- The Incident Commander has the authority to restrict or limit access to a site.
- A WMB representative will provide relevant safety information and will communicate and review site hazards for your staff at the fire site.
- In the event that this representative's instructions are disregarded, the Incident Commander may require the violator(s) to leave the site.
- Continual safety violators may be reported to WorkSafe BC or Labour Canada for further follow-up.

Aircraft Operations

- All s.13 wildfires have "restricted airspace" applied to them. This is defined as an area with a radius of five nautical miles around the fire. It is illegal to enter the fire area without prior approval from the Regional Wildfire Coordination Officer (RWCO).
- If you want to request air access to a restricted area, please contact a s.13 Fire Centre Information Officer. The request will be forwarded to the Regional Wildfire Coordination Officer and access may be granted if conditions are appropriate and it's safe to do so. If there is a NOTAM (Notice to Airmen) in place for that particular incident, the pilot must check the NOTAM for any other specific restrictions.
- Unmanned Aerial Vehicles (UAVs, or "drones") are subject to the same restrictions as any other type of aircraft. Use of a UAV would be considered an airspace incursion, and could result in administrative charges.

Be Aware

- Know your escape routes. ASK if you are unsure or have any other concerns.
- Watch out for rolling logs and rocks dislodged by fire suppression activity.
- Stay away from windfalls, weakened trees, loose rocks and hot spots.
- Ride only in pedestrian vehicles (not bulldozers or skidders) and always wear a seatbelt.
- Use caution around machinery and only approach when you are in full view of the operator.
- Stay at least two tree lengths away from tree-falling activities.
- A safety briefing will be provided before you enter a helicopter.
- When boarding or exiting a helicopter, follow the pilot's instructions.
- Stay clear of airtanker drop areas and helicopter landing areas.
- Have plenty of water on hand to prevent dehydration.
- Any injury MUST be reported and treated.

If you have further questions about your safety responsibilities as an employer, you may contact the following organizations:

For print media outlets	For radio and television media outlets
WorkSafe BC - Prevention Division: 604 276-3100 in the Lower Mainland 1 888 621-7233 toll-free within B.C. www.worksafebc.com	Labour Canada: 1-800-641-4049

Thank you for reviewing these site safety rules. The Wildfire Management Branch is dedicated to safeguarding all personnel within a fire site. Your efforts to help ensure safe work site practices are appreciated.

Contact: Kevin Skrepnek
s.22
Provincial Fire Information Officer
Provincial Wildfire Coordination Centre
Wildfire Management Branch
250 312-3051

Wilson, John MTIC:EX

From: Umer, Manzoor <manzoor@shadowair.com>
Sent: Sunday, October 6, 2013 2:20 AM
To: Young, Bruce R FLNR:EX
Cc: Dalby, Bob S FLNR:EX; Snyder, Dave FLNR:EX; Gillich, Leo P FLNR:EX; Tomlins, Glenna FLNR:EX; Barber, Nina FLNR:EX; Murphy, Brenda J FLNR:EX; Lussier, Ed L FLNR:EX; Coutanche, Bruce FLNR:EX; Marek, Dave FLNR:EX; Nessman, Todd C FLNR:EX; Abbey, Travis FLNR:EX
Subject: Anti-Poaching / Forest Protection Cost Effective UAV / Airborne Technology
Attachments: Anti-Poaching-CamCopter-SL.pdf; Anti-Poaching-Fixed-Wing-UAV-RS20.pdf; Anti-Poaching-Fixed-Wing-UAV-SentryNode.pdf; Anti-Poaching-TEA-45.pdf; Anti-Poaching_Fixed_Wing_Manned_Observer_FINAL.ppt; Anti_Poaching_Fixed_Wing_Manned_Talon_I_FINAL.ppt; Anti_Poaching_Fixed_Wing_Manned_Talon_II_FINAL.ppt

Dear Sir,

ShadowAir Ltd. focused on providing state-of-the-art leasing, sales, consulting and operational services regarding airborne Image Defined Measurement and Signature Intelligence (IDMASINT) & Intelligence/Surveillance/Reconnaissance (ISR) platforms.

We integrate equipment to provide turnkey asset systems including aircraft, storage, transportation and communication systems to each Customer and Client. Our particular area of expertise is utilization of manned and dual mode Unmanned Aircraft Systems (UAS) in engine-off glider mode for highly covert surveillance and interdiction missions.

Very discreet missions can be made (in engine-off "glider mode") as our 5-second engine re-start capability and electric backup propulsion system provide ample safety margins for silent glider ops. We maximize and capitalize upon the element of surprise to provide a better, safer and more cost-effective solution to address airborne IDMASINT, ISR, and weaponized interdiction needs.

One very unique feature of our aircraft is that they can be quickly disassembled, shipped or airlifted via standard container, and rapidly redeployed at destination.

Our group includes other highly experienced personnel with similar military and law enforcement backgrounds. We have direct access to a pool of former/retired SOG, military and law enforcement professionals who are available for deployment worldwide.

The group provides leasing, sales, consulting and operational services for state-of-the-art Image Defined Measurement And Signature Intelligence (IDMASINT) and Intelligence / Surveillance / Reconnaissance (ISR) assets.

Our 2 Manned and "Dual-Mode" Aircraft Systems Include:

1- ShadowAir Observer:

The ShadowAir Observer comes equipped with a dual-sensor, belly-mounted, stabilized camera system that is easily removed for mounting on other fleet aircraft. Observer can be equipped with microwave, Wi-Fi, or SatCom links. Observer is ideal for those budget-conscious airborne law enforcement agencies and news media networks seeking to cut expenses or replace an aging aircraft fleet.

2- ShadowAir Talon:

The ShadowAir Talon is a "Dual-Mode" aircraft system capable of manned or Optionally-Pilot Vehicle (OPV) & Unmanned Aircraft System (UAS) flight. Talon comes equipped with hard points that can carry two 60Kg loads. Talon is equipped with state-of-the-art sensor packages designed to meet all mission requirements. It is the platform of choice for clients who require persistent situational awareness for maritime and border patrolling or military missions.

The HAVOC System:

HAVOC is a turnkey system comprised of three ShadowAir Talon UAVs and one Ground Control Station (GCS). HAVOC is designed to meet the need for persistent situational awareness along a border, above an ocean or overhead a battlefield. HAVOC can be upgraded for conducting conventional or asymmetrical threat interdiction missions.

The GCS can be upgraded to withstand repeated assaults from RPGs, LAAWS rockets, C4 Plastic Explosives, 50 pounds of military-grade TNT and .50 caliber armor-piercing rounds.

The WAASS Technology (Wide Area Aerial Surveillance Systems):

We offer special WAASS (Wide Area Aerial Surveillance System) cameras for each base airframe: the S10-VT and S6-RT.

WAASS coverage area: Single Band EO Day-time Operations = 25 square miles for tracking people and 36 square miles for tracking vehicles. Dual-Band EO/MWIR Night-time Operations = 4 square miles coverage.

WAASS pixel resolution: Day-time = 192 megapixel, 1 image per second, orthorectified and time-stamped recording for real-time and forensic analysis. Dual-Band Day & Night Operations = 16-64 megapixel MWIR and 88 megapixel EO Visible (Monochrome) resolution.

Level I overnight analysis provides complete subject tracking info. Level II analysis (1-3 days) determines subject's contacts and provides tracking information regarding all parties concerned. Level III Network Analysis (1 Week) provides complete tracking information regarding the subject and all associates recorded during the entire time period of the aerial surveillance coverage.

We design for your success!

Our Special Services Division (SSD) provides covert air/ground surveillance teams for deployment worldwide. SSD also acts as liaison for executive protection and transportation services furnished by our select group of service providers.

ShadowAir can provide complete Security & Surveillance to Nuclear Power Plants, Refineries, Atomic

Reactors Sites, Gas Pipelines and many other Sensitive Areas for Civilian & Borders Intelligence as well as Environmental Monitoring, Patrolling, Research, Development & Geographical Mapping are most prominent expertise of us.

Our motto perhaps says it best of all: "To Protect & Serve From Above". We will deliver, what we commit !

Please request for complete brochures if you are interested in our Joint-Venture / Partnership Offers for all Oil & Gas Operations regarding Leakage Detection, Pipelines Surveillance, Monitoring, etc.

Thanks,

Warm Regards,

Umer Manzoor
V.P. Business Development

ShadowAir LTD.
Airborne ISR Solutions
300 Center Street, Suite G-214
Superior, CO 80027

Tel No. +1-888-731-3092 (Toll-Free)
+1-303-731-3092 (Direct)
Fax No. +1-888-731-3092
E-mail: manzoor@shadowair.com
Website: www.shadowair.com
DUNS:146670778 CAGE Code: 3UXD5



The CamCopter SL Unmanned Aerial Vehicle (UAV) comes standard equipped with a two-axis gimbal housing a Global Shutter Electro-Optical (EO) camera, a FLIR QUARK 336 Infrared (IR) camera and a Mobile Ad-Hoc Network (MANET) and antenna downlink having a 10 mile range.

The daytime Global Shutter EO camera provides 1080p density and two-axis stabilization and enables the capture of sharp images moving at high speed: all pixels in the imaging array are exposed starting and stopping simultaneously, avoiding distortion and artifacts in images of fast-moving objects.

The FLIR QUARK 336 IR camera provides nighttime imagery having a 336 x 256 Digital Video Display Format. Higher resolution is available at additional cost. The exportable frame rate is a minimum of 8.3 fps. The lens is fixed without any zoom capability.

The basic system includes the CamCopter SL UAV equipped as specified and one portable Ground Control Station (GCS).

Aircraft Specifications

Unmanned Aerial Vehicle (UAV)

Vertical Takeoff & Landing (VTOL)

Weight: 35 lbs

Length: 8' 0"

Useful Load: 22 lbs

Fuel: MOGAS

Endurance: 3.5 hours

Cruise Airspeed: 35 mph

Launch/Recovery: VTOL

Trailer Transportable

Standard Equipment Specifications

Two-Axis Stabilized Gimbal

Global Shutter Electro-Optical (EO) camera: 1080p density

FLIR QUARK 336 Infrared (IR) camera: 336 x 256 Digital Video Display Format

Mobile Ad-Hoc Network (MANET) antenna: 10 mile range

Downlink Antenna: 10 mile range

Portable Ground Control Station (GCS)

Lease Price Schedule

The CamCopter SL UAV turnkey system comprises the UAV with Standard Equipment as noted, 1 Ground Control Station (GCS), Crew = 1 Pilot & 1 ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60, or 84 months. Prices subject to change.

	<u>36 Months</u>	<u>60 Months</u>	<u>84 Months</u>
Hourly Cost:	\$428.90	\$410.49	\$402.73



The RS-20 Unmanned Aerial Vehicle (UAV) comes standard equipped with an Electro-Optical (EO) Mid-Wave Infrared (MWIR) sensor and password protected Line-of-Sight (LOS) Microwave Video Streaming System for live video viewable on any web browser equipped device (i.e. smartphones, tablets, laptops and PCs).

Included are 3G/4G and Satellite Auto-Email Systems capable of sending emailed JPEG or Google Earth (KMZ) pictures with one keystroke while airborne or on the ground by Verizon 3G data card or Satellite data-phone. Satellite Communications (SATCOM) Beyond-Line-of-Sight (BLOS) streaming video capability is optional.

Included Scan Plan Software enables preprogramming a path using GEO coordinates to automatically direct the imaging system. Highly valued for recurring patrols for pre/post disaster comparison video, search and rescue, border patrol and pipeline patrol.

The basic system includes 1 Ground Support System comprised of a Mobile Operations Center with RF Systems (60 km range), Ground Control Station (GCS), Maintenance Station, tools and spare parts. Real-time video streaming via Satellite is optional.

Aircraft Specifications

Unmanned Aerial Vehicle (UAV)

Wing Span: 17' 3"

MGTW: 165 lbs

Endurance: 12-16 hours

Service Ceiling: 15,000' msl

Maximum Airspeed: 90 knots

Payload Bay: 10.75" x 10.75" x 34"

Payload Capacity: 65 lbs

Payload Power: 400 watts

Hard Points: 2 @ 20 lbs each

Runway Independent: No runway required

Launch: Pneumatic Catapult

Recovery: Net or Belly Landing Recovery

Trailer Transportable

Standard Equipment Specifications

SkyIMD SkyFusionPak 4000 EO/MWIR Sensor

MWIR (Mid Wave Infra Red) internally cooled sensor system with Fiber Optic Gyro stabilization. Provides optimum night time vision for law enforcement, search and rescue and military missions. Both day and MWIR sensors are 640X480 pixels. The MWIR sensor offers continuous zoom from 22° to 2° Field of View.

Daylight Sensor: 640X480 pixel, 30x Optical zoom, 56.9° - 2° Field of View.

Night Sensor: FLIR MWIR (Mid-Wave Infra Red) 640X480 internally cooled sensor with continuous zoom 22-2° FOV for night imaging.

Stabilization Technology: Fiber Optic Gyro.

Video File Formats: H.264, AVI, MPEG4.

Snapshot File Formats: JPEG, KMZ (Google Earth, ESRI)

Moving Map: USGS topographic, Bing road map, Bing aerial photos with street names.

Command & Control: Touchscreen Tablet PC Laptop and software suite.

Microwave Video Streaming System

Enables password protected video streaming from the aircraft by microwave that are viewable with any web browser equipped device (iPhone, iPad, smart-phone, laptop, desktop PC).

Included are 3G/4G* and Satellite** Auto-Email Systems capable of sending emailed JPEG or Google Earth (KMZ) pictures with one keystroke while airborne or on the ground by Verizon 3G data card or Satellite data-phone.

*Customer is responsible for data card purchase and account maintenance.

**Customer is responsible for monthly data charges and account maintenance.

Satellite Communications (SATCOM) Beyond-Line-of-Sight (BLOS) streaming video capability is optional.

Included Scan Plan Software enables preprogramming a path using GEO coordinates to automatically direct the imaging system. Highly valued for recurring patrols for pre/post disaster comparison video, search and rescue, border patrol and pipeline patrol.

Lease Price Schedule

The RS-20 turnkey system comprises the UAV with Standard Equipment as noted, 1 Ground Control Station (GCS), Crew = 2 Pilots (Optional: 1 Pilot & 1 ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60, or 84 months. Prices subject to change.

	<u>36 Months</u>	<u>60 Months</u>	<u>84 Months</u>
Hourly Cost:	\$1,408.35	\$1055.44	\$906.65



The SentryNode Unmanned Aerial Vehicle (UAV) comes standard equipped with a two-axis gimbal housing a Global Shutter Electro-Optical (EO) camera, a FLIR QUARK 336 Infrared (IR) camera and a Mobile Ad-Hoc Network (MANET) and antenna downlink having a 10 mile range.

The daytime Global Shutter EO camera provides 1080p density and two-axis stabilization and enables the capture of sharp images moving at high speed: all pixels in the imaging array are exposed starting and stopping simultaneously, avoiding distortion and artifacts in images of fast-moving objects.

The FLIR QUARK 336 IR camera provides nighttime imagery having a 336 x 256 Digital Video Display Format. Higher resolution is available at additional cost. The exportable frame rate is a minimum of 8.3 fps. The lens is fixed without any zoom capability.

The basic system includes the SentryNode UAV equipped as specified and one portable Ground Control Station (GCS).

Aircraft Specifications

Unmanned Aerial Vehicle (UAV)

Runway Independent

Catapult or Hand Launch

Belly Landing Recovery

Wingspan: 10' 8"

Length: 5' 2"

Payload Capacity: 15 lbs

Battery Propulsion

Endurance: 2 hours @ 50 mph

Maximum Airspeed: 130 mph

Operational Altitude: 1,000' agl

Authorized by FAA COA

Trailer Transportable

Standard Equipment Specifications

Two-Axis Stabilized Gimbal

Global Shutter Electro-Optical (EO) camera: 1080p density

FLIR QUARK 336 Infrared (IR) camera: 336 x 256 Digital Video Display Format

Mobile Ad-Hoc Network (MANET) antenna: 10 mile range

Downlink Antenna: 10 mile range

Portable Ground Control Station (GCS)

Lease Price Schedule

The SentryNode UAV turnkey system comprises the UAV with Standard Equipment as noted, 1 Ground Control Station (GCS), Crew = 1 Pilot & 1 ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60, or 84 months. Prices subject to change.

	<u>36 Months</u>	<u>60 Months</u>	<u>84 Months</u>
Hourly Cost:	\$461.62	\$432.04	\$419.57



The TEA-45 Tactically Expedient Aerostat (TEA) comes standard equipped with an Electro-Optical (EO) Mid-Wave Infrared (MWIR) sensor and password protected Line-of-Sight (LOS) Microwave Video Streaming System for live video viewable on any web browser equipped device (i.e. smartphones, tablets, laptops and PCs).

Included are 3G/4G and Satellite Auto-Email Systems capable of sending emailed JPEG or Google Earth (KMZ) pictures with one keystroke while airborne or on the ground by Verizon 3G data card or Satellite data-phone. Satellite Communications (SATCOM) Beyond-Line-of-Sight (BLOS) streaming video capability is optional.

Included Scan Plan Software enables preprogramming a path using GEO coordinates to automatically direct the imaging system. Highly valued for recurring patrols for pre/post disaster comparison video, search and rescue, border patrol and pipeline patrol.

The basic system includes 1 Ground Support System comprised of a Mobile Operations Center with RF Systems (60 km range), Ground Control Station (GCS), Maintenance Station, tools and spare parts. Real-time video streaming via Satellite is optional.

Aircraft Specifications

Tactically Expedient Aerostat (TEA)

Runway Independent

Size: 45 Cubic Meters

Payload Capacity: 44 lbs

Endurance: 5+ Days

Tether Break Strength: 4,400 lbs

Winch Recovery: 24VDC

Maximum Wind Load: 60 knots

Operational Altitude: 1,000' agl

Spectra 3/16" tether cable

Tether Cut-down Device

Trailer Transportable

Includes 20-person Mobile Ad-Hoc Network (MANET) with GCS

Standard Equipment Specifications

SkyIMD SkyFusionPak 4000 EO/MWIR Sensor

MWIR (Mid Wave Infra Red) internally cooled sensor system with Fiber Optic Gyro stabilization. Provides optimum night time vision for law enforcement, search and rescue and military missions. Both day and MWIR sensors are 640X480 pixels. The MWIR sensor offers continuous zoom from 22° to 2° Field of View.

Daylight Sensor: 640X480 pixel, 30x Optical zoom, 56.9° - 2° Field of View.

Night Sensor: FLIR MWIR (Mid-Wave Infra Red) 640X480 internally cooled sensor with continuous zoom 22-2° FOV for night imaging.

Stabilization Technology: Fiber Optic Gyro.

Video File Formats: H.264, AVI, MPEG4.

Snapshot File Formats: JPEG, KMZ (Google Earth, ESRI)

Moving Map: USGS topographic, Bing road map, Bing aerial photos with street names.

Command & Control: Touchscreen Tablet PC Laptop and software suite.

Microwave Video Streaming System

Enables password protected video streaming from the aircraft by microwave that are viewable with any web browser equipped device (iPhone, iPad, smart-phone, laptop, desktop PC).

Included are 3G/4G* and Satellite** Auto-Email Systems capable of sending emailed JPEG or Google Earth (KMZ) pictures with one keystroke while airborne or on the ground by Verizon 3G data card or Satellite data-phone.

*Customer is responsible for data card purchase and account maintenance.

**Customer is responsible for monthly data charges and account maintenance.

Satellite Communications (SATCOM) Beyond-Line-of-Sight (BLOS) streaming video capability is optional.

Included Scan Plan Software enables preprogramming a path using GEO coordinates to automatically direct the imaging system. Highly valued for recurring patrols for pre/post disaster comparison video, search and rescue, border patrol and pipeline patrol.

Lease Price Schedule

The TEA-45 turnkey system comprises the aerostat with Standard Equipment as noted, 1 Ground Control Station (GCS), Crew = 1 Pilot & 1 ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60, or 84 months. Prices subject to change.

	<u>36 Months</u>	<u>60 Months</u>	<u>84 Months</u>
Hourly Cost:	\$1,032.00	\$807.61	\$713.02



Capabilities

- Certified Engine-off Silent Flight
- 5 Second Re-Start Guaranteed
- 2.37 GPH Burn Rate @ Loiter
- Optempo: 90% (329 days/year)
- Glide Ratio = 50 to 1
- Trailer Transportable

Specifications

- Crew (2 max) = 180Kg/397Lb
- Payload = 10Kg/22Lb
- Fuel = 32 Gal - AV/MOGAS
- Endurance = 8+ Hours
- Service Ceiling = 25,000 Ft AGL
- Takeoff/Landing Dist. = 660 Ft

Lease Price Schedule

- 36 Months = \$1088.65/Hour
- 60 Months = \$903.23/Hour
- 84 Months = \$822.28/Hour
- RT-600 Direction Finder = +40.00/Hour
- Kestrel Tracking System = +30.00/Hour

The Observer turnkey system comprises the Motor Glider with Standard Equipment as noted, Crew = 2 (Pilot & ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60 or 84 months. Prices subject to change.



Capabilities

- Certified Engine-off Silent Flight
- 5 Second Re-Start Guaranteed
- 2.37 GPH Burn Rate @ Loiter
- Optempo: 90% (329 days/year)
- Glide Ratio = 38 to 1
- Trailer Transportable

Specifications

- Crew (2 max) = 180Kg/397Lb
- Payload = 120Kg/265Lb
- Fuel = 34.5 Gal – AV/MOGAS
- Endurance = 8+ Hours
- Service Ceiling = 25,000 Ft AGL
- Takeoff/Landing Dist. = 660 Ft

Lease Price Schedule

- 36 Months = \$1488.86/Hour
- 60 Months = \$1197.32/Hour
- 84 Months = \$1072.90/hour
- RT 600 Direction Finder = +40.00/Hour
- Kestrel Tracking System = +30.00/Hour

The Talon I turnkey system comprises the Motor Glider with Standard Equipment as noted, Crew = 2 (Pilot & ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60 or 84 months. Prices subject to change.



Capabilities

- Certified Engine-off Silent Flight
- 5 Second Re-Start Guaranteed
- 2.37 GPH Burn Rate @ Loiter
- Optempo: 90% (329 days/year)
- Glide Ratio = 38 to 1
- Trailer Transportable

Specifications

- Crew (2 max) = 180Kg/397Lb
- Payload = 120Kg/265Lb
- Fuel = 34.5 Gal – AV/MOGAS
- Endurance = 8+ Hours
- Service Ceiling = 25,000 Ft AGL
- Takeoff/Landing Dist. = 660 Ft

Lease Price Schedule

- 36 Months = \$1488.86/Hour
- 60 Months = \$1197.32/Hour
- 84 Months = \$1072.90/hour
- RT 600 Direction Finder = +40.00/Hour
- Kestrel Tracking System = +30.00/Hour

The Talon I turnkey system comprises the Motor Glider with Standard Equipment as noted, Crew = 2 (Pilot & ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60 or 84 months. Prices subject to change.



TALON II

Capabilities

- Certified Engine-off Silent Flight
- 5 Second Re-Start Guaranteed
- 2.37 GPH Burn Rate @ Loiter
- Optempo: 90% (329 days/year)
- Glide Ratio = 38 to 1
- Trailer Transportable

Specifications

- Crew (2 max) = 180Kg/397Lb
- Payload = 120Kg/265Lb
- Fuel = 34.5 Gal AV/MOGAS
- Endurance = 8+ Hours
- Service Ceiling = 25,000 Ft AGL
- Takeoff/Landing Dist. = 660 Ft

Lease Price Schedule

- 36 Months = \$2318.86/hour
- 60 Months = \$1737.32/hour
- 84 Months = \$1502.90/hour
- RT-600 Direction Finder = +\$40.00/hour
- Kestrel Tracking System = +\$30.00/hour

The Talon II turnkey system comprises the Motor Glider with Standard Equipment as noted, Crew = 2 (Pilot & ISR Sensor Operator)*, Maintenance, Fuel and Insurance.**

*Client to provide adequate lodging and meals (or to-be-determined per-diem stipend).

**Client pays all crew and equipment transportation and repositioning costs.

The lease packages are based upon a client guaranty of 100 hours per month/1,200 hours per year minimum for a term of 36, 60 or 84 months. Prices subject to change.

Wilson, John MTIC:EX

From: Bruce Morrow s.22
Sent: Thursday, April 9, 2015 9:25 AM
To: Marek, Dave FLNR:EX
Subject: Class f permission clause
Attachments: UAV Staff Instruction.pdf

Dave,

I am having trouble identifying the clause that says a SFOC application for Class f airspace requires a letter of permission from the controlling agency. Under Appendix G, pg 96 Class F Restricted (General) Condition of the attached document it says that permission to use that airspace is required. When I find the exact clause I will forward.

The Hummingbird guys are taking AUV pilot training from some TC guys on May 4-5 in Vancouver. You are welcome to join us fro the training. I have not heard the cost but I understand it is minimal. Bruce

Bruce Morrow Forest Consulting Ltd

6504 Barnhartvale Rd

Kamloops, B.C.

V2C 6V7

250 573-6066 - office

s.22

morrowforestconsulting.com



Staff Instruction

Subject: Review and Processing of an Application for a Special Flight Operations Certificate for the Operation of an Unmanned Air Vehicle (UAV) System

Issuing Office:	Standards	Document No.:	SI 623-001
File Classification No.:	Z 5000-32	Issue No.:	02
RDIMS No.:	9946240-V1	Effective Date:	2014-11-19

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1.0 INTRODUCTION

1.1 Purpose

- (1) The purpose of this Staff Instruction (SI) is to provide Inspectors with the information, procedures and guidelines necessary to process a Special Flight Operations Certificate (SFOC) application and prepare an SFOC as required by section 602.41 of the *Canadian Aviation Regulations* (CARs) for the safe conduct of unmanned air vehicle (UAV) system operations.
- (2) This SI has been prepared in line with the functional authority and direction given by the Headquarters (HQ), Flight Standards division that is the delegated functional specialist for flight operations involving UAV systems. This SI will aid HQ and Regional staff by providing guidelines with regard to national policies, directives and standards with the aim of standardizing UAV system SFOC processes. All personnel, directly or indirectly concerned with UAV system operations must be informed of, and apply the procedures contained in this SI.
- (3) This document is intended to be an accepted, consistent means to evaluate SFOC applications for UAV system flight operations. However, due to the rapid pace of technological developments in this field, this SI may not address all applicable safety concerns. As such, this will continue to be a living document and will be revised and/or supplemented at intervals to take account of lessons learned, changes in technology, harmonization with international regulations and feedback from the UAV industry.

1.2 Applicability

- (1) This document applies to Transport Canada Civil Aviation (TCCA) personnel and the aviation industry.

Note:

Advisory circulars have been developed for the aviation industry.

1.3 Description of Changes

- (1) This document has been substantially revised to incorporate recommendations from the Transport Canada (TC) Canadian Aviation Regulations Advisory Council's UAV system Program Design Working Group and to account for changes in technology and lessons learned and includes a "Compliant Operator" SFOC process.
- (2) The format changed substantially and the order in which the information is presented follows the sequence of the Parts of the CARs (e.g. personnel issues, airworthiness issues, operational issues). Additionally, to the extent possible, the information in each section is in the same order as would be found in the CARs.

1.4 Grandfather Clause

- (1) All UAV system SFOC applications that are received after the publication of this SI shall be processed in accordance with the guidance herein.
- (2) Certificate applicants who hold a valid SFOC, as of the date this SI is published, may continue operations under that SFOC until that SFOC expires. When renewing said SFOC additional information may be required to ensure applicants meet the new requirements.
- (3) Certificate applicants that have an SFOC awaiting processing will not be required to submit a new SFOC application; however the submitted SFOC application will be assessed based on the guidance herein. Inspectors should anticipate that these applications may not contain all the

required information to process the SFOC and additional coordination with the applicant may be required.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

- (1) *Aeronautics Act* (R.S., 1985, c. A-2)
- (2) *Canadian Aviation Regulations*

2.2 Requirements

- (1) An SFOC is issued under the authority of the Minister pursuant to the *Aeronautics Act*. It may be suspended or cancelled at any time by the Minister for cause, including failure on the part of the UAV operator, its servants or agents to comply with the provisions of the *Aeronautics Act* or the conditions of the SFOC. The SFOC is not transferable and valid only for the period of time specified in the SFOC. The SFOC is the document that spells out the conditions under which a UAV system operation is to be conducted.
- (2) Section 602.41 of the CARs states; “*No person shall operate an unmanned air vehicle in flight except in accordance with the provisions of an SFOC or an Air Operators Certificate.*”

Note:

As changes occur in the UAV industry, or in Transport Canada's understanding of it, Certificate applicants should expect that conditions in future SFOCs may differ from those previously issued, in order to conform to changing UAV policies.

- (3) In addition to conditions set out in the SFOC, the UAV operator also has to comply with the provisions of Canadian Aviation Documents that may be issued pursuant to the *Aeronautics Act* or the CARs.

Note:

Transport Canada does not issue Air Operator Certificates for UAV operations however, subject to regulatory development, a UAV system operator certificate might be required in the future.

- (4) Section 603.65 states that *Division IV – Miscellaneous Special Flight Operations* applies to UAVs. Section 603.66 states; “*No person shall conduct a flight operation referred to in section 603.65 unless the person complies with the provisions of a special flight operations certificate issued by the Minister pursuant to section 603.67.*”
- (5) Section 603.67 states; “*Subject to section 6.71 of the Act, the Minister shall, on receipt of an application submitted in the form and manner required by the Special Flight Operations Standards, issue a special flight operations certificate to an applicant who demonstrates to the Minister the ability to conduct the flight operation in accordance with the Special Flight Operations Standards.*”
- (6) Subsection 623.65(d) of the CARs specifies the standards that apply to the SFOC application for, and the operation of, a UAV system.

2.3 Fees

- (1) Section 104.01 of the CARs, and its applicable Schedules, will specify any required charges that apply to the issuance or renewal of an SFOC.
- (2) At this time, there are no fees for the SFOC application.

2.4 Cancelled Documents

- (1) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.5 Definitions and Acronyms

- (1) The following definitions are used in this document. They are provided for information only and to help ensure a common understanding of UAV-related terms and definitions. Definitions marked with an asterisk (*) are existing definitions taken from the *Aeronautics Act* or the CARs.
 - (a) **Aerial Work** – means an aircraft operation in which an aircraft is used for specialized services such as agriculture, construction, photography, surveying, observation and patrol search and rescue, aerial advertisement, etc.
 - (b) **Automatic** – means the execution of a pre-defined process or event that requires UAV pilot initiation and/or intervention (e.g. automated take-off/landings, way-point navigation, auto-pilots, pre-programmed manoeuvres etc).
 - (c) **Autonomy** - means the ability to execute processes or missions using onboard decision making capabilities. The UAV system is not designed to permit crew member intervention.

Note:

The use of the term automatic and autonomy are often applied incorrectly. Automation includes autopilot systems and safety critical management systems. An autonomous UAV would be capable of dynamic mission management that is not scripted and would not allow pilot intervention in the management of the flight. It would depend on intelligent reasoning and deliberate behaviour for the ability to cope with uncertainty i.e. self-governance. While several companies around the world are studying autonomy and developing test beds to define technology requirements, at this time, there are no fully autonomous UAVs in production and any such operations would be out of the scope of this document.

- (d) ***Canadian Aviation Documents** – means any licence, permit, accreditation, certificate or other document issued by the Minister under Part I of the *Aeronautics Act* to or with respect to any person, or in respect of any aeronautical product, aerodrome, facility or service.

Note:

A Special Flight Operations Certificate is a Canadian Aviation Document.

- (e) **Command and Control (C2) Link** – means the data link between the UAV and the control station for the purposes of managing the flight.

Note:

These links are the wireless means of connecting one location to another for the purpose of transmitting or receiving data.

- (f) **Control Station** – means the facilities and/or equipment remote from the unmanned air vehicle from which the aircraft is controlled and/or monitored.
- (g) **Crew Member** – means a person assigned to duties essential to the operation of the unmanned air vehicle system during flight time.
- (h) **First Person View (FPV) Device** – means a device that generates and transmits a streaming video image to a ground station display or monitor giving the UAV pilot who is viewing this video, the illusion of actually flying the UAV from an onboard pilot perspective.
- (i) **Flight Termination System** – means the system that, upon initiation, terminates the flight of a UAV in a manner so as not to cause significant damage to property or severe injury to persons on the ground.
- (j) **Fly-away** – means an interruption or loss of the command and control link where the pilot is unable to affect control of the aircraft and the aircraft is longer following its preprogrammed procedures resulting in the UAV not operating in a predictable or planned manner.
- (k) **Handover** – means the act of passing pilot-in-command responsibilities from one control station or pilot to another.
- (l) ***Invited Assembly of Persons** – means any number of persons who have been invited, by any means, to attend a special aviation event. The term excludes competition judges, the holder of a special flight operations certificate, members of a certificate holder's staff and members of a participant's support team
- (m) **Lost Link** – means the loss of command and control link contact with the unmanned air vehicle such that the pilot can no longer manage the aircraft's flight.
- (n) ***Model Aircraft** – means an aircraft, the total weight of which does not exceed 35 kg (77.2 pounds), that is mechanically driven or launched into flight for **recreational purposes** and that is not designed to carry persons or other living creatures.
- (o) ***Owner** – in respect of an aircraft, means the person who has legal custody and control of the aircraft.
- (p) **Operator** - in respect of an aircraft, means the person that has possession of the aircraft or the UAV system, as owner, lessee or otherwise.
- (q) **Optionally Piloted Aircraft (OPA)** – means an aircraft that is integrated with UAV technology and still retains the capability of being flown by an onboard pilot using conventional control methods.

Note:

If the optionally piloted aircraft is being flown with a person on board it will be regulated as a manned aircraft.

- (r) **Payload** – means all elements of the aircraft that are not necessary for flight but are carried for the purpose of fulfilling specific mission objectives. This may include such sub-

systems as intelligence and surveillance assets, communication relay equipment, sensors, cargo and cameras.

- (s) **Payload Operator** – means the person (s) trained to operate the payload system, and in some cases, manage the flight profile.
- (t) ***Pilot-in-Command (PIC)** – means, in relation to an aircraft, the pilot having responsibility and authority for the operation and safety of the aircraft during flight time.

Note:

This responsibility and authority applies even though the pilot is external to the aircraft. The use of the term "pilot" in this SI, however, is not intended to suggest that the pilot is necessarily qualified as a crew member of a manned aircraft.

- (u) **Radio Line-of-Sight** – means the limit of direct point-to-point contact between a transmitter and a receiver given the equipment being used and the prevailing conditions.

Note:

It is imperative for the Inspector and Certificate applicant to have a common understanding of the term "line-of-sight" as it relates to the proposed operation. Visual line-of-sight is different from radio line-of-sight.

- (v) **Real-time** – means a process or activity occurring in real-time if it responds within a specified time variant from an external source, typically a fraction of a second.
- (w) **Recovery** – means the phase of a UAV flight that involves the return of an aircraft to the ground or to base.
- (x) **Sense and Avoid** – means the capability to see, sense or detect, conflicting traffic or other hazards and take appropriate action. (The International Civil Aviation Organization refers to "detect and avoid").
- (y) **Small UAV** – means a UAV with a maximum permissible take-off weight of 25kg (55 pounds) or less.
- (z) ***Unmanned Air Vehicle** – means a power-driven aircraft, other than a model aircraft, that is designed to fly without a human operator onboard.

Note:

Unmanned air vehicles exclude fireworks, kites, rockets and large unmanned free balloons.

- (aa) **Visual Line of Sight (VLOS)** – means unaided (corrective lenses and/or sunglasses exempted) visual contact with the aircraft sufficient to be able to maintain operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.

Notes:

Vision enhancing devices such as binoculars, night visual goggles, powered vision magnifying devices and goggles designed to provide a first person view are not considered "unaided visual contact".

In determining the range that will ensure the UAV can be seen, consideration must be given to the pilot or visual observer capabilities, the meteorological conditions, the size and conspicuity of the UAV and any other relevant factors.

- (bb) **Visual Observer** – means a trained crew member, in visual line-of-sight of the UAV, who assists the pilot in the duties associated with collision avoidance and complying with the applicable rules of flight.
- (2) The following acronyms are used in this document.
- (a) 1 CAD – 1 Canadian Air Division
 - (b) ACAS – Airborne Collision Avoidance System
 - (c) AGL – Above Ground Level
 - (d) ADS-B – Automated Dependant Surveillance – Broadcast
 - (e) AMA – Academy of Model Aeronautics
 - (f) AME – Aircraft Maintenance Engineer
 - (g) AMO – Aircraft Maintenance Organization
 - (h) ATC – Air Traffic Control
 - (i) ATS – Air Traffic Service
 - (j) BVLOS – Beyond Visual Line of Sight
 - (k) C2 – Command and Control
 - (l) CAD – Canadian Aviation Document
 - (m) CAIRS – Civil Aviation Issues Reporting System
 - (n) CARAC – Canadian Aviation Regulation Advisory Council
 - (o) CARs – Canadian Aviation Regulations
 - (p) ELT – Emergency Locator Transmitter
 - (q) GBSAA – Ground Based Sense and Avoid
 - (r) GHz – Gigahertz
 - (s) GNSS – Global Navigation Satellite System
 - (t) GPS – Global Positioning System
 - (u) HQ – Headquarters
 - (v) ICAO – International Civil Aviation Organization
 - (w) IFR – Instrument Flight Rules
 - (x) LED – Light Emitting Diode
 - (y) MAAC – Model Aeronautics Association of Canada
 - (z) MHz – Megahertz
 - (aa) MTOW – Maximum Take-off Weight
 - (bb) NM – Nautical Mile
 - (cc) NOTAM – Notice to Airmen
 - (dd) NVG – Night Vision Goggles

- (ee) OPA – Optionally Piloted Aircraft
- (ff) PED – Portable Electronic Device
- (gg) PIC – Pilot-in-Command
- (hh) RDIMS – Records, Documents and Information Management System
- (ii) SATCOM – Satellite Communication
- (jj) SFOC – Special Flight Operations Certificate
- (kk) SI – Staff Instruction
- (ll) SOP – Standard Operating Procedures
- (mm) TC – Transport Canada
- (nn) TCAS – Traffic Alert and Collision Avoidance System
- (oo) TSB – Transportation Safety Board
- (pp) UAV – Unmanned Air Vehicle
- (qq) VFR – Visual Flight Rules
- (rr) VHF – Very High Frequency
- (ss) VLOS – Visual Line of Sight
- (tt) VMC – Visual Meteorological Conditions

3.0 GENERAL PRINCIPLES AND POLICIES

3.1 Background

- (1) Unmanned air vehicles are considered to be an “aircraft” under the *Aeronautics Act*. A UAV system is a set of configurable elements consisting of an unmanned aircraft, its associated control station(s), the required command and control (C2) links and any other elements as may be required, at any point during flight operation. UAVs are aircraft of any size that may be remotely controlled or may have an automated flight capability. UAVs are operated by a pilot controlling the UAV remotely, while the aircraft may be unmanned, the system is not.
- (2) The *Canadian Aviation Regulations*, Part VI, Subpart 3, Division IV – Miscellaneous Special Flight Operations contains the information that must be submitted to the Minister in order to obtain an SFOC for the operation of an unmanned air vehicle system.
- (3) Under the *Aeronautics Act*, the Minister delegates the responsibility for approving SFOCs to appropriately delegated inspectors in the regional and national offices. This includes the authority and responsibility to issue SFOCs for the operation of UAV systems and to specify the conditions to be contained in the certificates.
- (4) In consideration of the limited aviation background and the lack of knowledge of TC requirements and procedures of many UAV system manufacturers and operators, upon initial contact with a Certificate applicant, the Inspector should ensure that the applicant is:
 - (a) In possession of the Standards applicable to UAV systems, and if not, inform the UAV operator of the procedures to obtain them.
 - (b) Made aware of the type of information that must be submitted in an SFOC application. (e.g. the Certificate applicant obtains a copy of this SI or applicable Advisory Circulars).
 - (c) Made aware that it is the Certificate applicant’s responsibility to provide sufficient information and risk mitigation measures to permit the Inspector to adequately assess the safety of the proposed operation. Failure of the applicant to demonstrate the ability to conduct safe operations will result in significant delays or a denial of the issuance of an SFOC.
 - (d) Made aware of the requirement to submit the SFOC application a minimum of 20 working days prior to the date of the proposed operation. This level of service timeframe assumes that TC received a comprehensive, complete and accurate SFOC application containing all required information.

3.2 Professionalism and Education

- (1) Unmanned aircraft are legitimate airspace users, however, they need to integrate into national airspace in a safe manner and routine access to the national airspace system poses a variety of technological, regulatory, workload, and coordination challenges. For everyone’s safety, aviation are governed by a stringent set of aviation regulations. A high level of professionalism is expected from the UAV operator.
- (2) In addition, TC inspectors should keep in mind that many entrepreneurs interested in obtaining authorization to use UAVs to provide aerial work services for example, real estate photography, academia, etc., are not aviation professionals. As such, they have limited aviation backgrounds, and lack knowledge about existing flight and airspace regulations. To protect the safety of the public and for these individuals to become viable UAV operators, Inspectors may need to inform them of the requirements and the process. UAV operators in turn must be informed on current regulations, policies and procedures and develop safe business practices in a similar fashion to professional “manned” aviation companies.

3.3 Terminology

- (1) Unmanned Air Vehicle (UAV) is the only term that currently has a legal basis in the CARs, for the purpose of all TC issued Canadian Aviation Documents (CAD).

Note:

The term UAV shall be utilized until such time as the terminology is formally amended in the CARs to harmonize with ICAO who distinguish between Remotely Piloted Aircraft Systems (RPAS) and Unmanned Aircraft Systems (UAS).

3.4 Application of the *Aeronautics Act*

- (1) The *Aeronautics Act* sets out responsibilities of the Minister of Transport for civil aviation and the Minister of Defence for military aviation, and provides for the making of regulations and the enforcement of aeronautics law. In terms of jurisdiction, the Act and the regulations there under apply to all Canadian aircraft and crew members both inside and outside Canada.
- (2) UAV operators need to be familiar with the applicable sections of the *Aeronautics Act*.

3.5 Application of the *Canadian Aviation Regulations*

- (1) Civil versus Military UAV Operator
 - (a) Transport Canada is responsible for the conduct of civil UAVs. The CARs do not apply to Canadian or foreign military UAVs however, these are subject to Military Flying Orders. Military operations conducted in civil airspace (i.e. outside Class F Military Restricted Airspace) require coordination with NAV CANADA and may require assistance from TC, General Flight Standards in HQ.
- (2) Foreign versus Canadian UAV Operator
 - (a) Foreign operators must be legally eligible to operate in their own country before the issuing an SFOC can be considered. Eligible foreign UAV operators intending to operate within Canadian sovereign airspace (anywhere within the 12 nautical miles of territorial waters boundaries) must apply for, and obtain, an SFOC. Additional approvals may also be required for foreign UAV operators. Further details regarding international operations can be found in Appendix L.

3.6 Staff Instruction Applicability

- (1) This SI is applicable to any UAV and overweight model aircraft:
 - (a) Overweight Model
 - (i) Canadian model aircraft that exceed 35 Kg in weight are legally considered UAVs and the operator of the model aircraft must apply for, and receive, an SFOC under Section 12 of this SI.
 - (ii) Members of the Model Aeronautics Association of Canada (MAAC) and the U.S. Academy of Model Aeronautics (AMA) participating in MAAC sponsored flying events must apply for and receive an SFOC that gives them the privilege at such events. In this case the model aircraft operator will also be required to apply under Section 12 of this SI.
 - (iii) In the event that the Certificate applicant is a member of MAAC and follows MAAC safety guidelines, it would be reasonable to issue the SFOC valid for operation at all the MAAC Safety Fields, where the applicant will be operating, as well as providing a three (3) year validity period. If the operator is not a member

of MAAC, limitations will be imposed in the SFOC so that the operator is confined to operating in a specific geographical area and the SFOC will not be valid for longer than one year.

- (2) This SI does not consider:
- (a) Persons who choose to operate UAVs under the exemptions issued by the Minister:
 - (i) with a maximum take-off weight not exceeding 2 kilograms (4.6 pounds); or
 - (ii) with a maximum take-off weight exceeding 2 kilograms (4.6 pounds) but not exceeding 25 kilograms (55.1 pounds);
 - (b) Autonomous UAV systems or UAVs operating with passengers carried onboard;
 - (c) Tethered UAVs that would otherwise be considered obstacles and some UAVs operated indoors;
 - (d) Large unoccupied free balloons, kites and rockets; and
 - (e) Model aircraft.

3.7 Other Legislations

- (1) Inspectors must advise Certificate applicants that nothing in an SFOC relieves the UAV operator from complying with the provisions of any other relevant Acts, Regulations or laws, from any level of government. These may include, but are not limited to:
- (a) *The Charter of Rights and Freedoms,*
 - (b) *Criminal Code of Canada;*
 - (c) *Privacy Act;*
 - (d) *Personal Information Protection and Electronic Documents Act;*
 - (e) *Customs Act;*
 - (f) *Trespass Act;*
 - (g) *Radiocommunication Act;*
 - (h) *Environmental Protection Act;*
 - (i) *National Parks Aircraft Access Regulations;*
 - (j) *Transportation of Dangerous Goods Act;* and
 - (k) *Canadian Transportation Accident Investigation and Safety Board Act.*
- (2) A statement to this effect shall be prominently included in all SFOCs cover letters issued by TC. Sample cover letter wording is provided in Appendix A.

3.8 Contravention of Legislations

- (1) Individuals new to the UAV and the model aircraft industry may not be aware of Canadian regulations or model aircraft industry published safety guidelines. This could lead to aircraft operations conducted in a reckless and negligent manner (e.g. in public places close to persons and private property, near aerodromes, beyond line-of-sight, at high altitudes and operating without liability insurance, etc.) The continuation of such practices will severely and negatively impact the legitimate unmanned aircraft industry and the freedom provided to modellers. Furthermore these actions could potentially cause fatalities, resulting in lawsuits, fines and jail time.

(2) The *Criminal Code of Canada* describes several offences involving the dangerous operation of aircraft and endangering the safety of other aircraft. Committing such offences is punishable by monetary penalties and/or jail time including imprisonment for life. In addition to *Criminal Code* offences the following apply to contraventions committed by persons operating UAVs or model aircraft.

(3) **UAVs**

- (a) Section 602.41 of the CARs is a designated provision. Penalties may be assessed in the amount of \$5,000 for individuals and \$25,000 for corporations for failure to obtain an SFOC..
- (b) Section 603.66 of the CARs is a designated provision. Penalties may be assessed in the amount of \$3,000 for an individual and \$15,000 for a corporation for failure to comply with the conditions of an SFOC.

Note:

Where there is a suspected violation, Inspectors shall provide detailed information to their Enforcement branch for action (i.e. Detection Notice).

(4) Civil Aviation Issues Reporting System (CAIRS)

- (a) The CAIRS provides stakeholders and the public, with a means to anonymously raise civil aviation issues (concerns, complaints and suggestions for improvement) to TC such as illegal or unsafe use of unmanned air vehicles.

<http://www.tc.gc.ca/eng/civilaviation/opssvs/secretariat-cairs-menu-209.htm>
- (b) It should be noted that the more specific the details are about a perceived contravention, the easier it will be for Transport Canada Enforcement officials to process the report. Nevertheless, individuals who witness, or are otherwise aware of violations, are encouraged to file a CAIRS report to allow Enforcement to investigate the matter.

4.0 GUIDANCE MATERIAL – PERSONNEL

4.1 Personnel Competencies

- (1) Persons associated with the operation of the UAV system, responsible for taking safety related actions or making safety related decisions about the operation (i.e. UAV operator, pilots, maintainers and visual observers) must be a minimum of 18 years of age.
- (2) Pilot
 - (a) Although the pilot-in-command (PIC) of a UAV system is external to the aircraft, they still have responsibility and authority for the operation and safety of the aircraft during flight time. As with manned aircraft, the PIC may not always be the individual manipulating the controls and may at times be supervising another pilot. The PIC may be supported by other crew members that have been assigned to duties essential to the operation of the UAV (e.g. payload operators, visual observers, operators of launch systems and arresting hooks and mission planners). Crew members engaged in the operation of a UAV system shall, during flight time, comply with the instructions of the PIC.
 - (b) UAV pilots must be properly trained and proficient to assure safe integration within national airspace.

Note:

Subject to regulatory development, it is anticipated that all UAV pilots will be licensed by TC.

- (c) For pilots of small UAVs (25 kg or less) operated within visual line-of-sight (VLOS), the following are considered the minimum requirements:
 - (i) Age – Minimum age of 18 years old.
 - (ii) Medical Fitness – Must be fit to conduct their required duties.
 - (iii) A working knowledge of:
 - (A) TC policies, guidance material and the applicable UAV related regulations in the CARs;
 - (B) The class of airspace in which they intend to operate including the vertical and horizontal airspace boundaries and determining adjacent classes of airspace;
 - (C) Aeronautical charts and the Canada Flight Supplement;
 - (D) Air Traffic Control (ATC) services and procedures (where the operation is conducted in, or near, controlled airspace);
 - (E) The affect of weather on UAV performance and the ability to identify critical weather situations;
 - (F) The identification of hazardous in-flight situations and collision avoidance requirements and procedures; and
 - (G) Type-specific UAV systems, limitations, normal procedures and emergency procedures.
 - (iv) Experience and Skill – Practical training is required on UAVs and system-specific training will be determined based on the level of automation, using competency as the basis of establishing experience and skill. The UAV pilot will need to demonstrate competency in the ability to maintain situational awareness and perform normal and emergency manoeuvres appropriate to the particular type of UAV system.

- (v) Currency – It is expected that UAV pilots maintain currency on all UAV systems they are approved to operate.
- (vi) Radiotelephony – A Radiotelephone Operator Restricted Certificate (Aeronautical) is required to communicate on frequencies within the protected aviation band.

- (A) Language Proficiency – Must be able to comply with the language proficiency requirements of subsections 401.06(1) and 421.06(4) of the CARs.

- (d) For pilots of all other UAV operations (i.e. not small UAVs operated within VLOS), additional pilot knowledge, skill and proficiency will be required and evaluated on a case-by-case basis. UAVs that share the airspace with manned aircraft and pose the same risks as a manned aircraft must require a similar level of pilot qualifications. As the level of complexity of the UAV operation increases, so does the training requirement. For example, to conduct Instrument Flight Rules (IFR) operations a pilot licence endorsed with an IFR rating is required.

(3) Visual Observers

- (a) A visual observer is a crew member assigned and trained to perform duties associated with the provision of sense and avoid, such as continuously monitoring the UAV and the airspace (e.g. for other traffic, clouds, obstructions and terrain) both around and sufficiently beyond the UAV. For operations within VLOS, a visual observer(s) will be required unless a safety case can be provided that shows how the risks can otherwise be mitigated.
- (b) The primary task of the visual observer is to provide the PIC with information to manoeuvre the aircraft clear of any hazards and any potential collision with ground obstructions or air traffic. Additionally, the visual observer must assist the UAV pilot to comply with applicable SFOC conditions, such as flight visibility and cloud clearance requirements and keeping the aircraft within VLOS. The visual observer must be able to see the aircraft and the surrounding airspace throughout the entire flight. They must be able to determine the aircraft's relative altitude, flight path, and proximity to all aviation activities and other hazards (e.g. terrain, weather, structures) sufficiently to prevent the aircraft from creating a collision hazard.
- (c) Visual observers shall only perform observation duties for one (1) UAV at a time.
- (d) Visual observers must maintain constant communication with the UAV pilot and have the ability to communicate timely information to the UAV pilot to avoid other aircraft where a potential for conflict exists.
- (e) The use of visual observers in/on moving land vehicles will not be approved as a method of extending the operating area/range of a UAV system.
- (f) For visual observers, the following are considered the minimum requirements:
 - (i) Age – Minimum age of 18 years old.
 - (ii) Visual acuity sufficient to conduct their duties.
 - (iii) A working knowledge of:
 - (A) Visual scanning techniques;
 - (B) Inter-crew communication requirements;
 - (C) Hazardous in-flight weather conditions;
 - (D) Actions to be taken in the event a risk of collision develops;

- (E) The vertical and horizontal boundaries of the operation;
 - (F) The class of airspace in which they intend to operate including the vertical and horizontal airspace boundaries and determining adjacent classes of airspace;
 - (G) Right of way rules as specified in the SFOC; and
 - (H) The UAV system limitations.
- (iv) Radiotelephony – A Radiotelephone Operator Restricted Certificate (Aeronautical) is required to communicate on frequencies within the protected aviation band.
- (A) Language Proficiency – compliance with the language proficiency requirements of subsections 401.06(1) and 421.06(4) of the CARs.

(4) Payload Operator

- (a) Age - Minimum age of 18 years old.
- (b) Must be trained to be thoroughly familiar with the UAV payloads being operated.
- (c) Where the pilot has a dual role (e.g. the UAV pilot is also the payload operator), the Certificate applicant must address any risks associated with the same person performing both functions. Conducting duties as the payload operator shall not affect the person's ability to control the aircraft and must not negatively impact their workload as the UAV pilot.

(5) System Maintainer

- (a) Age - Minimum age of 18 years old.
- (b) Must be trained on the maintenance of the UAV system.
- (c) An Aircraft Maintenance Engineer (AME) license is not required for small UAVs operating within VLOS. The maintenance, including airworthiness of the UAV, is the responsibility of the UAV operator.
- (d) For maintenance of all other UAVs (i.e. not small UAV operated within VLOS), additional knowledge, skill and proficiency will be required and evaluated on a case-by-case basis.

Note:

Where the system maintainer is self-taught, it is expected that the applicant will provide a summary of the information and materials used to conduct the self teaching.

(6) Other Crew Member Requirements

- (a) Support personnel for launch and recovery systems and dispatchers/mission planners will need to be trained and deemed competent to perform the duties assigned to them by the UAV operator.

4.2 Provision of Training

- (1) Although, at present, there are no minimum qualification standards for UAV training organizations the UAV operator remains responsible for ensuring that their personnel have reached a satisfactory level of knowledge, experience and skill.
- (2) The training to safely operate a UAV system can be received from a variety of sources including UAV operators, manufacturers, manned aviation flight training organizations or third parties. The approach to training, however, should not differ significantly from that currently applied to manned

aviation since fundamental knowledge, experience and skills are basic requirements to assure a safe and effective operating environment for all airspace users.

- (3) Organizations providing training for Compliant UAV Pilots of Small UAV systems, shall base their curriculum on the TP1526E - *Recommended Knowledge Requirements for Pilots of Small Unmanned Air Vehicle Systems, Restricted to Visual Line-of-Sight.*

4.3 Radiotelephone Certificates

- (1) Inspectors shall remind Certificate applicants of the requirement under the Radiocommunications Act for a Restricted Operator Certificate – Aeronautical. It may take up to 30 days to obtain radio frequency clearances, certificates and/or radio station licences. Radiocommunication regulations may be found at: <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-484/index.html>

5.0 GUIDANCE MATERIAL – UAV SYSTEM

5.1 Airworthiness / Continued Airworthiness/Maintenance

- (1) A detailed UAV system design standard for small UAV systems operated VLOS can be found in Appendix C of this SI. Although this design standard is not currently mandatory but could be subject to future regulatory development.
- (2) All UAV systems must be designed to perform their intended function and all equipment must be installed and functional in accordance with the limitations specified for the particular equipment.
- (3) The UAV operator is responsible for ensuring that the UAV system is in an airworthy condition prior to conducting flight operations. An airworthy condition includes, at a minimum;
 - (a) The UAV system has been maintained in accordance with the manufacturer's specified maintenance program and schedule;
 - (b) The requirements of any airworthiness directives (or equivalent) issued by the manufacturer of the aircraft, control station or other ancillary component have been completed;
 - (c) All modifications and repairs to the UAV system are carried out in accordance with the manufacturer's instructions and that no unapproved modifications have been carried out; and
 - (d) All UAV system equipment required for safe flight operations is serviceable.

5.2 Aircraft Marking and Registration

- (1) At this time, UAVs are not required to be marked and registered
- (2) Pending aircraft marking and registration, the UAV operator will need to establish, in coordination with the each applicable air traffic service provider, a call sign to be used during the particular operation in order to facilitate communication and avoid duplication of call signs.

5.3 Portable Electronic Devices.

- (1) Portable electronic devices (PED) are items such as two-way radios, cellular phones, tablets, laptop computers, audio/visual recorders and hand-held Global Positioning System (GPS) / Global Navigation Satellite System (GNSS), that are not part of the UAV system inventory.
- (2) The use of PEDs in manned aircraft is governed by section 602.08 of the CARs.
 - (a) In the absence of engineering evaluations on individual UAV systems, by the original equipment manufacturer or operator, TC will apply section 602.08 of the CARs to the use of PEDs in the UAV, the control station and around command and control segment equipment.
 - (b) PEDs such as hearing aids, heart pacemakers, electronic watches and UAV operator-installed PEDs that have been properly tested so as not to impair the functioning of the UAV's systems or equipment are permitted without restrictions.

5.4 Transportation of Dangerous Goods

- (3) In accordance with the *Transportation of Dangerous Goods Act*, transporting a UAV system with lithium batteries, in a vehicle or another aircraft requires mandatory special handling protocols. For more information, refer to TC Transportation of Dangerous Goods Bulletin [RDIMS-#8508799](#) or at <http://www.tc.gc.ca/eng/tdg/lithium-batteries-are-dangerous-goods-1162.html>

6.0 GUIDANCE MATERIAL – OPERATIONS

6.1 Airspace

- (1) UAVs do not have an automatic right to airspace use. They must integrate safely with other airspace users, so if safety provisions cannot be made or if operations are such that they negatively impact the safety of other airspace users, the operation cannot be approved. It is imperative that the capability of taking immediate active control of the aircraft by the pilot exists at all times, the same way it does with manned aircraft.
- (2) The risk of a UAV colliding with another aircraft must be comparable to that for manned aircraft (i.e. an equivalent level of safety). Vigilance for the purpose of detecting potential collisions must not be relaxed for any aircraft in flight, regardless of the type of flight, type of aircraft or class of airspace in which the aircraft is operating.

6.2 Separation and Collision Avoidance

- (1) Operating within Visual Line of Sight (VLOS)
 - (a) A visual observer(s) is required to perform the separation and collision avoidance functions. Certificate applicants proposing “see and avoid” strategies, in lieu of visual observers, will need to be able to demonstrate in their risk assessment that injury to persons or property (in the air or on the ground) along the proposed flight path is “extremely improbable”.
 - (b) For additional details on visual observer requirements refer to section 4.1(3) of this SI.
- (2) Operating Beyond Visual Line of Sight (BVLOS)
 - (a) When separation or collision avoidance functions cannot be conducted by a visual observer, in accordance with section 6.2(3)(b) below, an alternative means of ensuring this capability must be used. Therefore, UAV operations will not be permitted in non-segregated airspace (airspace shared with manned aviation), BVLOS of the UAV pilot or visual observer, without an acceptable sense and avoid system to reduce the possibility/potential of a mid-air collision.
 - (b) Exceptions to this policy will only be considered for:
 - (i) Operations where the BVLOS portion of the flight is contained wholly within restricted airspace; or
 - (ii) Operations where the Certificate applicant proposes an alternate means of mitigating any collision risks (e.g. ground based radar in remote areas, etc.) which the Minister deems acceptable.
 - (c) Notwithstanding (a) and (b) above, there may be situations where the risks to other airspace users may not be sufficiently mitigated and BVLOS cannot be authorized.
 - (d) Due to the increased complexity of proposed BVLOS operations, Certificate applicants should expect the approvals for any such SFOCs to take longer than the standard approval times.
- (3) Sense and Avoid System
 - (a) To provide traffic separation and a means for collision avoidance, a UAV operated BVLOS must be able to sense other airspace users, provide situational awareness to the UAV pilot and execute collision avoidance manoeuvres.
 - (b) The goal of any sense and avoid system is to perform those separation and collision avoidance functions normally provided by a pilot in a manned aircraft. Therefore, a sense and avoid system will have to detect the traffic in time to process the sensor information,

determine if a conflict exists, and execute a manoeuvre according to the right-of-way rules. If pilot interaction with the system is required, transmission and decision time must also be included in the total time between the initial detection and the point of minimum separation. Any sense and avoid system must possess the capability to detect both cooperative aircraft (aircraft with a means of electronic conspicuity (transponder, TCAS, ADS-B, etc.)) and non-cooperative aircraft.

- (4) Ground-Based Sense and Avoid (GBSAA)
 - (a) Some ground based radar systems may be utilized to provide a means of meeting sense and avoid requirements. In these cases the UAV operator must provide supporting data which demonstrates that the following can be accomplished safely:
 - (i) Both cooperative and non-cooperative traffic can be detected and tracked to ensure safe separation and collision avoidance;
 - (ii) The system will effectively mitigate the risks of a potential collision;
 - (iii) Personnel are suitably-trained and equipped to use the system effectively; and
 - (iv) Procedures are in place for the UAV pilot to effectively use the data.
 - (b) Use of GBSAA will be restricted to Class G airspace outside of 5 NM from the centre of an aerodrome.
 - (c) Inspectors will assess whether the GBSAA system is suitable to mitigate the risk of collisions with other aircraft and, if found suitable, appropriate conditions will be added to the SFOC.
- (5) Traffic Alert and Collision Avoidance System (TCAS) / Airborne Collision Avoidance System (ACAS)
 - (a) TCAS/ACAS does not have automated manoeuvring functionality. As such, due to the potential for lost link, UAV pilots shall only use TCAS/ACAS in the Traffic Advisory (TA) mode.
 - (b) The use of TCAS/ACAS by UAVs has not been validated as a means for meeting sense and avoid requirements. As such, TCAS/ACAS, in and of itself, is not a complete strategy for mitigating the UAV sense and avoid requirements.
 - (c) Where a UAV employs a collision avoidance system with reactive logic, any manoeuvre resulting from a perceived threat from another aircraft shall not reduce the effectiveness of a TCAS/ACAS resolution advisory manoeuvre from that other aircraft.
- (6) Automated Dependant Surveillance Broadcast System (ADS-B)
 - (a) ADS-B is a surveillance system that uses a GNSS aircraft avionics and ground infrastructure to accurately and quickly transmit flight information that includes aircraft identification, position, altitude, and velocity between aircraft and air traffic control. The ability to receive and display ADS-B messages and broadcast services, both from the ground and directly from other aircraft, is called ADS-B in. An ADS-B out system consists of at least a transponder, a GPS and the transponder controls. There may be other equipment, which connects to these components, such as a data concentrator or a flight management system.
 - (b) ADS-B is automatic since it functions without intervention from the flight crew as long as the necessary avionics are in place, connected and functioning. Contrary to the primary radar system which is not dependant on anything from the aircraft, ADS-B is a dependent system because it requires aircraft to state their position. As such only cooperative aircraft reap the benefits of ADS-B.

- (c) ADS-B surveillance in Canada is currently limited to the Hudson's Bay and Northeast and Oceanic areas to augment high-level remote and oceanic airspace radar coverage. ADS-B is not being mandated in Canada for manned or unmanned aircraft in the near term. It is acknowledged that ADS-B technology will supplement the current ground-based radar surveillance system and may eventually replace it to some extent, however, the details of ADS-B integration are yet to be determined.
 - (d) As ADS-B does not have the ability to detect non-cooperative aircraft, it is not an approved strategy, in and of itself, for mitigating the UAV sense and avoid requirements.
- (7) Multilateration
- (a) Multilateration is also a type of secondary surveillance system but is based on the use of conventional transponders and stationary receivers that provide an aircraft's position using triangulation principles. It may be considered as an alternative to conventional radar or ADS-B. Multilateration may provide similar benefits as secondary radar.
- (8) Chase Aircraft
- (a) For detailed guidance on chase aircraft refer to Appendix K.
- (9) First Person View (FPV)
- (a) A FPV device generates and transmits a streaming video image to a ground station display or monitor giving the pilot who is viewing this video, the illusion of actually flying the aircraft from an onboard pilot's perspective.
 - (b) FPV on a UAV does not constitute an acceptable solution for providing a sense and avoid capability nor is it considered to be a suitable substitute for the use of a visual observer during VLOS operations. As such, FPV devices shall only be operated as specifically approved in an SFOC for a particular UAV operation. The use of FPV technology must adhere to paragraph 6.2(1) and 6.2(3)(b) of this SI.

Note:

MAAC publishes safety guidelines on FPV devices for their members.

- (10) Separation and Collision Avoidance Standard Operating Procedures (SOPs)
- (a) SOPs addressing separation and collision avoidance could be published separately or in the UAV operator's operations manual. Requirements for the following phases of flight should be addressed:
 - (i) Take-off/launch and landing/recovery procedures;
 - (ii) En-route and terminal procedures;
 - (iii) Loss of control data link; and
 - (iv) Abort procedures following critical system failure.

6.3 Transponders

- (1) When operating in designated transponder airspace, as outlined in the Designated Airspace Handbook (TP 1820E), UAV systems shall meet the mandated equipment requirements as per section 605.35 of the CARs.

- (a) Where the UAV cannot meet the equipage requirements of designated transponder airspace, prior to considering such an operation, operators must coordinate with NAV CANADA to ensure the proposed operations can be authorized. Evidence of such coordination shall be included in the SFOC application.
- (b) Notwithstanding (a) above, specific permission must be gained by the UAV operator from the ATS Unit prior to conducting each operation in that airspace. If the ATS unit cannot accommodate such a request, UAV operations are not permitted.

6.4 UAV System Capability Requirements

- (1) An SFOC for the operation of a UAV system should not be approved unless there is a means of:
 - (a) controlling the flight of the UAV (e.g. reporting altitude, airspeed, etc.);
 - (b) monitoring the UAV system (e.g. performance limitations, fuel/energy status, landing gear indications, control link status, etc.);
 - (c) communication, as required by the Class of airspace or regulations;
 - (d) electronic surveillance (transponder) as required for the Class of airspace or regulations;
 - (e) a means of navigation;
 - (f) detecting hazardous environmental flight conditions (e.g. icing, thunderstorms, etc.);
 - (g) where the aircraft is to be handed over from one control station to another, the equipment required to execute the handover;
 - (h) mitigating the risk of loss of control of the UAV trajectory (e.g. route, course or path);
 - (i) aircraft lighting or illumination for night operations sufficient to maintain visual contact;
 - (j) a suitable light source to illuminate essential flight control equipment at the control station, where applicable, if the aircraft is operated at night;
 - (k) sensing and avoiding other aircraft;
 - (l) avoiding flight into obstacles and terrain; and
 - (m) remaining clear of cloud to the distance required for the airspace and operation.
- (2) Should a Certificate applicant be unable to meet the above requirements they will need to demonstrate appropriate mitigation measures to ensure they meet a comparable level of safety. Inspectors will need to consider what additional conditions/restrictions are required in the SFOC.

6.5 Light Emitting Diodes (LED) and Night Vision Goggles (NVG) Limitations for Night Operations

- (1) UAV operators using UAVs equipped with LEDs to satisfy the aircraft lighting requirements of section 605.17 of the CARs, shall ensure that any such LEDs are of sufficient intensity and use the appropriate spectrum to ensure they are visible to the UAV pilot/visual observer and/or other airspace users operating with NVGs.
- (2) During night operations, the use of NVGs by the UAV pilot or visual observer is not considered to be unaided visual contact with the UAV and as such does not provide an acceptable solution for providing a sense and avoid capability.

6.6 Authorization for the Use of Lasers

- (1) Before a Certificate applicant can operate a UAV fitted with laser equipment, the applicant has to complete a "Notice of Proposal to Conduct Outdoor Laser Operation(s)" and submit it to a TC

office. Additional information, including required forms can be found at <https://www.tc.gc.ca/eng/civilaviation/standards/aerodromeairnav-standards-ais-directed-bright-light-menu-1068.htm>

- (2) An aeronautical assessment is then conducted and the documentation is forwarded to Health Canada who validates the Nominal Ocular Hazard Distance calculated by the applicant in the "Notice of Proposal to Conduct Outdoor Laser Operations" form submitted. The normal process time is at least 30 days to review the notification and determine if a laser authorization can be issued.
- (3) There are no exceptions to the requirement for this process. For example, even if the aircraft is going to be fitted with a short-range laser rangefinder to act as an altimeter the equipment on the aircraft could cause a hazard to aviation safety therefore an assessment is required.
- (4) Refer to sections 601.20 (Projection of Directed Bright Light Source at an Aircraft), 601.21 (Requirement for Notification) and 601.22 (Requirement for Pilot-in-command) of the CARs for further guidance.

6.7 Frequency Spectrum

- (1) The use of radiocommunication systems is essential to the safe and expeditious operation of UAVs. The number and type of these radiocommunication systems vary according to the UAV operation and may be composed of terrestrial and satellite components. A number of the safety-critical applications are already supported by existing aeronautical systems that operate in a dedicated spectrum to ensure the appropriate level of protection.
- (2) In order to support the safe operation of UAVs, the 2012 ITU World Radiocommunication Conference afforded aviation a new allocation to the aeronautical mobile (route) service in the C-band (5030 – 5091 MHz) for line-of-sight UAV C2 links, limited to internationally standardized aeronautical systems. An existing C-band allocation to the aeronautical mobile satellite (route) service was similarly modified for beyond line-of-sight UAV C2 links.
- (3) Currently, Fixed Satellite Services are not within the protected aviation frequency bands and as such there exists an increased risk of interference and potential loss of control of the UAV. As such, additional attention for the security of the C2 links may be required. Refer to section 6.30 of this SI for security requirements.

Note:

Fixed satellite services is a radiocommunication service between earth stations at given positions, when one or more satellite stations are used. They also include the radiocommunication associated with the operation of the satellite station (e.g. tracking, telemetry and telecommand functions).

6.8 Radio Station Licensing

- (1) Industry Canada is the lead department responsible for radio frequencies, spectrum and telecommunications issues. The Inspector shall remind the Certificate applicant of the requirement to contact Industry Canada regarding the assignment of radio frequencies. Coordination with Industry Canada is not required if using licence-exempt radio frequencies (e.g. 72 MHz, 902-928 MHz, 2.4 GHz, etc.). Industry Canada Regional and District Office addresses and telephone numbers may be found at: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01742.html>

- (2) From an aeronautical mobile service perspective, there are two categories: those that have aeronautical service radio equipment onboard the UAV, and those that do not. In the latter case, the aeronautical service communications aspect is facilitated by ground-based UAV pilot/visual observer, via handheld radio or a fixed ground station.
- (3) With respect to radio licensing of associated ground-based radios used to facilitate aeronautical mobile service communications, the following policies apply:
 - (a) In the case of a permanent fixed ground station, a valid radio station licence is required at all times, regardless of whether the station is operated by a federal department, government agency or a private sector UAV operator.
 - (b) Where a handheld or mobile radio is used, such equipment is considered a component of the UAV's aeronautical radio service system, and therefore is exempted from the requirement to obtain a radio licence. It should be understood that this "exemption" applies only to mobile/handheld radio equipment used expressly during UAV operation and testing. Such mobiles would not be considered licence-exempt if used outside the scope of UAV operation and testing.
 - (c) Regardless of whether aeronautical mobile service communication is conducted via land or mobile stations, UAV pilots/visual observers must have a valid Restricted Operators Certificate - Aeronautical (ROC-A).

6.9 Communications

- (1) **ATS Unit Communications**
 - (a) The UAV pilot must establish and maintain direct two-way radio communication with the appropriate ATS Unit, as dictated by the airspace being operated in and the flight rules under which they are operating, in accordance with Part 6, Division V of the CARs.
 - (i) ATS communications requirements shall be stipulated in the SFOC.
 - (ii) Sample conditions for ATS communications at uncontrolled airports can be found in Appendix G through J).
 - (b) Communications between the UAV pilot and an ATS Unit are to be established through onboard radio equipment to provide a voice relay, unless an alternative communications strategy is specifically addressed in the SFOC.
 - (i) In addition to the onboard radio requirements, the UAV operator shall ensure a back-up form of communication, between the UAV crew and the ATS Unit, is available (e.g. cell phone, satellite phone, landline, etc.).
 - (ii) The primary and back-up communication devices must be tested with the ATS unit prior to conducting operations.
 - (c) The use of portable electronic devices (including cell phones) or land-line telephones is not approved as a primary means of communication with an ATS Unit unless specifically authorized in the SFOC. Additional information on portable electronic devices can be found in section 5.3.
 - (d) UAV crews shall comply with ATS Unit instructions in a timely manner and in accordance with section 602.31 of the CARs.
 - (e) Only trained, licensed and authorized UAV crew members shall communicate with the ATS Unit.
 - (f) For UAV operations, a separate person responsible for communications is required unless a safety case can be provided that shows how the risks associated with the pilot

conducting both the piloting duties and communications tasks can otherwise be mitigated.

(2) Inter-Crew Communications Requirements

- (a) Any person charged with providing see-and-avoid assistance to the UAV pilot must have immediate and continuous communication with the UAV pilot.
- (b) If a chase aircraft is being utilized, immediate communication between the chase aircraft flight crew and the UAV pilot is required at all times. Additional information regarding use of chase aircraft can be found in Appendix K.
- (c) If the UAV pilot is in communication with the ATS Unit, it is recommended that all UAV crew members (e.g. pilots, visual observers, payload operators and chase pilots) monitor the ATS Unit frequency to improve situational and navigational awareness.

6.10 Emergencies / Contingencies

(1) For the purpose of establishing safe aircraft operating procedures, Certificate applicants shall establish and make immediately available to each UAV flight crew member a UAV system emergency procedures checklist for each UAV system that it operates.

(2) Lost Link - General

- (a) There are many acceptable approaches to satisfy lost link requirements. The aim of any lost link procedure is to ensure that the aircraft's flight path remains predictable and does not pose a risk to other airspace users. Inspectors shall ensure that the UAV lost link procedures/conditions specified in the SFOC application or in UAV operator's operations manual are referenced by an SFOC condition.
- (b) Lost Link procedures provided in the SFOC application should include, as applicable, lost link route of flight, transponder use, lost link orbit points, communications procedures (with whom and when), and pre-planned flight termination points or other contingency planning measures in the event that the recovery of the UAV is not feasible.
- (c) The PIC must be able to assess the risk involved with the particular lost link circumstance and establish when auto-recovery manoeuvres or flight termination shall be initiated.
- (d) If a lost link situation could result in entering controlled airspace or any area that has reporting requirements (i.e. restricted airspace) the Certificate applicant must provide their lost link plan to the appropriate ATS Unit or user agency, in advance of proposed operations.

(3) Lost Link - While Operating Under an IFR Clearance

- (a) Unless otherwise authorized, if operating under an IFR clearance, the lost link procedure must comply with the last ATC clearance for a sufficient period of time to allow the ATS Unit to be informed of the lost link situation and ensure conflict resolution.
- (b) Lost link procedures that differ from standard IFR lost communication profiles shall be pre-coordinated with the appropriate ATS Unit(s) and included in the SFOC application as well as the UAV operator's operations manual.
- (c) Unless otherwise authorized, lost link procedures must:
 - (i) limit UAV flight to over water or sparsely populated areas in order to transit to a pre-planned lost link point within VLOS to re-establish link;
 - (ii) avoid unpredictable turn-arounds and/or altitude changes; and
 - (iii) not contain holding points within any published holding area, airways or air route.

- (d) If the link is not re-established within a pre-determined period of time as specified in the SFOC application, the aircraft may:
 - (i) autoland;
 - (ii) proceed to another lost link point in an attempt to regain C2 link; or
 - (iii) proceed to a flight termination point.
 - (e) Where multiple or concurrent UAV operations are planned in the same area, the Certificate applicant must provide a segregation plan in the event of a simultaneous lost link scenario. The deconfliction plan may include altitude offsets and horizontal separation by using independent lost link points.
- (4) Flight Termination
- (a) All UAV systems should have adequate system redundancies and independent functionality to ensure the overall safety and predictability of the UAV system.
 - (b) In order to avoid a fly-away situation and safeguard other airspace users, UAV systems that lack redundancies may be required to have an independent flight termination system that can be activated by the UAV pilot.
- (5) Emergency Equipment Requirements
- (a) The following emergency equipment shall be available to the appropriate crew member(s).
 - (i) a hand-held fire extinguisher of a type suitable for extinguishing fires that are likely to occur, and
 - (ii) a suitable portable light source to illuminate essential flight control equipment at the control station if the aircraft is operated at night.

6.11 Military Class F Restricted Airspace Coordination

- (1) Where an Inspector receives an SFOC application proposing operations in military Class F Restricted airspace, the Inspector will advise 1 Canadian Air Division (1 CAD) Staff Officer Unmanned Aircraft (SO UA) in Winnipeg at (204) 833-2500 x 6445 or email A3UAV@forces.gc.ca.
- (2) The Certificate applicant is responsible for working with appropriate military authorities to gain access to the Base/Range airspace and prepare their operating procedures to the satisfaction of the applicable Range Control Officer and/or the Base/Wing Commander.
 - (a) Certificate applicants must obtain written authorization from Range Control and/or the Base/Wing Commander.
 - (b) Operations will be conducted in accordance with Range rules and restrictions unless they are less restrictive than the SFOC conditions and the CARs.
 - (c) Where intended operations are in Class F airspace over a Canadian military establishment, TC Inspectors shall inform Certificate applicants of the requirement to obtain written permission from the Department of National Defence (DND).
- (3) Upon issuance of an SFOC for operating a UAV in military Class F Restricted airspace, the inspector shall inform the Certificate applicant of their requirement to contact 1 Canadian Air Division (1 CAD) Staff Officer Unmanned Aircraft (SO UA) in Winnipeg at (204) 833-2500 x 6445 or email A3UAV@forces.gc.ca.
 - (a) DND requires that the Certificate applicant provide both their approved SFOC and Base/Range authorization letter to 1 CAD for verification a minimum of 30 days prior to

the intended date of operations. Upon confirmation of a valid SFOC and applicable Canadian Forces Base range access approval, 1 CAD will issue a letter of endorsement.

6.12 Air Traffic Management

- (1) In broad terms, UAVs should be able to interact with all other airspace users, regardless of the airspace or UAVs flight profile, in a manner that is predictable and transparent to all other airspace users and Air Navigation Service Providers. UAV systems shall be interoperable with all surveillance systems without any additional workload for an ATS Unit, manned aircraft pilots or other UAV pilots. UAV systems shall be equipped with suitable communications, navigation, surveillance/air traffic management (CNS/ATM) equipment so as to be interoperable with other aircraft flying in the airspace in which the UAV intends to operate.

6.13 Air Traffic Service Provider Coordination

- (1) Certificate applicants must be aware that they will need to contact the air traffic service provider (i.e. NAV CANADA, DND, Serco or Midwest Aviation) well in advance of any proposed operations to coordinate airspace requirements.
- (2) For NAV CANADA, the National Operations Centre can be contacted at 613-563-5626 or NOC@navcanada.ca. The following are examples of information that the UAV operator should provide to the applicable ATS unit:
 - (a) Intended date, time and duration of the operation;
 - (b) Type of UAV including its equipment capabilities and physical characteristics;
 - (c) Weather limits stipulated in the SFOC;
 - (d) Time of day (day or night);
 - (e) Vertical and horizontal boundaries of the area of operation;
 - (f) Route to access the area of operation;
 - (g) Proximity of the operation to approaches, departures and traffic patterns;
 - (h) Means by which sense and avoid functions will be carried out;
 - (i) Means by which two-way communications will be maintained;
 - (j) Emergency contact information for the UAV operator;
 - (k) Proposed lost link procedures/profiles;
 - (l) Procedures to be followed under emergency situations (e.g. fly-away); and
 - (m) Process and the time required to terminate UAV operations.
- (3) Validity of the SFOC is contingent upon the Certificate applicant coordinating with the applicable ATS Unit and a condition will be included in the SFOC to reflect this requirement.
- (4) In some cases, the Inspector may require the Certificate applicant to initiate efforts to notify other airspace users of the UAV activity (e.g. Notice to Airmen (NOTAMs), Automatic Terminal Information Service (ATIS) Broadcast, Aeronautical Information Publication (AIP) Supplements).
- (5) Prior to take-off/launch, the UAV operator or a designated representative (e.g. pilot in command) shall provide any ATS Unit involved in the operation of the flight with the same information required by an ICAO Flight Plan.
- (6) To ensure the safety of other airspace users, all ATS Units that could be affected by a UAV fly-away must be contacted immediately and advised of the situation. The UAV operator shall establish processes for such notifications prior to the commencement of operations.

- (7) Where air traffic management services of Canadian Domestic Airspace have been delegated to the Federal Aviation Administration, all the above coordination requirements remain applicable.
- (8) Where an Inspector is approving a UAV operator to operate into or within the Canadian Air Defence Identification Zone (ADIZ), or a Standing SFOC is being issued that could include such an operation, the Inspector shall include a condition in the SFOC requiring the UAV operator to comply with section 601.145 of the *CARs*.

6.14 NOTICE TO AIRMEN (NOTAMs)

- (1) A NOTAM will not normally be issued for UAV operations as compliance with the SFOC conditions should result in safe operations.
- (2) However, a NOTAM should be considered where the presence of a UAV creates a temporary hazard that could endanger air navigation or aircraft operations. The criteria for issuing a NOTAM are outlined in Annex 15 of to the Convention on International Aviation.
- (3) The need to publish a NOTAM is determined by TC and not left to the discretion of the UAV operator or negotiated between the aerodrome operator, the UAV operator or other parties.
- (4) NOTAMs are distributed at least five hours in advance of the operation but generally not more than 48 hours. The Canadian NOTAM Procedures Manual is publically available online and provides contact information for the NOTAM office and contains procedures for issuing a NOTAM.

6.15 Restricted Airspace Policy

- (1) Until such time as UAVs have common operational, technical and safety systems to ensure seamless integration in the existing airspace structure, designating Class F Restricted airspace for UAV research, training, testing and development efforts may be an option.
- (2) The following principles will govern such airspace requests:
 - (a) TC will consider only one designation of such airspace per TC Region;
 - (b) Commercial operations will not be approved;
 - (c) An aeronautical study is required to be conducted by NAV CANADA;
 - (d) Establishment of airspace under this policy is delegated to Chief, Flight Standards, TC Headquarters; and
 - (e) A dedicated SFOC will be required by each UAV operator in order to operate in these restricted areas.

6.16 Indoor Operations

- (1) The following TC policies apply when operating a UAV inside a building/structure or in a subterranean environment:
 - (a) Where only the UAV crew is present an SFOC is not required.
 - (b) Where only the UAV crew and people directly participating in the UAV operation are present (e.g. actors on a movie set) and no spectators or invited assembly of persons are present, an SFOC is not required. The UAV operator should ensure that all those participating in the operation are briefed on any potential hazards or risks.
 - (c) Where there are people within the structure who are not part of the UAV operation (e.g. spectators at a sporting event, participants at trade show demonstrations, etc.) an SFOC is required. The Certificate applicant should refer to the appropriate SFOC application process in this SI for further guidance.

- (2) In all the above situations, the UAV operator shall gain consent of the land/property owner prior to any such operation.

6.17 Tethered UAVs

- (1) Generally, aircraft that do not carry persons (e.g. small balloons/airships and kites) that are connected to the ground by way of a tether, operated as antennas, surveillance aircraft, sampling devices etc. are treated as obstacles to air navigation and are to be marked and lit in accordance with the obstruction marking and lighting standards found in section 621.19 of the CARs. However, since the Minister is responsible for protecting persons and property on the ground and other airspace users, tethered UAVs that are extremely manoeuvrable and which operate over wide vertical/horizontal areas may require an SFOC. In these cases, protecting other airspace users by marking, lighting and issuing a NOTAM may not be sufficient and/or may not address very low level operations in built-up areas.
- (2) The type of regulations that apply to tethered UAVs depends on what type of UAV is being considered and the purpose of the aerial work. However, operating an aircraft on a tether simply to avoid SFOC requirements is not a viable solution.

6.18 Aerodromes

- (1) There are many unique characteristics of UAVs that will affect aerodrome operations and these characteristics need to be considered to facilitate the integration of UAVs at aerodromes. For example, the UAV pilot will need to identify, in real-time, the physical layout of the aerodrome and associated equipment, such as aerodrome lighting and markings, in order to manoeuvre the aircraft safely and correctly, regardless of the location of the control station.
- (2) It must be emphasized that while an aerodrome operator may have authority to close the aerodrome in order to allow UAV operators onto the airfield, only TC has the authority to restrict airspace.
- (3) Any temporary or permanent UAV infrastructure located on an airfield may impact the certification of the aerodrome. Inspectors are encouraged to coordinate with their Aerodrome Standards counterparts to confirm any such impacts.
- (4) Certificate applicants are responsible for obtaining necessary permissions from aerodrome authorities prior to operating on the aerodrome.
- (5) For operations conducted at or in the vicinity of an aerodrome, the requirements of Part 6, Subpart 2, Division V, of the CARs shall apply, insofar as they apply to the type of operation being conducted.
- (6) Small UAVs shall avoid the pattern of traffic formed by manned aircraft operating at or in the vicinity of an aerodrome.
- (7) Certificate applicants must coordinate emergency response requirements with the aerodrome manager or authority and identify any UAV unique requirements (e.g. dangers posed by composite materials or ballistic parachutes, etc.).

6.19 Site Survey

- (1) Flying UAVs requires an assessment of the suitability of each site to be made prior to conducting operations to ensure such operations can be conducted safely. Such an assessment must be made by conducting a site visit and utilizing aeronautical charts and other sources of information such as the Canada Flight Supplement, digital imagery (e.g. Google Earth / Google Maps, etc.), the Designated Airspace Handbook, etc.
- (2) Typical elements of an assessment could include, but are not limited to:

- (a) Defining the boundaries of the area where the actual operation will be carried out;
 - (b) Class of airspace and specific provisions of the airspace (e.g. controlled airspace);
 - (c) Altitudes and routes to be used on the approach and departure to and from the area where the operation will be carried out;
 - (d) Other aircraft operations (e.g. proximity of aerodromes including heliports and seaplane bases, or other operating sites);
 - (e) Hazards associated with nearby industrial sites;
 - (f) Areas of high-intensity radio transmissions or electromagnetic interference (e.g. radar sites);
 - (g) Limitations and/or restrictions of local by-laws;
 - (h) Location and height of obstacles (e.g. wires, masts, buildings, cell phone towers, wind turbines, etc.);
 - (i) Airspace restrictions such as restrictions around nuclear facilities;
 - (j) Built-up areas, major roadways and recreational activity sites;
 - (k) Security provisions to limit public access;
 - (l) Predominant weather conditions for the site and proposed operating areas; and
 - (m) Minimum separation distances from persons, vehicles and structures.
- (3) Inspectors processing Standing SFOC applications shall require Certificate applicants to state their methodology for conducting site surveys in the SFOC application. The SFOC shall contain a condition requiring the Certificate holder to follow the site survey procedures stated in their SFOC application.

6.20 General Flight Rules

- (1) Right of Way
- (a) The PIC of a small UAV shall give way to manned aircraft at all times.
 - (b) Section 602.19 of the CARs should apply for all other UAV operations, however, Inspectors will need to assess each SFOC application on the basis of aircraft size, operational environment, sense and avoid mitigation measures, etc. The Inspector shall ensure a condition is incorporated in the SFOC that addresses right-of-way requirements.
- (2) Weather Requirements
- (a) For VLOS operations, the visual meteorological conditions in Part VI, Subpart 2 of the CARs (602.114, 602.115) will be applied unless the Certificate applicant is able to provide satisfactory rationale and risk mitigations for applying lower limits.
 - (i) For VLOS operations ground visibility may be used, in lieu of flight visibility, for meeting prescribed weather limits.
 - (b) For BVLOS operations, conducted under Visual Flight Rules (VFR), the visual meteorological conditions in Part VI, Subpart 2 of the CARs (602.114 – 602.117) will be applied.
 - (c) For BVLOS operations, conducted under IFR, specific weather requirements for IFR operations are determined on a case-by-case basis. The minimum meteorological conditions must be suitable to allow the safe departure and arrival of the aircraft.
 - (d) The forecast /actual wind speed and direction must be within the operating limitations of the aircraft.

- (3) Operations in Icing Conditions
- (a) Flight into known or expected icing conditions should not be conducted unless the UAV system is appropriately certified and equipped to operate in icing conditions and the UAV flight crew is current and qualified in cold weather operations.
 - (b) If (a) above has been met, Inspectors shall impose the following condition: The PIC will not conduct a take-off/launch or continue a flight of a UAV where icing conditions are reported to exist or are forecast to be encountered along the route of flight unless the PIC determines that the aircraft is adequately equipped to operate in those icing conditions.
 - (c) If the aircraft is not equipped to operate in icing conditions, Inspectors will prohibit operations in icing conditions.
 - (d) In the case of a Compliant operator, the Inspector may authorize flight into icing conditions without de-icing or anti-icing equipment where the Certificate applicant has demonstrated that the flight is planned and conducted such that persons or property on the ground and other airspace users are not endangered.

Note:

Such operations in icing conditions are considered specialized operations of small, UAVs and additional risk assessments/mitigations may be required.

- (4) Emergency Locator Transmitter (ELT)
- (a) Inspectors shall not approve an SFOC for the operation of a UAV system equipped with an ELT.
- (5) Radio Frequency Interference
- (a) The PIC shall not operate a UAV until it has been confirmed that no radio frequency interference that will affect safety of flight is present prior to flight, nor is likely to be present during flight.
- (6) Operations in Built-up Areas
- (a) Inspectors assessing SFOC applications for UAV operations in built-up areas must consider the additional risks associated with such an operation to include, but not limited to the following:
 - (i) Airspace considerations (e.g. controlled/uncontrolled, additional ATC coordination, communications requirements, weather limits, lost link/fly-away procedures, etc.);
 - (ii) Greater risk of radio frequency interference;
 - (iii) Ensuring a sterile operating areas (e.g. distances to people and property may need to be increased);
 - (iv) Additional security requirements (physical and electronic);
 - (v) Municipal/city restrictions and bylaws;
 - (vi) Challenges to aircraft performance in urban meteorological conditions; and
 - (vii) Ability to remain within visual line-of-sight given the predominance of obstacles.
 - (b) Once the above assessment is completed, Inspectors shall develop appropriate SFOC conditions to mitigate these additional risks.
- (7) National, Provincial and Municipal Parks, Reserves and Refuges

- (a) Unless specifically authorized in an SFOC, to preserve that natural environment of parks, reserves and refuges and to minimize the disturbance to the natural habitat, UAVs should not be operated in these areas below 2000 feet above ground level (AGL).

(8) Forest Fire Aircraft Operating Restrictions

- (a) Unless specifically authorized in an SFOC, UAV operations shall comply with Section 601.15 of the CARs.

6.21 Operating under IFR

- (1) Additional scrutiny is required from Inspectors when IFR operations are proposed in the SFOC application. In order to safely accommodate a UAV on an IFR flight plan additional conditions will be necessary. Sample conditions required for IFR operations can be found at Appendix H of this SI.

6.22 Specialized Operational Uses

- (1) Unmanned aircraft may, at times, be considered for operations that would put manned aircraft in hazardous or dangerous situations. There may be times when Inspectors will want to consider requests by UAV operators to conduct operations that would not normally be approved due to the potential risk of aircraft damage/loss. To assess such requests, TC will utilize a typical safety risk assessment on a case-by-case basis, taking into consideration the benefits of the operation balanced with the risk such an operation may pose to the aircraft and to other airspace users or people and property on the ground. These operations may also include the anticipated or intentional loss of the UAV.
- (2) In approving these special operational situations, Article 8 to the Convention on International Civil Aviation applies such that “Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions that are open to civil aircraft shall be so controlled as to obviate danger to civil aircraft”. To address this responsibility, UAV operators shall have operational procedures that mitigate the risks associated with the intentional loss of the UAV and/or the recovery of a potentially damaged UAV.
- (3) Examples of these operational requests could include, but are not be limited to, flight into hurricanes, dangerous clouds (e.g. chemical, nuclear, etc.) or volcanic ash.

6.23 Aerial Application

- (1) The aerial application industry is highly regulated to ensure everyone’s safety. Industry groups, such as the Canadian Aerial Applicators Association work with government departments including TC, Agriculture and Agri-Food Canada, Health Canada and Environment Canada to ensure safe application of pesticides and other products. Manned aerial applicators’ work is becoming increasingly obstructed by transmission lines, communication towers and wind turbines, so while it is easy to see the potential for UAV use, it must be emphasized that UAV operators are not exempt from the regulatory requirements imposed by other government departments.

6.24 International Operations

- (1) Detailed guidance on international UAV operations is contained in Appendix L to this SI.

6.25 Air Shows and Aerial Demonstrations

- (1) It is TC’s policy that UAVs above 25 kg not participate in air shows or similar type special aviation events. Any exception to this policy will be reviewed on a case-by-case basis and requires a safety case/risk assessment demonstrating that an acceptable level of risk can be maintained.

- (2) To ensure the safe conduct of small UAVs participating in CAR 603 Special Aviation Events a separate SFOC dedicated to that purpose is required. Application for participation in an air show must be made under Section 10 of this SI. Sample conditions for UAVs participating at air shows are provided in Appendix H of this SI.
- (3) For Certificate applicants operating UAVs for multiple purposes, including aerial demonstrations to illustrate system capabilities to customers, Inspectors may wish to consult the Special Flight Operations Standards - Special Aviation Events - Air Show Standards for establishing the specific conditions required for crowd control, flight lines, distances from spectators, etc.
- (4) UAVs participating in air shows or aerial demonstrations shall not conduct aerobatic type manoeuvres. Manoeuvres considered as normal operating procedures (e.g. deep stall landing, parachute landing systems, etc.) are not considered aerobatic manoeuvres.

6.26 Optionally Piloted Aircraft (OPA)

- (1) When an OPA is operated without a pilot onboard, it is considered a UAV. SFOC applications for OPAs shall be submitted in accordance with Section 10 of this SI.
- (2) The operation of an OPA with a pilot onboard is not considered to be a UAV and is governed by the appropriate CARs for manned aircraft.

6.27 Control of a UAV from Moving Vehicles

- (1) There is insufficient information at this time to determine whether UAVs can be controlled safely from another aircraft/moving land vehicle and ensure an appropriate level of safety is maintained.
- (2) Certificate applicants intending to conduct such operations shall provide the Inspector with a safety assessment showing how the risks of these operations can be appropriately mitigated to an acceptable level.

6.28 Manuals and Records

- (1) Based on the complexity of the UAV operation, the types of manuals and the content therein will vary. The types of documentation a UAV operator would be expected to maintain could include, but are not limited to, operations manuals, maintenance manuals, UAV system flight manuals (for each type of UAV being operated), aircraft checklists, SOPs, etc. The type of SFOC application process being used (see section 7.2 of this SI) will determine the actual documentation requirements and the level of detail contained in these documents.
- (2) The UAV operator shall provide checklists and placards that enable the pilot to operate the UAV system in accordance with the UAV system flight manual, pilot operating handbook or other equivalent document.
- (3) UAV operators shall maintain records of their flight operations to include the following information:
 - (a) Flight records (location, date, times, crew, aircraft type, etc.);
 - (b) Total flight hours accumulated per aircraft (where the SFOC contains a condition regarding maintenance requirements); and
 - (c) Pilot(s) flight hours (day, month, year).

6.29 Accident and Incident Reporting

- (1) Transportation Safety Board (TSB)

- (a) The TSB is responsible for investigating all transportation accidents and incidents in Canada. The UAV operator must be aware of, and act upon, the legislation regarding reportable aviation incidents and accidents.
- (2) Transport Canada
 - (a) The UAV operator shall report specified accidents and incidents to TC as soon as possible after the occurrence and shall not operate the UAV following the occurrences until such time as the Regional Office approves its further operation.
 - (b) A condition is required in the SFOC specifying when such reporting is mandated.
 - (c) In their SFOC application, the Certificate applicant should specify an expected level of equipment attrition (e.g. if the aircraft routinely suffers damage on landing).
- (3) Once an Inspector is made aware that a Certificate holder has experienced an accident or incident, the Inspector must advise the Certificate holder to cease operations until such time as the cause of the accident/incident has been identified and measures have been taken to ensure the causal factors do not reoccur. This may also require the Inspector to suspend or cancel the existing SFOC and issue a more restrictive SFOC which places greater limitations on the UAV operation.

6.30 Security

- (1) Certificate applicants shall provide Inspectors with the company procedures/processes that are utilized to manage physical and technical security of the UAV system. These may include:
 - (a) Physical Security
 - (i) physical procedural security for the secure and safe operation of the UAV;
 - (ii) restricting access to UAV assets to authorized persons; and
 - (iii) secure storage of UAV assets in a manner that prevents and detects tampering and protects the integrity of vital components.
 - (b) Technical Security
 - (i) reduction of the susceptibility of the C2 link to unintentional or malicious interference on both a software and hardware level; and
 - (ii) policies, restricting UAV operations in areas of high radio frequency contamination (e.g. near radar sites, etc.).

6.31 Liability Insurance

- (1) Certificate applicants must be made aware early in the application process that they must subscribe for adequate liability insurance covering risks of public liability as outlined in section 606.02 of the CARs. This requirement must be a condition in the SFOC.
- (2) Most general company liability insurance policies do not cover the operation of aircraft. As such, UAV operators must ensure that they have liability insurance which applies to the operation of aircraft.
- (3) Insurance available to MAAC members does not cover UAV operations.

6.32 Operational Control

- (1) The Certificate applicant must indicate that they have, and can maintain, an adequate management organization that is capable of exercising supervision and operational control over persons participating in the UAV system operations.

- (2) It is important that the Certificate applicant be made aware that it is their responsibility to ensure that the operation is managed and conducted in such a way that the safety of persons and property on the ground and other airspace users is not jeopardized.

Note:

The management of a UAV system operation varies according to the scope and complexity of the aerial work - e.g. a small UAV operating within VLOS in a remote area may not require the support of a large number of persons, rather the expertise in a variety of areas could come from one or two key personnel.

7.0 SFOC APPLICATION PROCEDURES

7.1 General

- (1) In order to apply for an SFOC, Certificate applicants will be required to create and submit an application in accordance with this SI. Prior to submitting an SFOC application the applicant is expected to assess the risks involved with the proposed operation and include appropriate mitigation measures as part of the application.
- (2) For each type and purpose of operation, the UAV operator should develop detailed plans to mitigate the risks of: collision with other aircraft and persons and property on the ground, impacts of inclement weather/icing, lost link scenarios, diversions or flight termination.
 - (a) The Certificate applicant's risk management process should be similar to a Safety Management System (SMS) based risk assessment methodology and the TC Civil Aviation Integrated Risk Management Framework (Canadian Aviation Document QUA-007).
- (3) When a Certificate applicant's submission has been reviewed and it is determined that the requirements of the Standards have been met, an SFOC is prepared for the signature of the Regional, Technical Team Lead or other duly authorized individual.
- (4) Operating conditions vary depending on aircraft performance capabilities, equipment on the UAV (e.g. payload), mission requirements, operating environment, complexity of the operation etc. Some conditions are essential to all operations and others may or may not apply. Mandatory conditions required of each SFOC are included in Appendix G through J. Additionally, a list of optional conditions is provided that may be imposed depending on the nature of the operation. There may also be a need to impose further conditions that have not been considered herein. In this case, please advise the General Flight Standards Office at HQ who will keep track of the new conditions for a future SI edition.
- (5) If a foreign Certificate applicant is not legally eligible to conduct UAV operations in the State of Registry, they will not be eligible to apply for an SFOC to conduct such operations in Canada. An exception would be that such a Certificate applicant may be eligible to conduct research and development operations in Canada under an SFOC issued for operations within an established UAV test area.
- (6) Some existing restrictions or prohibitions on UAV flights are not intended to be permanent. As experience is gained in UAV operations and UAV system technology evolves, some of these conditions/restrictions may be revisited.

7.2 Types of Applications

- (1) Although the SFOC is the only authority to allow UAVs to fly there are two processes for seeking such authority. There is a Compliant operator process and a Restricted operator process. The Restricted operator process provides Certificate applicants with four methodologies for applying for an SFOC based on the scope and complexity of the proposed operation. Details of these processes are provided below:
 - (a) **Compliant Operator Application** - These Certificate applicants are required to demonstrate that they have a compliant organization with qualified personnel operating a compliant small UAV within VLOS in accordance with a set of criteria. These applicants will be granted greater geographical flexibility, longer SFOC validity periods and this process will provide for more streamlined SFOC renewals. The processing of Compliant operator applications may also be given priority. See the specific eligibility requirements and SFOC application process in Section 9 of this SI.

- (b) Restricted Operator Application – These Certificate applicants are either unable or unwilling to meet the criteria to become a Compliant operator or compliance with these criteria is not required based on the scope and complexity of the operation. Again, these operators will be granted fewer privileges than those extended to Compliant operators. A description of each methodology is provided below.
- (i) Complex Application - Applies to all UAV system operations except those addressed under Compliant operator applications or any other Restricted Applications outlined below. See the specific eligibility requirements and SFOC application process in Section 10 of this SI.
 - (ii) Simplified Application - Applies to small UAVs, operated within VLOS where the scope of operation is limited. See specific eligibility requirements and the SFOC application process in Section 11 of this SI.
 - (iii) MAAC/AMA Application - Applies to model aircraft that exceed the 35 kg maximum weight required to meet the definition of model aircraft and are operated recreationally by members of MAAC for all operations or AMA member participating in MAAC sponsored events. See specific eligibility requirements and the SFOC application process in Section 12 of this SI.

Note:

The UAV system regulatory recommendations approved by the TC Canadian Aviation Regulatory Committee require UAV operators to become "Compliant". As such all Certificate applicants are strongly encouraged to work towards becoming compliant to ensure their operations can be continued with minimal interruption once future regulatory development is completed.

- (2) The policy whereby new Certificate applicants are required to demonstrate safe, professional operation before being granted less prescriptive SFOCs will continue independent of the SFOC application process used (e.g. Compliant operators who have not yet established a history of safe operations should expect to initially be issued SFOCs of limited scope e.g. time of day, date, location, etc.).

7.3 Submission of Application

- (1) Prior to submitting an SFOC application, Certificate applicants should read this SI (sections 1.0 through 8.0) and applicable Advisory Circulars for guidance on terms and definitions, general operating rules, risk management, liability insurance requirements, radiotelephone operator certificate requirements and general information .
- (2) The Certificate applicant must clearly identify which process they are applying under. Failure to do so will result in delays in receiving approval. To ensure proper use of TC resources, Inspectors receiving SFOC applications that do not clearly identify the process will immediately return the application.
- (3) Certificate applicants, excluding Compliant operators, proposing to operate in multiple regions shall submit separate SFOC applications to each TC region in which they intend to operate.
- (4) Certificate applicants for Compliant operator SFOCs shall submit the SFOC application to the TC regional office in the region where the company head office is located. In the case of a Standing SFOC for operations in more than one region, once the SFOC is completed, the region processing the SFOC application will notify all other regions in which operations are to be conducted.

7.4 Validity Period

- (1) The validity period for a UAV SFOC may range from a few days to three (3) years and depends on several factors including the experience of the UAV operator, the type of SFOC application and the nature or scope of the operation itself.
- (2) Under all SFOC application processes, initial Certificate applicants are limited to only the validity period required to complete the specifically proposed operation. Longer term validity periods shall not be approved until the UAV operator has gained sufficient experience and demonstrated a history of safe operations.
- (3) The maximum validity period for a UAV SFOC shall be three (3) years which is only applicable for Compliant operators and overweight model aircraft operated in accordance with this SI. The maximum validity for all other Certificate applicants will be one (1) year.
- (4) The following wording shall be included in the SFOC, "*This Certificate is valid from ... until... or until it is suspended or cancelled*".

7.5 Standing SFOCs

- (1) A Standing SFOC is issued to allow operations within a defined geographical boundary (e.g. municipality, province, region, etc.) at operating sites that have not been assessed by the Inspector as part of the application. Validity periods may be up to the maximum allowed in section 7.4 above. A Standing SFOC will not be issued until the UAV operator has gained sufficient experience and demonstrates a history of safe operations. Standing SFOCs will not be issued to initial Certificate applicants.
- (2) Inspectors shall impose a condition in all Standing SFOCs, requiring the UAV operator to conduct site surveys prior to any operation. Site surveys conducted in accordance with the direction in section 6.19 of this SI should be considered the minimum standard.
 - (a) Certificate applicants requesting Standing SFOCs, shall specify in their SFOC application, their methodologies and procedures for conducting site surveys.
- (3) The following applies to Standing SFOCs:
 - (a) Inspectors will specifically address in what class(s) of airspace operations are permitted and include specific conditions addressing operations in each class of airspace.
 - (b) When operations are proposed in ATC managed airspace, Inspectors shall impose a condition requiring the UAV operator to coordinate with the applicable ATS unit(s) a minimum of seven (7) days prior to commencement of operations.
 - (c) Participation in air shows is not approved. Inspectors shall ensure that such a condition is included in the SFOC. Aerial demonstrations to illustrate system capabilities to customers may be approved provided appropriate conditions are included in the SFOC. Refer to Section 6.25 of this SI for further information.
 - (d) In accordance with sub-paragraph 623.65(d)(3)(f) of the CARs, contact information must be provided for the Operation Manager or Ground Supervisor on site for each operation.
 - (e) UAV flight training operations will only be approved for Compliant operators.
 - (f) Multi-regional SFOCs will only be issued to Compliant operators.
 - (g) One or more types of UAV systems, may be authorized provided the systems have similar characteristics. This option is only available to Compliant operators.

7.6 Extensions or Amendments to SFOCs

- (1) There is no provision to amend or extend an SFOC once issued.

- (2) There may be situations where SFOCs need to be re-issued due to a change in a UAV operator's operational requirements. It is up to the Inspector to determine if an addendum to the original SFOC application is sufficient or if a new application is required. In all cases a new SFOC will be issued, however the level of review may be reduced based on the scope of the amendment. If an addendum to an original SFOC application is submitted the new SFOC must reference the original SFOC application and the amendment, by date.
- (3) If an SFOC must be replaced before it expires, a new SFOC will have to be issued with the following statement, "*This Certificate cancels and supersedes the SFOC issued to (enter name of applicant) on (enter date) at (enter city, province) by (enter title of person who signed the original SFOC) on behalf of the Minister of Transport*". Once an SFOC is expired, there is no need to include the above statement.

7.7 Standard Format for SFOC Cover Letter

- (1) All SFOCs shall be accompanied by a cover letter. Such letters shall be issued in a standard letter format using TC letterhead. An example of a standard format cover letter can be found in Appendix A.

7.8 Standard Format for the SFOC

- (1) To ensure that the required standardization exists to allow multi-region and national SFOCs, all UAV system SFOCs shall be issued in a standard format found in Appendix G through J, using TC letterhead.

8.0 REVIEWING THE APPLICATION

- (1) Inspectors must be familiar with Sections 1 – 7 of this SI prior to commencing the review of any SFOC application.
- (2) Inspectors shall advise all Certificate applicants that they are required to submit an SFOC application in accordance with 623.65(d)(3)(a)-(k) of the CARs. Formatting limitations in this document prevent the standard from being replicated verbatim. As such Inspectors are encouraged to refer to the CARs for the exact format of the standard.
- (3) The information required by 623.65(d)(3)(a)-(j) will apply equally to all Certificate applicants regardless of the SFOC application process being used. An overview of the standard information required/expected by 623.65(d)(3)(a)-(j) is provided in Paragraphs 9.1 – 9.10 below.

Note:

For Compliant operators, this information may be contained in a company operations manual, a flight manual, or standard operating procedures. However, it would be expected that the applicant would clearly indicate in the SFOC application where, within these manuals, the specific information is located.

- (4) The Minister also requires other information to ensure the safe conduct of the operation, as referenced in 623.65(d)(3)(k). The depth of information required under 623.65(d)(3)(k) varies depending on the SFOC application process being utilized. Refer to the specific application process being used for a detailed description of the information required under 623.65(d)(3)(k) – Appendix G through J.
- (5) If the SFOC application clearly indicates that the minimum requirements have not been met or if the Inspector requires more information, then the Inspector will not process the application until such time as the application is complete or the applicant can show competency. Once an application has been returned to the applicant, the applicant will need to amend the application and resubmit it. This will result in the application losing its place in the processing queue.

8.1 623.65(d)(3)(a)

- (1) ***“The name, address, and where applicable, the telephone number and facsimile number of the applicant.”***
 - (a) The Certificate applicant must provide their name, address, telephone and facsimile numbers, and any other pertinent contact information (e.g. email address).
 - (b) As applicable to manned aviation, the Certificate applicant must be the individual/organization that has possession of the UAV system as owner or lessee. This person or company has complete responsibility for the operation and safety of the UAV flight operation and responsibility for compliance with the conditions contained in the SFOC.
 - (c) It is essential that the UAV operator is aware of the responsibility to ensure that the UAV operation is conducted in such a way that the safety of persons and property on the ground and other airspace users is not jeopardized.

8.2 623.65(d)(3)(b)

- (1) ***“The name, address, and where applicable the telephone number and facsimile number of the person designated by the applicant to have operational control over the operation (Operation Manager).”***

- (a) The Certificate applicant must provide the name, address, telephone and facsimile numbers and any other pertinent contact information (e.g. email address) of the person designated to have operational control over the operation.
- (b) The SFOC application must describe how/why this person is qualified to act as the Operation Manager.

Note:

This SI is not intended to confine a UAV operator to a mandatory management structure, including position titles. A UAV operator may or may not use position titles such as "Operation Manager" and "Ground Supervisor" within their organization, however someone must have operational control over the operation and someone must be responsible for supervision of the operation area. It must be clearly indicated in the SFOC application who has been designated these responsibilities. In small operations, the Operation Manager and the Ground Supervisor could be the same person.

8.3 623.65(d)(3)(c)

(1) ***"Method by which the Operation Manager may be contacted directly during the operation."***

- (a) TC must be able to immediately contact a responsible person at the site of the operation. The Certificate applicant will provide the contact information for the responsible person on-site (e.g. Operation Manager, Ground Supervisor) who can be contacted directly during the operation.
- (b) If the contact information provided above is for a mobile device, the UAV operator must be confident that the contact information provided will be functional in all the proposed operating area(s) so that the responsible person can be contacted. If it is determined that contact with the responsible person cannot be established using the information provided, the UAV operator shall provide TC with updated contact information prior to commencing operations.

8.4 623.65(d)(3)(d)

(1) ***"The type and purpose of the operation."***

- (a) The Certificate applicant must provide a description of the type(s) (e.g. VLOS, BVLOS, day, night, VFR, IFR) and the purpose(s) of the operation (e.g. aerial photography, geophysical surveying, aerial demonstration, aerial inspection, wildlife management, search and rescue).
- (b) The Certificate applicant must be specific when describing the purpose(s).
- (c) Where a UAV system will be used for multiple purposes, all these purposes and the associated risk mitigations must all be detailed in the SFOC application.

8.5 623.65(d)(3)(e)

(1) ***"The dates, alternate dates and times of the proposed operation."***

- (a) The Certificate applicant must provide the dates, alternate dates and times of the proposed operation.

Note:

The Inspector works with the Certificate applicant to determine an appropriate validity period for the operation, taking into account potential delays for inclement weather, etc. As there may be circumstances where the applicant is unable to complete the operation within a tightly defined validity period, it is recommended that a buffer be added to the validity period rather than issuing a second SFOC.

8.6 623.65(d)(3)(f)

- (1) **“A complete description, including all pertinent flight data on the aircraft to be flown.”**

Notes:

The depth of information that needs to be provided varies depending on the size and complexity of the UAV system.

Where the purpose of the SFOC application involves test bed aircraft where components are intended to be swapped, it may be necessary to issue more than one (1) SFOC unless this action does not dramatically change the performance characteristics of the UAV system and/or the risks associated with the operation.

All information provided in the SFOC application shall use standard aviation related units of measure (e.g. nautical miles per hour (nm/hr), feet (ft), etc.)

- (a) The manufacturer, make and model of the UAV system including three view drawings or photographs of the aircraft.
- (b) A complete description of
 - (i) The UAV, including:
 - (A) Category (e.g. fixed wing, rotary wing, airship, etc.);
 - (B) Composition (e.g. graphite, composites, etc.);
 - (C) Measurements (e.g. wingspan, fuselage length, rotor diameter, etc.);
 - (D) Weight (e.g. maximum gross take-off weight, empty weight, payload weight, etc.);
 - (E) Type of propulsion system (make and model) (e.g. electric, turboprop, turbofan; rear or forward mount, etc.);
 - (F) Fuel /Energy system (e.g. battery type, AVGAS, capacity, etc.);
 - (G) Method of take-off/ launch (e.g. taxi and take-off, pneumatic catapult, hand-launched, etc.);
 - (H) Method of landing / recovery (e.g. approach and runway landing, parachute, belly/skid landing, skyhook, etc.);
 - (I) Navigation equipment/capability (e.g. visual, GPS, etc.);
 - (J) Electronic surveillance equipment (e.g. transponder (modes, etc.), ADS-B, etc.);
 - (K) Flight sensors (e.g. barometric altimeter, airspeed indicator, icing detection, etc.);

- (L) Redundant systems (e.g. flight controls, avionics, flight termination system, etc.);
- (M) Visual detectability (e.g. lighting (position, anti-collision), high visibility paint scheme, etc.); and
- (N) Flight data on the aircraft to be flown:
 - I. Performance (e.g. operating speeds, climb and descent rates, maximum altitude, maximum range, maximum endurance, etc.); and
 - II. Operating Limitations (e.g. winds (wind shear, gusts), cross-winds, temperatures, day, night, icing, etc.).
- (ii) The Control Station, including:
 - (A) Control method (e.g. manual flight, pre-programmed, tethered, autoland, etc.);
 - (B) Flight Instrumentation (e.g. attitude, altitude, airspeed, heading, present position, navigation etc., and method of displaying the information);
 - (C) Systems diagnostic and monitoring information (e.g. low battery, fuel status, critical systems failure, visual and audio warnings, etc.);
 - (D) Environmental warnings (e.g. icing, rain, terrain, etc.);
 - (E) Redundant systems (e.g. back-up computer displays, back-up power supply);
 - (F) Control station power source (e.g. generator, power grid, rechargeable);
 - (G) Equipment in the control station (e.g. lights for night operations, fire extinguisher); and
 - (H) Control station security (e.g. capable of being locked).
- (iii) The Command and Control Links including:
 - (A) C2/data bands and frequencies (e.g. Very High Frequency (VHF) band, Ku-Band, Ultra High Frequency (UHF) Satellite Communication (SATCOM), Geostationary satellites, etc.);
 - (B) Radio range of the control links;
 - (C) Lost Link indications (e.g. "off flags", signal strength indicators, etc.);
 - (D) Measures for preventing or mitigating radio frequency interference; and
 - (E) Single or dual redundant control links.
- (iv) Voice Communications including:
 - (A) Primary method of communicating with ATC and other airspace users (e.g. radio relay through the air vehicle, fixed based transmitter, etc.);
 - (B) Backup communication capability (e.g. landline, cell phone, etc.);
 - (C) Communication latencies (e.g. able to perform ATC directed actions without delay, etc.); and
 - (D) Communication system used for the pilots, ground support personnel and observers to communicate with each other.
- (v) Payload(s) including:

- (A) Payload limitations (e.g. impact on flight envelope, how conflicts are managed when aircraft and payload operational limits differ, etc.);
- (B) Dangerous payloads (e.g. pyrotechnics, explosives, lasers, pesticides, etc.);
- (C) Secondary purposes of payload (e.g. camera controls the flight path of the UAV, etc.); and
- (D) Increase to crew workload (e.g. pilot operating UAV and payload, etc.).

8.7 623.65(d)(3)(g)

(1) ***“The security plan for the area(s) of operation and security plan for the area(s) to be over flown to ensure no hazard is created to persons or property on the surface.”***

- (a) The Certificate applicant must describe the security plan for the area(s) of operation and for the areas to be over flown.

Note:

Security plan pertains to safety and security of persons and property on the ground. Physical and control station security issues (e.g. unlawful interference) are addressed in paragraph (k).

- (b) The following should be considered when developing the security plan:
 - (i) Proposed safe altitudes and distances for the operation (e.g. from members of the public, structures, vehicles, vessels etc.);
 - (ii) Isolation of bystanders during take-off/launch, in-flight and landing/recovery (e.g. fences, barriers, removal of people from operating area, etc.);
 - (iii) Permission to access private property;
 - (iv) Permission from aerodrome authorities; and
 - (v) Permission for land use from other jurisdictions (e.g. civic authorities, government held property, DND, etc.).

8.8 623.65(d)(3)(h)

(1) ***“The emergency contingency plan to deal with any disaster resulting from the operation.”***

- (a) The Certificate applicant must describe the emergency contingency plan(s).
- (b) The Certificate applicant will:
 - (i) Have an emergency plan in place describing the personnel and equipment available to respond to anticipated emergencies, including incidents and accidents, or medical emergencies;
 - (ii) Have the equipment and personnel described in the emergency plan readily available during flight operations;
 - (iii) Coordinate the emergency contingency plan with applicable emergency agencies and authorities (e.g. airport operator, etc.);
 - (iv) Ensure that all persons associated with the operation who may be required to respond to an emergency situation are briefed in advance of the operation (e.g.

available emergency services, methods of contacting emergency services, checklists); and

- (v) Where applicable, ensure access routes are available for emergency vehicles.

Notes:

It is expected that the emergency contingency plan will be well thought out and detailed in the SFOC application. Relying on calling 911 would not, meet the standard expected of an emergency contingency plan.

If the emergency contingency plan includes contacting 911, the Certificate applicant must identify that calling 911 is only related to the emergency contingency plan actions and that it is not appropriate to call 911 for aircraft-related emergencies (e.g. lost link, fly-away, damage to UAV, etc.)

Joint Rescue Coordination Centres should not be contacted for any UAV related emergency or accidents.

8.9 623.65(d)(3)(i)

(1) ***“The name, address, telephone and facsimile numbers of the person designated to be responsible for supervision of the operation area (Ground Supervisor), if different from the Operation Manager during the operation.”***

- (a) The Certificate applicant must provide the name, address, telephone and facsimile numbers, or any other contact information (e.g. email) of the person designated to be responsible for supervision of the operation area.
- (b) If a Ground Supervisor is utilized, the SFOC application must describe how/why this person is qualified to act as the Ground Supervisor.

8.10 623.65(d)(3)(j)

(1) ***“A detailed plan describing how the operation shall be carried out. The plan shall include a clear, legible presentation of the area to be used during the operation. The presentation may be in the form of a scale diagram, aerial photograph or large scale topographical chart and must include at least the following information:”***

- (a) ***“(i) the altitudes and routes to be used on the approach and departure to and from the area where the operation will be carried out;”***
- (b) ***“(ii) the location and height above ground of all obstacles in the approach and departure path to the areas where the operation will be carried out;”***
- (c) ***“(iii) the exact boundaries of the area where the actual operation will be carried out; and”***
- (d) ***“(iv) the altitudes and routes to be used while carrying out the operation.”***

Notes:

For a Standing SFOC the requirement to conduct a site survey, as per Section 6.19 of this SI, meets the aim of the above standard.

- (2) In addition to the standard detailed above, the following is required:
- (a) All Certificate applicants will identify the class(s) of airspace in which the operations are planned. Certificate applicants who wish to conduct operations in Class F Restricted airspace must indicate this fact in the SFOC application so that appropriate conditions can be added to the SFOC. See paragraph 623.65(d)(3)(k) for additional airspace considerations.

8.11 623.65(d)(3)(k)

- (1) ***“Any other information pertinent to the safe conduct of the operation requested by the Minister.”***
- (a) Refer to the specific SFOC application process being used for a detailed description of the information required under 623.65(d)(3)(k).

9.0 COMPLIANT OPERATOR APPLICATION PROCESS

9.1 Purpose

- (1) The purpose of this section is to provide guidance to Inspectors regarding SFOC applications received from Compliant operators that involves the operation of small UAVs operated within VLOS in accordance with the specific criteria outlined below.

9.2 Background

- (1) In June 2012, the UAV System Program Design Working Group provided its recommendations for Phase 1 to the CARAC Technical Committee for comment and approval. These recommendations and Technical Committee comments were accepted and subsequently reviewed and approved by TC's Canadian Aviation Regulatory Committee.
- (2) This SI has been amended to include the proposed recommendations, to the extent possible, by recognizing the proposed regulatory recommendations as "best practices". Certificate applicants complying with these practices will be eligible for SFOCs with greater geographical flexibility and/or longer SFOC validity periods.

9.3 Applicability

- (1) This SFOC application process applies to compliant UAV operators, age 18 or over, that are able to meet all of the requirements outlined below, and are operating small UAVs within VLOS for purposes other than participation in an air show. Air show participation requirements are outlined in section 6.25.
- (2) An SFOC approved under this process is not applicable to operations conducted within Class F Restricted airspace dedicated for UAV testing and development, as specific conditions are necessary for these operations. Certificate applicants wishing to conduct such operations will utilize the SFOC application process in Section 10.
- (3) SFOC applications will be assessed on a case-by-case basis and an SFOC will only be issued once it is demonstrated that the risks associated with the operation of the UAV can be managed to an acceptable level.

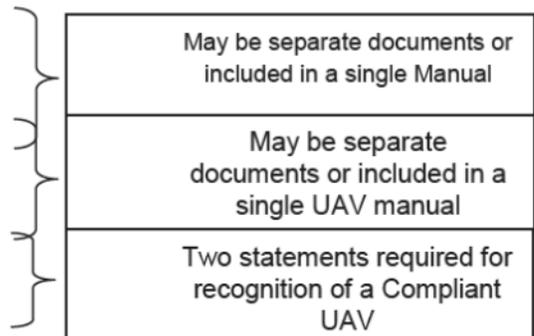
9.4 Eligibility

- (1) In order to use this Compliant operator application process, the proposed operation will have to consist of a small UAVs operated within VLOS under VFR, day or night, where the Certificate applicant demonstrates that:
 - (a) all pilots are appropriately qualified;
 - (b) a small UAV system meets the Design Standard; and
 - (c) the UAV operator is compliant.

9.5 Supporting SFOC Application Documentation

(1) Certificate applicants shall provide the following documents in support of their initial SFOC application:

- (a) UAV operator operations manual;
- (b) Standard Operating Procedures (SOPs);
- (c) Training manual;
- (d) UAV system flight manual;
- (e) UAV maintenance manual;
- (f) Declaration of Compliance; and
- (g) Statement of Conformity.



(2) These supporting documents will form the foundation of the SFOC application and will be referenced accordingly in the SFOC.

9.6 Administrative Process

(1) The SFOC application process for Compliant operators operating small UAVs, within VLOS is described below:

- (a) Certificate applicants intending to operate in a single TC region shall submit their SFOC application to that TC regional office. Certificate applicants intending operations in multiple TC regions shall submit the SFOC application to the regional office in which their head office/base of operations is located.
- (b) Once an Inspector has deemed a UAV operator to be compliant they shall notify TC HQ of this fact. Email notification containing confirmation of compliance and all associated RDIMS file numbers is required.
- (c) In the case of a multi-region SFOC application the issuing Inspector shall ensure that once the SFOC is completed all applicable TC regional offices are notified.
- (d) Once the Certificate applicant has provided supporting documentation with the initial SFOC application, subsequent SFOC applications should only require a summary of the activities on the previous SFOC (hours flown, locations, etc.) and any changes to documentation on file with TC.

9.7 Reviewing an Application

(1) Refer to Section 8 of this SI for guidance with respect to the standard information required by subparagraphs 623.65(d)(3)(a)-(i):

(2) Please refer to the following section for guidance with respect to the information required by 623.65(d)(3)(k) - ***“Any other information pertinent to the safe conduct of the operation requested by the Minister.”***

- (a) Personnel Qualifications - The Certificate applicant must provide evidence that the pilot(s) has met the Appendix B - Criteria for a Compliant Pilot of Small UAV. Additionally, the Certificate applicant must describe the relevant qualifications of additional crew members in sufficient detail to demonstrate that the personnel have been trained and are qualified to fulfill their duties. Section 4.1 sections 2 to 6, of this SI stipulates, the minimum requirements.

- (i) UAV Pilot - Inspectors shall refer to the Criteria for a Compliant Pilot of Small UAV Systems in Appendix B to validate that the pilots are appropriately trained, qualified, proficient and current to operate the UAV in the operating environment. This should include written verification from the individual(s)/organization(s) that provided the knowledge and experience training and skill testing.
 - (A) Where the pilot has a dual role (e.g. also the payload operator), the Certificate applicant will need to address any risks associated with the same person performing two functions.
- (ii) Visual Observers - Inspectors must be satisfied that visual observers are adequately trained to perform their duties.
- (iii) System Maintainer - Inspectors must be satisfied that the UAV maintenance personnel are appropriately trained and qualified to maintain the UAV system, including the aircraft, control station components (e.g. hardware, software and firmware) and command and control links are in a fit for flight condition.
 - (A) Inspectors should take into account previous aviation maintenance knowledge and experience (e.g. AME licence, previous UAV maintenance experience, completion of a course on aviation maintenance, etc.) when determining whether an individual is qualified to act as a maintainer.

Note:

Maintenance of small UAV systems must be performed by properly trained and experienced personnel, but they do not have to be an AME or work under an Aircraft Maintenance Organization (AMO).

(b) UAV System Airworthiness

- (i) To be considered "Compliant", a UAV will be required to meet the Small UAV Design Standard found in Appendix C.
- (ii) Achieving Compliance - To achieve compliance the manufacturer must analyze the technical specifications, drawings, calculations, assembly instructions and other documented materials that fully describes the model of aircraft and its associated systems (i.e. type definition) against the requirements of the design standard, and conduct any necessary ground and flight tests to determine that it is compliant.

Note:

For the purposes of this document, the manufacturer is the person or company that designs and builds (fully assembled or kit) small UAV systems and owns the rights to the UAV system type definition.

- (iii) Documenting Compliance - The manufacturer must preserve sufficient documentation to substantiate how each requirement of the Design Standard has been met to include any ground and flight testing.
- (iv) A Declaration of Compliance and a Statement of Conformity must be provided to the Minister as outlined below.
 - (A) A Declaration of Compliance is a written submission to TC by the manufacturer of a small UAV system attesting that the Type Definition for a particular make and model of a small UAV system complies with the

Design Standards published in Appendix C and has found the UAV performance to be acceptable. Such a declaration will;

- I. identify the UAV by make, model and manufacturer;
- II. state that the manufacturer has kept records of the Type Definition, all ground and flight tests and analyses; and
- III. state that the Type Definition of this UAV system model meets the Design Standard.

(B) A Statement of Conformity is a document upon which a manufacturer attests that a specific small UAV system conforms to the Type Definition as stated in the Declaration of Compliance for that make and model of small UAV system and the owner attests that it has not been altered or modified so as to invalidate the manufacturer's attestation. Such a document will:

- I. identify the UAV by make, model, manufacturer and serial number;
- II. include a Manufacturer's statement that the individual UAV system, as assembled, conforms to the Type Definition as declared in the Declaration of Compliance, conforms to the Design Standard and is fit for flight;
- III. include an owner's statement that the individual UAV system has not been modified from what was received from the manufacturer; and.
- IV. be provided to TC by the UAV operator.

(C) Templates for the Declaration of Compliance and the Statement of Conformity can be found in Appendix E and F, respectfully.

(D) Original Equipment Manufacturer and SFOC applicants should be reminded that false declarations are punishable under the *Aeronautics Act*.

(v) The Manufacturer shall provide each owner with a current UAV system flight manual and maintenance manual.

(c) Continuing Airworthiness/Maintenance

(i) It is the responsibility of the UAV operator to ensure that:

- (A) the UAV system remains in a fit for flight condition and is not modified without approval from the manufacturer;
- (B) all maintenance, servicing and disassembly-assembly of the UAV and associated components are performed in accordance with the procedures and maintenance schedule established by the manufacturer to ensure that the UAV system remains in conformity with its compliant Type Definition;
- (C) the requirements of any airworthiness directives (or equivalent) issued by the manufacturer have been completed;
- (D) any modifications to the UAV system are carried out in accordance with the manufacturer's instructions and that no unapproved modifications have been carried out; and
- (E) all UAV system equipment required for safe flight operations is serviceable.

- (ii) Maintenance of avionics components (other than removal and installation) is considered to be specialized maintenance and must be performed by an AMO or other qualified organization. Section 571.04 of the CARs, Schedule II stipulates what constitutes specialized maintenance.
 - (iii) The UAV operator shall have and maintain a current UAV system flight manual and maintenance manual.
- (d) Operations
- (i) The SFOC will include numerous conditions necessary for aviation safety for which the Certificate applicant will not need to provide any information. However, the applicant must specifically address the areas discussed below as part of the SFOC application.
 - (A) In general, UAVs should be operated in accordance with the principles governing the flights of manned aircraft. See section 6.20 for key principles and some specific flight rules applicable to these UAV operations.
 - (ii) Weather Limitations
 - (A) The Certificate applicant must specify the weather conditions under which they will operate in accordance with Section 6.20 of this SI. This will include, as a minimum; visibility, distance from cloud, cloud ceiling, wind direction and speed, and temperatures.
 - (B) The Certificate applicant must have a system in place to assess and monitor the weather in order to comply with the applicable weather minima. This would include actual and forecasted weather along the flight path, and where applicable, the weather along the pre-programmed "lost link route" of flight.
 - (C) Icing – UAVs are not normally permitted to operate in areas of known/forecast icing. Those Certificate applicants intending to conduct operations in icing conditions must demonstrate in their SFOC application how it can be done safely.
 - (iii) System Capability Requirements
 - (A) UAV system capability requirements are stipulated in the Design Standard found in Appendix C. The Standard offers flexibility for VLOS operations allowing the pilot and or visual observer to meet some of the required capabilities. As such, the system capability requirements are spelled out as conditions in the SFOC.
 - (iv) Explosive Payloads
 - (A) Payload requirements are stipulated in the Design Standard found in Appendix C. The Standard offers flexibility for allowing explosive payloads to be carried onboard a UAV. Carriage of explosive, corrosive or bio-hazard payloads are prohibited as a standard condition in every SFOC unless the UAV operator demonstrates in the SFOC application how such payloads can be carried, operated and jettisoned safely. In this case additional conditions will be required in the SFOC.
 - (v) Air Traffic Service Provider Coordination
 - (A) The Certificate applicant is responsible for coordination with the air traffic service provider responsible for supplying air traffic services for the airspace affected by the operation. Certificate applicants are also

responsible for obtaining necessary permissions/advising aerodrome authorities etc. Validity of the SFOC is contingent upon the Certificate applicant coordinating with the applicable ATS Unit.

- (B) As with manned aircraft, UAV operations require deconfliction with, coordination with, and notification to other airspace users. Whenever two-way communications are required with an ATS Unit the UAV pilot must continuously monitor the appropriate radio frequency. Additionally the UAV pilot must comply with ATC instructions.
- (C) In some cases, the Certificate applicant will need to notify other airspace users of the UAV activity. See section 6.14 of this SI for details regarding the issuance of NOTAMs.
- (vi) Inadvertent Flight into Controlled Airspace and/or Fly-away
 - (A) If not authorized to enter controlled airspace, the Certificate applicant must describe the following items in the event that there is an inadvertent flight into controlled airspace and/or fly-away:
 - I. a means of determining if they inadvertently enter controlled airspace;
 - II. a plan to communicate with the ATS Unit where the UAV inadvertently flies into controlled airspace and cannot be immediately returned to the area of operation; and
 - III. the ability to contact, and know who to contact, if the UAV is no longer under control of the pilot and the UAV flies away.
- (e) Compliant Operator of Small UAV Systems
 - (i) A UAV operator will be considered compliant when meeting the requirements of the standards found in Appendix D.
 - (ii) The UAV operator must determine maximum flight duty times and minimum rest periods and establish a system that monitors the flight duty time, and time free from duty, for each of its flight crew members. The details of that system shall be included in the UAV operator's operations manual.
 - (iii) The UAV operator must ensure that all personnel involved in the operation or maintenance of the UAV system are appropriately trained and qualified.
 - (iv) Liability Insurance – The Certificate applicant must stipulate in the SFOC application that they subscribe to liability insurance in accordance with the requirements in section 6.31 of this SI.

Note:

Inspectors are not required to obtain an actual copy of the UAV operator's Insurance policy. A declaration of the fact that they have such insurance is sufficient.

10.0 RESTRICTED OPERATOR – COMPLEX APPLICATION PROCESS

10.1 Purpose

- (1) The purpose of this section is to provide guidance to Inspectors regarding Complex SFOC applications that involve the operation of UAVs operated in accordance with the specific criteria outlined below.

10.2 Background

- (1) These operators are either unable or unwilling to meet the criteria to become a Compliant operator or compliance with those criteria are not required based on the scope and complexity of the operation. These operators will be granted fewer privileges than those extended to Compliant operators.
- (2) For TC to provide maximum flexibility and freedom of operations, eligible Certificate applicants are encouraged to become a Compliant operator and apply under Section 9 of this SI.
- (3) Inspectors processing SFOC applications under this process will refer to the guidance provided in this section, Section 8 and Appendix H of this SI.

Note:

Certificate applicants are reminded that this SFOC process may no longer be available once regulations are promulgated except for short term testing and development flights. At that time, operators will be required to meet the standards of a Compliant operator.

10.3 Applicability

- (1) This SFOC application process applies to all Certificate applicants who are not eligible to apply under the Compliant operator, Simplified, or MAAC/AMA processes. Specifically this process applies to:
 - (a) Small UAVs (not Compliant operators or Restricted operators - Simplified application process);
 - (b) UAVs with a maximum take-off weight above 25 kg;
 - (c) Model aircraft operated by non MAAC members where the aircraft exceeds 35 Kg;
 - (d) UAVs conducting BVLOS operations;
 - (e) UAVs participating in air shows;
 - (f) UAVs operated by eligible foreign UAV operators; or
 - (g) UAVs operating in Class F Restricted airspace dedicated to UAV testing and development.

10.4 Reviewing an Application

- (1) Refer to Section 8 of this SI for guidance with respect to the standard information required by subparagraphs 623.65(d)(3)(a)-(i):
- (2) Please refer to the following section for guidance with respect to the information required by 623.65(d)(3)(k) - **“Any other information pertinent to the safe conduct of the operation requested by the Minister.”**:
 - (a) Personnel Qualifications - The Certificate applicant must describe the relevant aviation related qualifications of the UAV pilot(s), observer(s) and UAV system maintainer(s) in

sufficient detail to demonstrate that the personnel have been trained and are qualified to fulfill their duties. Section 4.1 of this SI stipulates the minimum age, medical, knowledge, experience and skill requirements.

- (i) UAV Pilot - Inspectors must be satisfied that pilots are appropriately trained, qualified, proficient and current to operate the UAV in the operating environment.
 - (A) Inspectors should take into account previous aviation knowledge and experience (e.g. pilot licence/permit, ratings, air traffic specialist qualifications, previous unmanned aircraft qualifications, completed a course of pilot ground school instruction, etc.) when determining whether an individual is qualified to act as a PIC.
 - (B) Where the pilot has a dual role (e.g. also the payload operator), the Certificate applicant will need to address any risks associated with the same person performing two functions.
 - (ii) Visual Observers - Inspectors must be satisfied that visual observers are adequately trained to perform their duties.
 - (iii) System Maintainer - Inspectors must be satisfied that the UAV maintenance personnel are appropriately trained and qualified to maintain the UAV system, including the aircraft, control station components (e.g. hardware, software and firmware) and command and control links in a fit for flight condition.
 - (A) Inspectors should take into account previous aviation maintenance knowledge and experience (e.g. AME licence, previous UAV maintenance experience, completion of a course on aviation maintenance, etc.) when determining whether an individual is qualified to act as a maintainer.
- (b) UAV System Airworthiness and Continuing Airworthiness
- (i) UAV System Airworthiness

Note:

Other than small UAVs operated VLOS, TC does not currently define the matters to be taken into account for the design of UAVs and associated systems. Use of the term "airworthy" in this document means "in a fit and safe state for flight" but may not mean in conformity to a type definition.

- (A) The Certificate applicant must describe how they have determined that the aircraft and the system are airworthy, including:
 - I. UAV system designed to facilitate control of the UAV by the pilot and provide clear indications of UAV flight status;
 - II. a means for the UAV to remain within its flight envelope;
 - III. redundancy of flight critical components to ensure safe recovery of the UAV (e.g. automatic landing/recovery systems, flight termination systems, etc.);
 - IV. operational history - accident rate as compared to total hours flown by the aircraft type. Corrective action taken to prevent future failures;
 - V. authorizations issued by other civilian or military authorities.

- (B) The Inspectors must be satisfied that the Certificate applicant has demonstrated that the UAV system can safely conduct the proposed operation.
- (ii) UAV System Maintenance
 - (A) The Certificate applicant must describe how the UAV system is being maintained, including:
 - I. maintenance and inspection manuals;
 - II. maintenance and inspection plan/schedule;
 - III. who established the maintenance schedule (e.g. UAV manufacturer); and
 - IV. the keeping of maintenance records (e.g. aircraft, components, control station, C2 link, etc).
- (c) Operations
 - (i) Operational Flight Rules - The SFOC includes numerous conditions necessary for aviation safety for which the applicant will not need to provide any information. However, the Certificate applicant must specifically address the areas discussed below as part of the SFOC application
 - (A) In general, UAVs should be operated in accordance with the principles governing the flights of manned aircraft. See section 6.20 for key principles and the conditions provided in Appendix H for the flight rules applicable to these UAV operations.
 - (B) Right of Way - When a UAV cannot give way to other aircraft (e.g. no sense and avoid capability) the Certificate applicant must demonstrate how the risk of loss of separation/collision will be mitigated.
 - (ii) Weather Limitations
 - (A) The Certificate applicant must specify the weather conditions under which they will operate in accordance with Section 6.20. This will include, as a minimum: visibility, distance from cloud, cloud ceiling, wind direction and speed, turbulence and temperatures.
 - (B) The Certificate applicant must have a system in place to assess and monitor the weather in order to comply with the applicable weather minima. This would include actual and forecasted weather along the flight path, and where applicable, the weather along the pre-programmed "lost link route" of flight.
 - (C) Icing - UAVs are not normally permitted to operate in areas of known/forecast icing. Certificate applicants intending to conduct operations in icing conditions must demonstrate in their SFOC application how the UAV can do so safely.
 - (iii) Air Traffic Service Provider Coordination
 - (A) The Certificate applicant is responsible for coordination with the air traffic service provider responsible for supplying air traffic services for the airspace affected by the operation. Certificate applicants are also responsible for obtaining necessary permissions/advising aerodrome authorities etc. Validity of the SFOC is contingent upon the Certificate applicant coordinating with the applicable ATS Unit.

- (B) As with manned aircraft, UAV operations require deconfliction with, coordination with, and notification to other airspace users. Whenever two-way communications are required with an ATS Unit the UAV pilot must continuously monitor the appropriate radio frequency. Additionally the UAV pilot must comply with ATC instructions.
- (C) In some cases, the Certificate applicant will need to notify other airspace users of the UAV activity. See section 6.14 of this SI for details regarding the issuance of NOTAMS.

Note:

UAVs are often slower than most manned aircraft that routinely fly in the same operational stratum. This raises the question of whether UAVs will need to have increased separation minima where a UAV is unable to operate at performance levels consistent with ATC control clearances. Additionally, specific UAV IFR Procedures may be required and they may need specific designation. However, these are not issues that will be addressed in this SI.

- (iv) Inadvertent Flight into Controlled Airspace and/or Fly-away
 - (A) If not authorized to enter controlled airspace, the Certificate applicants must describe the following items in the event that there is an inadvertent flight into controlled airspace and/or fly-away:
 - I. a means of determining if they inadvertently enter controlled airspace;
 - II. a plan to communicate with the ATS Unit where the UAV inadvertently flies into controlled airspace and cannot be immediately returned to the area of operation; and
 - III. the ability to contact, and know who to contact, if the UAV is no longer under control of the pilot and the UAV flies away.
- (v) UAV System Security
 - (A) Certificate applicants shall provide Inspectors with the company procedures/processes that are utilized to manage physical and technical security of the UAV system as described in Section 6.30 of this SI.
- (d) UAV Operator Requirements
 - (i) A UAV operator must be 18 years of age or older.
 - (ii) The Certificate applicant must articulate in the SFOC application how they intend to maintain an adequate management organization that is capable of exercising supervision and operational control over persons participating in the UAV system operations.
 - (iii) Operating Procedures - The Certificate applicant must provide a description of the normal and emergency procedures for the intended operation to ensure that the UAV will not create a hazard to other airspace users or persons or property on the ground. These procedures include:
 - (A) Flight release/authorization
 - (B) Pre-flight preparation/planning, as applicable:
 - I. checking NOTAMS;
 - II. filing ATC flight plan;

- III. weather briefing;
- IV. fuel/energy and oil requirements;
- V. weight and balance calculations;
- VI. securing of cargo;
- VII. radio frequency interference check; and
- VIII. carriage of dangerous goods;
- (C) Take-off/Launch, Flight and Landing/Recovery:
 - I. aborted take-off/launch;
 - II. landing/recovery (e.g. programming of navigation system, go-around/balked landing, etc.);
 - III. use of checklists;
 - IV. crew coordination (e.g. briefings, calls, handover procedures, etc.);
 - V. operating in hazardous conditions (e.g. icing, thunderstorms, white-out, windshear, etc.);
 - VI. preventing incidents of interference with UAV system command and control links;
 - VII. ensuring that the UAV pilot maintains the UAV within the prescribed altitude and distance limitations;
 - VIII. confirming navigation system accuracy and reliability during BVLOS operations; and
 - IX. the use of automation and when to discontinue use of automation.
- (D) Post flight
 - I. accident/incident reporting procedures; and
 - II. maintenance discrepancy reporting and requirements;
- (E) Emergencies
 - I. command and control link failure;
 - II. loss of visual contact;
 - III. operation of the flight termination system;
 - IV. emergency landing/ditching (e.g. engine failure, fuel starvation, aircraft malfunction, etc.);
 - V. control station failures (e.g. loss of power, software, hardware, etc.);
 - VI. communications failures (e.g. ATC, visual observer, etc.);
 - VII. fly-aways (e.g. immediate actions, ATC communications, etc.); and
 - VIII. notifying of first responders (e.g. post crash response).

(iv) Manuals and Records - The Certificate applicant must indicate in the SFOC application the manuals and records utilized to support safe operations, in accordance with the requirements in Section 6.28 of this SI.

(v) Flight Duty Time Limitations and Rest Periods - The Certificate applicant must indicate maximum flight duty times and minimum rest periods and establish a system that monitors the flight duty time and time free from duty of each of its flight crew members.

(vi) Liability Insurance – The Certificate applicant must stipulate in the SFOC application that they subscribe to liability insurance in accordance with the requirements in Section 6.31 of this SI.

Note:

Inspectors are not required to obtain an actual copy of the UAV operator's Insurance policy. The applicant's declaration of the fact that they have such insurance is sufficient.

10.5 Sample Conditions

- (1) Sample conditions for a Complex UAV SFOC can be found in Appendix H.

11.0 RESTRICTED OPERATOR - SIMPLIFIED APPLICATION PROCESS

11.1 Purpose

- (1) The purpose of this section is to provide guidance to Inspectors regarding the assessment of an SFOC application, as it applies to subparagraph 623.65(d)(3)(k) of the CARs, for the Simplified Application Process.

11.2 Background

- (1) This criteria is based on recommendations of the CARAC UAV System Program Design Working Group Phase 1 Report and developed to better respond to the demands of a large portion of UAV operators who utilize UAV systems for aerial work purposes such as aerial photography and aerial inspection. The operation of these UAV systems are not overly complex insofar as they are limited to being operated from a single control station and only a single UAV may be in flight, operated by a single pilot at any one time. The airspeed limitation is 87 knots.
- (2) These operators are unwilling to meet the criteria to become a Compliant operator or compliance with those criteria are not required based on the scope and complexity of the operation. Operators applying under this process will be granted fewer privileges than those extended to Compliant operators.
- (3) For TC to provide maximum flexibility and freedom of operations, eligible Certificate applicants are encouraged to become Compliant operators and apply under section 9 of this SI.
- (4) Inspectors processing SFOC applications under this process will refer to the guidance provided in this section, Section 8 and Appendix I of this SI.

11.3 Applicability

- (1) This SFOC process applies to all Certificate applicants who do not intend to apply under the Compliant operator or Complex processes and are not eligible to apply under the MAAC/AMA processes. Specifically this process applies to:
 - (a) small UAVs operating within VLOS conducting pilot training or aerial work (excluding aerial demonstrations or air shows before invited persons).
- (2) Air show participation requirements are outlined in Section 6.25 and require an SFOC application under Section 10 of this SI).
- (3) Where the UAV operation cannot meet the eligibility criteria below, the Certificate applicant must make application in accordance with Section 10 of this SI.

11.4 Eligibility

- (1) In order to use this simplified application process, the proposed operation will have to consist of a single make/model of small UAV operated within VLOS under VFR, day or night:
 - (a) from a single control station;
 - (b) in flight by a single pilot at any one time;
 - (c) at a maximum altitude of 300 feet AGL;
 - (d) at not less than 100 feet lateral distance from persons not associated with the operation;
 - (e) only in Class G airspace;
 - (f) more than 3 nm from the centre of an aerodrome:

- (g) at a maximum calibrated airspeed at full power in level flight of 87 knots or less; and
- (h) with no explosive, corrosive or bio-hazard payloads carried onboard or any payloads that can be jettisoned, dispersed or dropped.

11.5 Explanation of Eligibility Requirements

- (1) Only those UAVs which have the capability to allow direct and immediate pilot intervention at all times will be permitted to operate under this Section.
- (2) Control relays to extend the operational area are not permitted. Handovers transferring PIC responsibilities from one control station or pilot to another, or controlling the UAV from a moving vehicle or an aircraft are not permitted under this SFOC application process.
- (3) The UAV system shall have the capability of providing the pilot with reliable and timely information regarding the aircraft altitude and airspeed in order to remain within the operational limitations (e.g. less than 300 feet AGL and less than 87 knots).
- (4) The UAV is prohibited from operating inside Class A, B, C, D, E and F airspace (advisory airspace, restricted airspace or danger areas) or transponder airspace. Certificate applicants will be expected to indicate in their SFOC applications the means by which they will determine that the operation is remaining outside these areas (e.g. carry and be familiar with the applicable Aeronautical charts, Canada Flight Supplement, etc).
- (5) Pilots must have a means of determining the location of aerodromes near the proposed operating site.
- (6) Certificate applicants must identify their communication plan with the applicable ATS Unit(s) in the case where the UAV inadvertently flies into controlled airspace and cannot be immediately returned to the area of operation.

11.6 Reviewing an Application

- (1) Refer to Section 8 of this SI for guidance with respect to the standard information required by subparagraphs 623.65(d)(3)(a)-(i):
- (2) Please refer to the following section for guidance with respect to the information required by 623.65(d)(3)(k) - ***“Any other information pertinent to the safe conduct of the operation requested by the Minister.”***
 - (a) Personnel Qualifications - The Certificate applicant must describe the relevant aviation related qualifications of the UAV pilot(s), observer(s) and UAV system maintainer(s) in sufficient detail to demonstrate that the personnel have been trained and are qualified to fulfill their duties. Sections 4.1 and 4.2 of this SI stipulate the minimum age, medical, knowledge, experience and skill requirements.
 - (i) UAV Pilot - Inspectors must be satisfied that pilots have been appropriately trained, qualified, are proficient and current to operate the UAV in the operating environment.
 - (A) Inspectors should take into account previous aviation knowledge and experience (e.g. pilot licence/permit, ratings, air traffic specialist qualifications, previous unmanned aircraft qualifications, completed a course of pilot ground school instruction, etc.) when determining whether an individual is qualified to act as a PIC.
 - (B) Where the pilot has a dual role (e.g. also the payload operator), the Certificate applicant will need to address any risks associated with the same person performing two functions

- (ii) Visual Observers - Inspectors must be satisfied that visual observers are adequately trained to perform their duties.
- (iii) System Maintainer - Inspectors must be satisfied that the UAV maintenance personnel are appropriately trained and qualified to maintain the UAV system, including the aircraft, control station components (e.g. hardware, software and firmware) and command and control links in a fit for flight condition.
 - (A) Inspectors should take into account previous aviation maintenance knowledge and experience (e.g. AME licence, previous UAV maintenance experience, completion of a course on aviation maintenance, etc.) when determining whether an individual is qualified to act as a maintainer.
- (b) UAV System Airworthiness and Continuing Airworthiness
 - (i) UAV System Airworthiness

Note:

Other than small UAVs operated VLOS, TC does not currently define the matters to be taken into account for the design of UAVs and associated systems. Use of the term "airworthy" in this document means "in a fit and safe state for flight" but may not mean in conformity to a type definition.

- (A) The Certificate applicant must describe how they have determined that the aircraft and the system are airworthy, including:
 - I. aircraft designed to facilitate control of the UAV by the UAV pilot and provide clear indications of UAV flight status;
 - II. means for the aircraft to remain within its flight envelope;
 - III. Redundancy of flight critical components to ensure safe recovery of the aircraft (e.g. automatic landing/recovery systems, flight termination systems, etc.); and where applicable,
 - IV. operational history - accident rate as compared to total hours flown by the aircraft type. Corrective action taken to prevent future failures.
 - V. authorizations issued by other civilian or military authorities.
- (B) The Inspectors must ensure that the Certificate applicant has demonstrated that the UAV system can safely conduct the proposed operation.
- (ii) UAV System Maintenance
 - (A) The Certificate applicant must describe how the UAV system is being maintained, including:
 - I. maintenance and inspection manuals;
 - II. maintenance and inspection plan/schedule;
 - III. who established the maintenance schedule (e.g. UAV manufacturer); and
 - IV. the keeping of maintenance records (e.g. aircraft, components, control station, C2 link, etc.).

- (c) Operations
 - (i) Operational Flight Rules - The SFOC will include numerous conditions that TC deems necessary for aviation safety for which the applicant will not need to provide any information. However, the Certificate applicant must specifically address the areas discussed below as part of the SFOC application.
 - (A) In general, UAVs should be operated in accordance with the principles governing the flights of manned aircraft. See section 6.20 for the flight rules applicable to these UAV operations.
 - (ii) Weather Limitations
 - (A) The Certificate applicant must specify the weather conditions under which they will operate in accordance with Section 6.20. This will include, as a minimum; visibility, distance from cloud, cloud ceiling, wind direction and speed, and temperatures.
 - (B) The Certificate applicant must have a system in place to assess and monitor the weather in order to comply with the applicable weather minima to include actual and forecast weather.
 - (iii) Inadvertent Flight into Controlled Airspace and/or Fly-away
 - (A) The Certificate applicants must describe the following items in the event that there is an inadvertent flight into controlled airspace and/or fly-away:
 - I. a means of determining if they inadvertently enter controlled airspace;
 - II. a plan to communicate with the ATS Unit where the UAV inadvertently flies into controlled airspace and cannot be immediately returned to the area of operation; and
 - III. the ability to contact, and know who to contact, if the UAV is no longer under control of the pilot and the UAV flies away.
 - (iv) UAV System Security
 - (A) Certificate applicants shall provide Inspectors with the company procedures/processes that are utilized to manage physical and technical security of the UAV system as described in Section 6.30 of this SI.
- (d) UAV Operator Requirements
 - (i) A UAV operator must be 18 years of age or older.
 - (ii) The Certificate applicant must articulate in the SFOC application how they intend to maintain an adequate management organization that is capable of exercising supervision and operational control over persons participating in the UAV system operations.
 - (iii) Operating Procedures – The Certificate applicant must provide a description of the normal and emergency procedures for the intended operation to ensure that the UAV will not create a hazard to other airspace users or persons or property on the ground. These procedures include:
 - (A) Flight release/authorization
 - (B) Pre-flight preparation/planning, as applicable
 - I. fuel/energy and oil requirements; and
 - II. radio frequency interference check.
 - (C) Take-off/Launch, Flight and Landing/Recovery
 - I. aborted take-off/launch;

- II. landing/recovery;
 - III. use of checklists;
 - IV. preventing incidents of interference with UAV system command and control links; and
 - V. ensuring that the UAV pilot maintains the UAV within the prescribed altitude and distance limitations;
- (D) Post flight
- I. accident/incident reporting procedures; and
 - II. maintenance discrepancy reporting and requirements.
- (E) Emergencies
- I. command and control link failure;
 - II. loss of visual contact;
 - III. operation of the flight termination system;
 - IV. emergency landing/ditching (e.g. engine failure, fuel starvation, aircraft malfunction, etc.);
 - V. control station failures (e.g. loss of power, software, hardware, etc.);
 - VI. communications failure (e.g. visual observer, etc.);
 - VII. fly-aways (e.g. immediate actions, ATC communications, etc.); and
 - VIII. notifying of first responders (e.g. post crash response).
- (iv) Manuals and Records - The Certificate applicant must indicate in the SFOC application the manuals and records utilized to support safe operations, in accordance with the requirements in section 6.28 of this SI.
- (v) Liability Insurance – The Certificate applicant must stipulate in the SFOC application that they subscribe to liability insurance in accordance with the requirements in section 6.31 of this SI.

Note:

Inspectors are not required to obtain an actual copy of the UAV operator's Insurance policy. The applicant's declaration of the fact that they have such insurance is sufficient.

11.7 Sample Conditions

- (1) Sample conditions for a Simplified UAV SFOC can be found in Appendix I.

12.0 MODEL AERONAUTICS ASSOCIATION OF CANADA (MAAC) AND ACADEMY OF MODEL AERONAUTICS (AMA) MEMBERS APPLICATION PROCESS

12.1 Purpose

- (1) The purpose of this section is to provide guidance to Inspectors for SFOC applications involving model aircraft that exceed the 35 kg maximum weight required to meet the definition of model aircraft and are operated recreationally by members of the MAAC or operated by AMA members at MAAC sanctioned events. By definition, exceeding the maximum weight for model aircraft results in the aircraft becoming a UAV.

12.2 Background

- (1) MAAC exists for the benefit of recreational remote control model aircraft enthusiasts. MAAC has developed minimum standards in terms of safety codes for field operations, wings training programs and aircraft safety/airworthiness inspection programs. MAAC Safety Code prohibits pilots from use of "autonomous/automated" flight capabilities or navigating their aircraft to a point beyond their unaided visual line-of-sight. The safety code and permission of the site owner are prerequisites for insurance coverage of modeling activities sanctioned by MAAC.
- (2) AMA is the preeminent national body for model aviation in the United States. AMA's purpose is to promote development of model aviation as a recognized sport and worthwhile recreation activity.
- (3) Both MAAC and AMA are chartering organizations for model aircraft clubs across their respective countries and offer chartered clubs official contest sanction, insurance, and assistance in getting and keeping flying sites.
- (4) Applications will be assessed on a case-by-case basis and an SFOC will only be issued once it is demonstrated that the risks associated with the operation of the UAV can be managed to an acceptable level.

12.3 Applicability

- (1) This SFOC application process applies to model aircraft that are too heavy to meet the definition of model aircraft. They are model aircraft that are operated recreationally by MAAC members, in accordance with the relevant MAAC Safety Codes. They also include AMA members who are visitors to Canada that hold a valid Flight Permit for the AMA Experimental Class for models weighing 55-100 lbs and who are demonstrating at events sanctioned by MAAC.
- (2) Certificate applicants who are not MAAC members are required to make application for an SFOC in accordance with the guidance provided in Section 10 of this SI.
- (3) Certificate applicants who are MAAC members, operating aircraft 35kg or less, planning to operate for other than recreational purposes (e.g. commercial, academic, research, etc.) are required to make application for an SFOC in accordance with the guidance provided in Section 10 or 11 of this SI, as applicable.

12.4 Insurance

- (1) The SFOC will have a condition requiring the Certificate applicant to subscribe for adequate liability insurance covering risks of public liability at the levels required in subsection 606.02(8) of the CARs. It should be noted that MAAC has insurance requirements for Canadian operators and requires visiting U.S. AMA members to hold AMA insurance. The level of coverage offered by these policies is likely to be higher than that required by the CARs, therefore, Certificate applicants holding MAAC or AMA insurance should be adequately covered.

12.5 Admission to MAAC Sanctioned Event

- (1) Certificate applicants should be aware that the event organizer (e.g. Contest Director in charge of the event) will expect to see a copy of the SFOC prior to participating in the event.

12.6 Submitting an Application

- (1) In addition to the information contained herein, Certificate applicants shall reference the MAAC website (www.maac.ca) for the appropriate SFOC application forms.

12.7 Sample Conditions

- (1) Sample conditions for a MAAC and AMA SFOC can be found in Appendix J.

13.0 DOCUMENT HISTORY

(1) This document has the following history:

- (a) SI SUR 623-001 Issue 2 dated 2008-11-27 -*The Review and Processing of an Application for a Special Flight Operations Certificate for the Operation of an Unmanned Air Vehicle (UAV) System*

14.0 CONTACT OFFICE

Recommendations for improvements or questions pertaining to the information contained in this SI should be forwarded to:

General Flight Standards (AARTAC)
4th Floor
Place de Ville, Tower C
330 Sparks Street, Ottawa, ON K1A 0N8

Phone: 613-990-1033 or 613-990-9869

or by using the TC Civil Aviation Issues Reporting System (CAIRS) at
<http://www.tc.gc.ca/eng/civilaviation/opssvs/secretariat-cairs-menu-209.htm>.

[original signed by]

Aaron McCrorie
Director, Standards
Civil Aviation
Transport Canada

APPENDIX A - SFOC COVER LETTER TEMPLATE

TC Logo

Return Address

Our File Notre reference

Date:

Person or Organization:

Address:

Address:

City, Province / State:

Postal Code / Zip code:

Dear:

Please find attached the requested Special Flight Operations Certificate in accordance with your Special Flight Operations Certificate application of (***enter the application date***) and supplementary documents (***enter the date(s) of the supplementary documents***).

Nothing in this Special Flight Operations Certificate relieves you, the UAV operator, from complying with the provisions of any other relevant Acts, Regulations or laws or from any level of government.

Should you have any questions or concerns please do not hesitate to communicate with (***enter Inspectors name and contact information***).

Yours truly,

Signature

Signature Block

APPENDIX B - CRITERIA FOR A COMPLIANT PILOT OF SMALL UAV SYSTEMS

- (1) A Compliant Pilot of a small UAV system, restricted to VLOS, will meet the following requirements:
- (a) Age - The pilot shall be a minimum of eighteen (18) years of age
 - (b) Medical Fitness - The pilot shall be deemed eligible for a Category 4 Medical Declaration/Certificate. A current medical associated with a pilot's licence or permit would suffice.
 - (c) Knowledge - A UAV Pilot-in-command shall have:
 - (i) completed a course of pilot ground school instruction, based on the TP1526E - *Recommended Knowledge Requirements for Pilots of Small Unmanned Air Vehicle Systems, Restricted to Visual Line-of-Sight*, which includes the following subjects:
 - (A) air law and procedures relevant to the permit (e.g. general provisions, general operating and flight rules, air traffic control services and procedures, aviation occurrence reporting),
 - (B) flight instruments (e.g. altimetry, GPS, airspeed and heading indicators),
 - (C) navigation (e.g. aeronautical charts, pre-flight preparation),
 - (D) flight operations (e.g. wake turbulence causes, effects and avoidance; data and command links),
 - (E) meteorology (e.g. required for line-of-sight operations),
 - (F) human factors (e.g. aviation physiology, the operating environment, aviation psychology), and
 - (G) theory of flight (e.g. basic principles),
 - (ii) obtained a passing grade on a written exam, administered by a training organization.
 - (d) Experience - The UAV pilot shall have acquired on a small UAV system:
 - (i) practical training; and
 - (ii) has reached a satisfactory standard of experience to establish proficiency.
 - (e) Skill - The pilot must successfully demonstrate the ability to perform both normal and emergency manoeuvres appropriate to the small UAV system used for the training program, and with a degree of competency appropriate for the operation of a small UAV system - Restricted to VLOS
 - (f) Credits - A UAV pilot may be given credit for previous experience in accordance with the guidance below:
 - (i) Canadian Civil Licence:
 - (A) UAV pilots who hold a Private Pilot Licence or higher may be considered to have met paragraph c above (knowledge requirement).
 - (ii) Foreign Pilots:
 - (A) UAV pilots with foreign credits will be evaluated on a case-by-case basis.
 - (iii) Canadian Forces Pilots:
 - (A) Active and retired Canadian Forces personnel who have qualified to pilot aeroplane wings standard or who have successfully completed the Basic Flying Training course of approximately 120 hours, may be considered as having met paragraph c above (knowledge requirement).
 - (B) Active and retired Canadian Forces pilots who hold current Canadian Forces qualifications on a small UAV (or equivalent), may be considered as having met paragraph c, d and e above (knowledge, experience, skill).

APPENDIX C - CRITERIA FOR A COMPLIANT SMALL UAV SYSTEM DESIGN

- (1) General - The following sections set out:
 - (a) The airworthiness criteria for a small UAV system that includes a UAV with a maximum take-off weight (MTOW) of 25 kg or less; and
 - (b) The requirements for inspections, equipment and instruments, and operating information necessary for this UAV system to be considered Compliant.
- (2) Flight Performance
 - (a) The aircraft shall be safely controllable and manoeuvrable during all flight phases including, where applicable:
 - (i) taxi;
 - (ii) take-off/ launch;
 - (iii) climb;
 - (iv) level flight;
 - (v) descent;
 - (vi) go-around;
 - (vii) landing/recovery; and
 - (viii) at all permissible aircraft speeds and in all permissible aircraft configurations.
 - (b) It shall be possible to make a smooth transition from one flight condition to another (including turns and slips) without danger of exceeding the limit load factor, under any probable operating condition.
 - (c) If the UAV can aerodynamically depart from controlled flight:
 - (i) the probability of such a departure from which recovery is not possible using a prescribed technique shall be extremely remote, or
 - (ii) there shall be a means of initiating flight termination in the event of such a departure.
 - (d) The UAV pilot shall be provided sufficient and timely flight and systems information to adequately operate the UAV system.

Note:

This may include, if they are required by the pilot to maintain control, fuel or other energy source, angle of attack, angle of sideslip, speeds, g-loads, etc.

- (e) A centre of gravity envelope, where the aircraft remains safely controllable, shall be established. The aircraft centre of gravity, including all modifications, consumables, configurations and payloads, shall remain within this envelope during flight.
- (f) A performance envelope in terms of speeds, climb rate, and any other operating parameters, for all permissible aircraft weights and configurations, shall be established to determine the operating limitations of the UAV.

Note:

May include: best glide speed, V_{mca} , V_{mcg} , V_d , V_{cruise} , V_s , V_r , etc.

- (3) UAV Structure

- (a) The UAV shall be designed to have sufficient strength for all expected operating conditions, including those with propulsion system failures and involving environmental factors such as gusts.
 - (b) Representative limit load cases shall be demonstrated to prove compliance with a 1.5 safety factor.
 - (c) The UAV structure shall not exhibit unintended binding, chafing or permanent deformation due to any expected flight and ground loads (including take-off/launch and landing/recovery).
- (4) Design and Construction
- (a) The suitability of each part, component, and assembly, having an important bearing on safety and operations, shall be established.
 - (b) Materials and Workmanship - The suitability and durability of materials used for parts, the failure of which could adversely affect safety, shall:
 - (i) be established by experience or tests;
 - (ii) meet accepted specifications that ensure their having the strength and other properties assumed in the design data;
 - (iii) take into account the effects of environmental conditions, such as moisture (i.e. rain), temperature and humidity, expected in service; and
 - (iv) have a high standard of workmanship.
 - (c) Fabrication Methods - The methods of fabrication used shall produce consistent results. If a fabrication process (such as gluing, spot welding, or heat-treating) requires close control to reach this objective, the process shall be performed under a documented process specification.
 - (d) Fasteners - Fasteners with suitable locking mechanisms shall be employed, where the failure of which, would prevent continued controlled flight.
 - (e) Protection of Structure - Each part of the structure shall be suitably protected against deterioration or loss of strength in service due to any cause, including:
 - (i) weathering;
 - (ii) corrosion; and
 - (iii) abrasion.
 - (f) If the UAV operation requires application of full propulsive power while the aircraft remains stationary, then a suitable means shall be provided to restrain the aircraft.
 - (g) Systems that present the potential for fire on the UAV shall be designed to minimize this risk.
 - (h) UAV designs should avoid sharp edges and incorporate energy absorbing materials.
- (5) Propulsion System
- (a) If a single failure within the propulsion system could result in the loss of control of the UAV trajectory:
 - (i) the probability of such a failure under all expected operating conditions shall be extremely remote, or
 - (ii) there shall be a means of initiating flight termination in the event of such a failure.
 - (b) The installation of the propulsion system shall ensure safe operation throughout the aircraft flight envelope.
 - (c) Any propellers or rotors shall have sufficient strength to ensure safe operation throughout the flight envelope.

- (d) Each fuel system shall be constructed and arranged to ensure fuel flow at a rate and pressure established for proper engine and auxiliary power unit functioning under all likely operating conditions.
 - (e) Each fuel tank and its associated plumbing and related components shall be able to withstand, without failure, the vibration, inertia, fluid, and structural loads that it may be subjected to in operation.
 - (f) Each electrical source for propulsion shall be constructed and arranged to ensure energy delivery at the required voltage and current levels under all likely operating conditions.
 - (g) Each electrical source for propulsion and its associated wiring and related components shall be able to withstand, without failure, the vibration, inertia, temperature and structural loads that it may be subjected to in operation.
 - (h) The UAV design shall incorporate provision for adequate cooling of propulsion system components.
- (6) Systems and Equipment
- (a) General Function and Installation
 - (i) Each item of installed equipment in a UAV shall:
 - (A) be of a kind and design appropriate to its intended function;
 - (B) be labelled as to its identification, function, or operating limitations, or any applicable combination of these factors, if appropriate;
 - (C) be installed according to limitations specified for that equipment; and
 - (D) function properly when installed.
 - (b) Flight and Navigation Information
 - (i) The UAV system shall provide the pilot a means to determine, in a timely manner, the following parameters:
 - (A) UAV present position;
 - (B) UAV altitude;
 - (C) UAV heading;
 - (D) UAV fuel or other indication of remaining flight time;
 - (E) UAV operating status; and
 - (F) any parameters shall be provided at the resolution and accuracy levels required to comply with Air Navigation System requirements as mandated operational requirements
 - (ii) This information shall be provided in a clear fashion, under all operational conditions.

Note:

Some of this information may be provided through visual observation of the UAV.

- (c) High-Intensity Radiated Fields (HIRF) Protection
 - (i) If the operation of the UAV system includes flight in areas where HIRF are probable, the UAV system electrical and electronic systems that perform functions whose failure would prevent the continued safe flight and recovery of the UAV shall be designed to mitigate this risk.
- (d) Equipment, Systems, and Installations
 - (i) Each item of equipment, each system, and each installation:

- (A) when performing its intended function, shall not adversely affect the response, operation, or accuracy of any equipment essential to safe operation; and
- (B) shall be designed to minimise hazards to the safe operation of the UAV system in the event of a probable malfunction or failure.
- (ii) If a single failure of a UAV system could result in the loss of control of the UAV trajectory:
 - (A) the probability of such a failure under all expected operating conditions shall be extremely remote, or
 - (B) there shall be a means of initiating flight termination in the event of such a failure, or
 - (C) there shall be an alternate means of regaining control.
- (e) Navigation Systems
 - (i) A UAV system shall have a means to determine the position and altitude of the aircraft in flight sufficiently accurate for the operation and associated airspace.

Note:

A pilot and/or observer may meet this requirement.

- (f) Sense and Avoid Systems
 - (i) All UAV Systems shall have a means to sense and avoid collisions with other aircraft.

Note:

The pilot, or the pilot assisted by visual observers may satisfy the sense and avoid requirement.

- (g) UAV Control
 - (i) For command, control and communication links required during the operation of the UAV system, the probability of a failure that results in loss of timely aircraft trajectory control shall be extremely remote, or the failure shall result in the activation of a flight termination system.

Note:

The performance of pre-programmed manoeuvres to regain link and/or return to base are not generally considered to constitute a "loss of timely aircraft trajectory control".

- (ii) The pilot-in-command must be able to assess the risk involved with the particular lost link circumstance and establish when auto-recovery manoeuvres or flight termination shall be initiated.
- (iii) There shall be a means to assure that prior to taxi and take-off or launch, the UAV systems and subsystems are operating correctly.

- (iv) The probability of loss of control of aircraft trajectory caused by control station handovers shall be extremely remote in all expected operating conditions or this condition shall result in the activation of a flight termination system.
- (v) The control station and associated link to the UAV shall be designed such that the probability of the UAV receiving an incorrect command is, extremely remote.

Note:

The above includes security provisions against malicious hacking.

- (vi) Warning information shall be provided to alert crew member(s) to unsafe system operating conditions and to enable them to take appropriate corrective action.
 - (vii) Systems, controls, and associated monitoring and warning means shall be designed to minimise crew member errors that could create additional hazards.
 - (viii) The control station shall provide appropriate control station and data link status information to the pilot-in-command (PIC).
 - (ix) The control station and associated UAV shall be tested and demonstrated in an integrated manner to be functional.
 - (x) The control station permissible operating conditions shall be specified and verified.
 - (xi) Control station swap-out provision - In the case of a UAV where the UAV may be operated by a variety of permissible control stations, the above criteria (g (i) – (x)) shall be met by each combination which are to be specified in the Type Definition.
 - (xii) Data and control links swap-out provision - In the case of a UAV where the UAV may be operated by a variety of permissible data and control links, the above criteria (g (i) – (x)) shall be met by each combination which are to be specified in the Type Definition.
 - (xiii) In cases where the control station relies on an external source of power, a means to retain control of the UAV in the event of power failure shall be present.
- (h) Launch and Recovery Systems
- (i) Operation of the launch and recovery system shall not pose a safety hazard.
 - (ii) The performance envelope for a safe take-off/launch and landing/recovery of the UAV shall be specified, including, if appropriate, but not limited to:
 - (A) clear areas required for take-off/launch and landing/recovery;
 - (B) meteorological conditions;
 - (C) wind components;
 - (D) density altitude;
 - (E) launch/recovery equipment settings;
 - (F) permissible aircraft configurations/loadings; and
 - (G) required system checks.
 - (iii) The conditions under which the operation of the launch system results in consistent transition into safe flight in all permissible operating conditions shall be defined.

- (iv) The conditions under which the operation of the recovery system results in a predictable outcome in all permissible operating conditions shall be defined.
- (v) If a failure of launch or recovery systems can result in loss of control of the UAV trajectory:
 - (A) the probability of such a failure under all expected operating conditions shall be extremely remote;
 - (B) a flight termination system shall be initiated; or
 - (C) there shall be safe alternatives available to conclude the UAV operation.
- (i) Payloads
 - (i) Payloads shall not create a hazard to the safe operation of the UAV system or to persons and property on the ground.
 - (ii) The limitations for payloads on the UAV shall be defined and a list of permissible payloads shall be provided.
 - (iii) A permissible payload shall meet the following standards:
 - (A) Maximum power load of payloads plus maximum power loads of all other systems onboard shall be within the power allowance of the aircraft power system;
 - (B) Payloads shall be designed and tested to avoid the inadvertent transmission of any electromagnetic interference (EMI) that affects the control of the UAV trajectory; and
 - (C) Payloads, associated fairings and their attachment to the aircraft shall be designed and tested to withstand maximum expected loads during flight, including take-off/launch and landing/recovery loads, or be placarded to impose flight restrictions to limit the aircraft to acceptable flight operations.
 - (iv) Active Payloads

Note:

Active payloads are defined as payloads that intentionally and actively release any Radio Frequency (RF), acoustic or material emissions as part of their normal function.

- (A) Active payloads shall not present a hazard to ground crew or shall have a means of being rendered safe on the ground.
- (B) Active payloads shall have a visible means of indicating that they are rendered safe on the ground.
- (C) Active payloads shall have a safe means of testing their function(s) while on the ground.
- (D) Active payloads shall have a secure and reliable means to manage its operation in flight, even in lost link and flight termination scenarios, if such operation presents a hazard.
- (v) Explosive Payloads (notwithstanding other regulations for these payloads)
 - (A) Explosive payloads shall have a means of being jettisoned during an emergency.
 - (B) There shall be a means to ensure that jettisoning of explosive payloads is conducted over designated safe areas only.

- (C) Explosive payloads shall remain inert so long as the ground safeing equipment is in place.
- (vi) Moving Payloads
 - (A) Moving payloads shall not present a hazard to ground crew or shall have a visible means of being rendered safe on the ground.
 - (B) Moving payloads shall have a safe means of testing their function(s) while on the ground.
 - (C) Payloads with moving parts shall be designed and tested to show that all possible movement does not adversely affect aircraft performance.
- (vii) Payloads with Rotating Components
 - (A) Payloads with rotating components shall be designed and tested to ensure that either maximum rotation does not affect safe UAV trajectory in the air or that maximum rotation cannot be maintained for any duration of time that poses a risk to control of the aircraft trajectory.

Note:

As an example: gyroscopic effect critically hindering turn response.

- (viii) External Payloads
 - (A) External payloads or payload components shall not render unsafe any flight critical systems on the UAV.
 - (B) External payloads or payload components shall not render unsafe the operation of the take-off/launch, landing/recovery, flight termination or safety features of the UAV.
- (ix) Payloads used for "Flight Decisions"
 - (A) Payloads integral to the control of the UAV shall conform to the airworthiness standards for the flight control system.
- (x) In the case of a UAV system where the UAV may be operated with a variety of permissible payloads, the above criteria ((i) – (ix)) shall be met by each combination which are to be specified in the Type Definition.

(7) Manuals and Documentation

- (a) Flight Manual - The UAV system shall have a flight manual that includes operating limitations, standard operating procedures, emergency procedures, assembly instructions and UAV performance data.
- (b) Maintenance Manual - The UAV shall have a maintenance manual (which may be part of the flight manual) that defines actions that shall be taken to keep the UAV system in conformity with its Type Definition.
- (c) The following is the basic structure of a small UAV system flight manual. This outline is not exhaustive.

Notes:

Mandatory (safety critical) items and sections are identified by bolded and underlined text.

The flight manual and maintenance manual may be separate documents or combined in a single document.

- (i) **General**
 - (A) Description of the UAV
 - (B) Engine, propeller, rotor
 - (C) Three-view drawing
 - (D) Flight Controls, control deflections
 - (E) Ancillary controls
 - (F) Displays
 - I. Flight-related (Altitude, airspeed, magnetic heading, position, attitude)
 - II. Control settings
 - III. Switches and caution/warning lights

- (ii) **Limitations**
 - (A) Weight
 - I. Maximum weight
 - II. Centre of gravity limits
 - (B) Speed (or others that are appropriate for the UAV)
 - I. Maximum speed (VDive)
 - II. Manoeuvring speed
 - III. Best gliding speed (max L/D)
 - (C) Manoeuvring load factor (or equivalent)
 - (D) Prohibited manoeuvres
 - (E) Weather conditions (e.g. icing conditions)
 - (F) Safety footprint for operational phases such as take-off/launch and landing/recovery

- (iii) Powerplant – propeller
 - (A) Maximum power
 - (B) Maximum engine/motor speed – propellers
 - (C) Fuel system, indicators; battery state indicators

- (iv) **Emergency procedures**
 - (A) Engine failure
 - (B) Fire
 - (C) Gliding
 - (D) Landing/recovery
 - I. Conventional horizontal run
 - II. Parachute
 - III. Net
 - IV. Other
 - (E) Other emergencies:
 - I. Loss of navigation aids
 - II. Loss of command link
 - III. Control jam
 - IV. Structural failure
 - V. Etc.
 - (F) Flight termination

- (v) **Normal Procedures**
 - (A) Pre-flight inspection
 - (B) Synchronization or other initialization procedures
 - (C) Start up, taxi
 - (D) Take-off/launch/launch

- I. Conventional horizontal run;
- II. Hand launch;
- III. Catapult;
- IV. Winch;
- V. Other
- (E) Cruise
- (F) Landing/recovery
 - I. Conventional horizontal run
 - II. Parachute
 - III. Net
 - IV. Other
- (G) Post flight/shutdown landing and shutting down powerplant

(vi) **Performance**

- (A) Take-off/launch
- (B) Wind limitations
- (C) Landing/recovery

(vii) Mission equipment

- (A) List of equipment
 - I. Identify flight critical equipment
 - II. Identify equipment that may direct the trajectory

(viii) **Assembly and adjustment**

- (A) Assembly and disassembly instructions
- (B) Rigging

(d) The following is the basic structure of a small UAV system maintenance manual. This outline is not exhaustive:

- (i) Wings or envelope;
- (ii) Structure:
 - (A) Doors and hatches;
 - (B) Fasteners; and
 - (C) Non-metallic components, including fabric or other covering
- (iii) Engine(s) and propeller(s);
- (iv) Command and control systems;
- (v) Environmental/type of use considerations;
- (vi) Simple periodic maintenance activities based either on the number of flying hours or on calendar periods of use (whichever is reached first);
- (vii) Major maintenance activities necessitating thorough checks which could require partial disassembly;
- (viii) Acceptance inspection following the first TBD hours of use of a new system;

Note:

The manufacturer shall establish the appropriate period after which an acceptance inspection is due.

- (ix) Necessary inspections following removal from storage;
- (x) A table containing the checks and deadlines that allows the owner to add his/her signature and the date the check is carried out. Any problems encountered, solutions applied and replaced parts should be noted;
- (xi) Specify any instruments, special tools, jigs, fixtures or tooling used to help assess acceptable tolerance levels. The manual specifies life-limited parts;

- (xii) Information, drawings or cut-away diagrams necessary to show how to assemble the various parts which can normally be disassembled. These criteria may also be taken into account by the propeller manufacturer;
- (xiii) Repair procedures;
- (xiv) Inspection procedures after abnormal occurrences;
- (xv) Maintenance release procedures; and
- (xvi) Miscellaneous.

APPENDIX D - CRITERIA FOR A COMPLIANT OPERATOR OF SMALL UAV SYSTEMS

A Compliant operator of a small UAV system, restricted to visual line-of-sight (VLOS), will meet the following requirements:

- (1) General
 - (a) The Certificate applicant must demonstrate the ability to:
 - (i) maintain an adequate organizational structure;
 - (ii) maintain operational control;
 - (iii) meet training program requirements;
 - (iv) comply with maintenance requirements;
 - (v) meet the standards contained herein; and
 - (vi) conduct the operation safely.
 - (b) For the purposes of section (a) above, a Certificate applicant shall have the following:
 - (i) a management organization capable of exercising operational control;
 - (ii) managerial personnel who perform the following functions
 - (A) operational control;
 - (B) pilot supervision and training; and
 - (C) maintenance.
 - (iii) the ground handling services and equipment necessary to ensure the safe handling of its flights;
 - (iv) UAV that are properly equipped and crew members who are qualified for the area of operation and the type of operation;
 - (v) identified the operating performance capabilities including maximum performance levels of the UAV to be used;
 - (vi) a training program that meets the requirements of this standard;
 - (vii) an operations manual; and
 - (viii) a maintenance system.
- (2) Flight Operations
 - (a) Operating Instructions
 - (i) The UAV operator shall ensure that all operations personnel are properly instructed about their duties and about the relationship of their duties to the operation as a whole; and
 - (ii) The operations personnel of a UAV operator shall follow the procedures specified in the operations manual in the performance of their duties.
 - (b) Operational Control
 - (i) The UAV operator shall not operate a UAV system unless it is under the control of its operations manager.
 - (c) Operational Flight Plan
 - (i) The UAV operator shall not permit a person to commence a flight of a UAV unless an operational flight plan has been prepared in accordance with the procedures specified in its operations manual.
 - (ii) Minimum Content of an Operational Flight Plan:
 - (A) UAV operator name;
 - (B) date;
 - (C) UAV registration(s), when applicable;
 - (D) UAV model(s);

- (E) Pilot-in-command name(s);
 - (F) flight profile description; and
 - (G) other information pertinent to the safe completion of the flight.
 - (iii) The operational flight plan shall permit the flight crew to record the fuel/other energy state and the progress of the flight relative to the plan.
 - (iv) The UAV operator shall specify, in its operations manual, how formal acceptance of the operational flight plan by the PIC shall be recorded.
 - (d) Maintenance of Aircraft
 - (i) The UAV operator shall not permit a person to conduct a take-off/launch of a UAV that has not been maintained in accordance with the UAV operator's approved maintenance manual.
 - (e) Built-up Area and Site Survey
 - (i) The UAV operator shall not operate over a built-up area at altitudes and distances less than those specified in Section 602.14 of the CARs, or conduct a take-off/launch, approach or landing/recovery within a built-up area of a city or town, unless the operator conducts a site survey in accordance with Section 6.19 of this SI.
- (3) Personnel Requirements
- (a) Designation of Pilot-in-command
 - (i) The UAV operator shall ensure that a PIC is designated at all times during a UAV flight.
 - (b) Pilot Qualifications
 - (i) The UAV operator shall not permit a person to act and no person shall act as a pilot of a UAV system unless the person:
 - (A) is deemed compliant as per Appendix B – Criteria for a Compliant Pilot of Small UAV systems; and
 - (B) has fulfilled the requirements of the UAV operator's ground and flight training program.
 - (c) Crew Member Qualifications
 - (i) The UAV operator shall not permit a person to act and no person shall act as a crew member of a UAV unless the person
 - (A) has fulfilled the requirements of the UAV operator's training program.
 - (d) Training
 - (i) Training Program
 - (A) The UAV operator shall establish and maintain a ground and flight training program that is designed to ensure that each person who receives training acquires the competence to perform their assigned duties.
 - (B) The UAV operator's ground and flight training program shall be conducted in accordance with the Training Standard provided in paragraph (e) below and will include:
 - I. company indoctrination training;
 - II. upgrading training;
 - III. training in the specific work to be conducted; and
 - IV. initial and recurrent training, including
 - V. UAV type training,

- VI. procedures for passing piloting control from one control station or pilot to another,
 - VII. aircraft servicing and ground handling training,
 - VIII. emergency procedures training,
 - IX. training for personnel who are assigned to perform duties associated with the flight, and
 - X. any other training required to ensure a safe operation.
- (C) The UAV operator shall:
- I. include a detailed syllabus of its ground and flight training program in its operations manual; and
 - II. ensure that adequate facilities and qualified personnel are provided for its ground and flight training program.

(e) Training - Standard

(i) Company Indoctrination Training - This training is required for all persons assigned to the operation. Company indoctrination training shall include, as applicable ;

- (A) *Canadian Aviation Regulations* and applicable standards;
- (B) UAV SFOC and the conditions specified therein;
- (C) company reporting relationships and communication procedures, including duties and responsibilities of crew members and the relationship of their duties to other crew members;
- (D) flight planning and operating procedures including
 - I. operational preparation procedures related to reconnaissance of aerial work areas before low level flight operations; and
 - II. operational restrictions;
- (E) fuelling procedures, including fuel contamination precautions;
- (F) critical surface contamination and safety awareness program;
- (G) use and status of the operations manual including maintenance release procedures and accident/incident reporting procedures;
- (H) meteorological training appropriate to the area of operation;
- (I) navigation procedures appropriate to the area of operation;
- (J) carriage of external loads;
- (K) operational control system; and
- (L) weight and balance system.

(ii) Upgrading Training

- (A) Upgrading training to PIC on a UAV type shall include:
- (B) completion of applicable qualification training related to assigned duties; and
- (C) completion of type training as PIC on the UAV type and a PIC competency check.

(iii) Ground Technical Type Training (Initial and Recurrent)

- (A) This training shall ensure that each crew member is knowledgeable with respect to the systems of the UAV system and all normal, malfunction and emergency procedures, as applicable to their assigned duties. Ground technical type training programs shall include:
 - I. aircraft systems operation and limitations as contained in the UAV system operating manual, manual supplements, standard operating procedures;
 - II. use and operation of navigation and ancillary equipment;
 - III. equipment differences of UAV of the same type, as applicable;
 - IV. UAV performance and limitations;
 - V. weight and balance procedures; and

- VI. UAV servicing and ground handling procedures.
- (iv) UAV Servicing and Ground Handling Training
 - (A) Training in UAV servicing and ground handling for each crew member, as applicable to their duties and applicable to the UAV type, shall include:
 - (B) fuelling/charging procedures:
 - I. types of fuel, oil and fluids used in the UAV;
 - II. correct fuelling procedures;
 - III. procedures for checking fuel, oil and fluids and securing of caps; and
 - IV. procedures for charging batteries.
 - (C) use and installation of protective covers; and
 - (D) procedures for operating in cold weather such as:
 - I. moving the UAV or other components of the UAV from a warm facility when precipitation or high humidity is present;
 - II. engine pre-heat procedures including proper use of related equipment; and
 - III. managing battery degradation.
- (v) UAV Flight Training Program (Initial and Recurrent)
 - (A) The initial and recurrent flight training program shall ensure that each crew member is trained to competently perform the assigned duties including those relating to abnormal and emergency duties. Simulated malfunctions and failures shall only take place under operating conditions which do not jeopardize safety of flight. Flight training programs shall include, as applicable to the UAV system:
 - I. standard operating procedures for normal, abnormal and emergency operation of UAV systems and components;
 - II. use of check lists and pre-flight checks;
 - III. crew member co-ordination procedures;
 - IV. normal take-offs/launchs, circuits, approaches and landing/recovery including, as applicable, ground manoeuvring and hovering;
 - V. control station fire procedures, including smoke control;
 - VI. fire control and handling of hazardous materials;
 - VII. simulated engine and system malfunctions and failures including hydraulic and electrical systems;
 - VIII. simulated failure of navigation and communication equipment;
 - IX. stall (clean, take-off/launch and landing/recovery configuration) prevention and landing/recovery procedure;
 - X. autorotations and anti-torque system malfunctions, as applicable;
 - XI. rejected take-off/launch and landing/recovery procedures;
 - XII. use of performance information and performance calculation procedures;
 - XIII. simulated emergency descent;
 - XIV. collision avoidance techniques;
 - XV. operational procedures involving visual observers;
 - XVI. steep turns and flight characteristics;
 - XVII. briefings on recovery from turbulence and windshear; and
 - XVIII. flight manoeuvres used in specific operations.
- (vi) Training and Qualification Records
 - (A) The UAV operator shall, for each person required to receive training, establish and maintain a record of:

- I. the person's name and, where applicable, personnel permit/licence number,
 - II. if applicable, the person's medical category and the expiry date of that category;
 - III. the dates on which the person, while in the UAV operator's employ, successfully completed any training or competency checks; and
 - IV. information relating to any failure of the person, while in the UAV operator's employ, to successfully complete any training or competency check or to obtain any qualification required herein.
- (B) The UAV operator shall retain the records referred to in paragraphs (A) (III) and (IV) above, for at least three years.

(4) Manual Requirements

(a) Operations Manual

- (i) The UAV operator shall establish and maintain an operations manual that meets the requirements of Section (b) below.

(b) Contents of Operations Manual

- (i) The operations manual, which may be issued in separate parts corresponding to specific aspects of an operation, shall include the instructions and information necessary to enable the personnel concerned to perform their duties safely and shall contain the information required by the standards in Section (5)(a) below.
- (ii) The operations manual shall be such that
 - (A) all parts of the manual are consistent and compatible in form and content;
 - (B) the manual can be readily amended;
 - (C) the manual contains an amendment control page and a list of the pages that are in effect; and
 - (D) the manual has the date of the last amendment to each page specified on that page.

(c) Distribution of Operations Manual

- (i) The UAV operator shall provide a copy of the appropriate parts of its operations manual, including any amendments to those parts, to each of its crew members and to its ground operations and maintenance personnel.
- (ii) Every person who has been provided with a copy of the appropriate parts of an operations manual pursuant to subsection (i) above, shall keep it up to date with the amendments provided and shall ensure that the appropriate parts are accessible when the person is performing assigned duties.

(d) Standard Operating Procedures

- (i) The UAV operator shall, for each operation that is described in the operations manual, establish and maintain type-specific standard operating procedures that meet the standards described in Section (5)(b) below.
- (ii) The UAV operator that has established standard operating procedures shall ensure that a copy of the standard operating procedures is available at the control station.

(5) Manuals - Standard

- (a) Operations Manual Content - The operations manual shall include the following, as applicable to the operation:
 - (i) preamble related to use and authority of manual;
 - (ii) table of contents;

- (iii) amending procedures, amendment record sheet, distribution list and list of effective pages;
- (iv) copy of the SFOC;
- (v) flight authorization and flight preparation procedures;
- (vi) retention period of flight operations documents;
- (vii) dissemination procedures for operational information;
- (viii) fuel/energy and oil requirements;
- (ix) weight and balance system;
- (x) accident/incident reporting procedures;
- (xi) use of check lists;
- (xii) maintenance discrepancy reporting and requirements on completion of flights;
- (xiii) operating weather minima and applicable requirements;
- (xiv) operations in hazardous conditions such as icing, thunderstorms, white-out, windshear;
- (xv) operations conducted from control stations that are situated above 10,000 ft. ASL and associated oxygen requirements for crew members;
- (xvi) performance limitations;
- (xvii) securing of cargo;
- (xviii) briefing procedures for persons other than crew members;
- (xix) use of UAV operating instructions and standard operating procedures;
- (xx) aircraft ice, frost and snow critical-surface contamination procedures;
- (xxi) procedures for carriage of dangerous goods;
- (xxii) fuelling procedures including:
 - (A) fuel contamination precautions;
 - (B) bonding requirements; and
 - (C) fuelling with engine running;
- (xxiii) list of emergency and survival equipment, how to use the equipment and periodic inspection requirements;
- (xxiv) emergency procedures for:
 - (A) command and control link;
 - (B) flight termination system;
 - (C) loss of visual contact;
 - (D) preparation for emergency landing/ditching;
 - (E) control station failures; and
 - (F) emergency control station evacuation;
- (xxv) minimum crew members required and crew member qualifications;
- (xxvi) flight time, flight duty time limitations and rest requirements;
- (xxvii) training programs, including copy of company training and qualification record form(s);
- (xxviii) operational support services and equipment;
- (xxix) procedures related to operations including:
 - (A) carriage of external loads;
 - (B) low level flight precautions;
 - (C) towing precautions, pick-up and release procedures;
 - (D) external load procedures, including flight and ground crew signals and briefing procedures, steps to be taken before starting an external load operation, hazards of oscillating loads, low density loads and unfamiliar load configurations; and
 - (E) operational restrictions related to the operation.
- (xxx) procedures to prevent and manage incidents of interference with UAV system command and control links; and
- (xxxi) procedures to prevent and manage incidents of interference with a crew member.

(b) Standard Operating Procedures (SOPs)

- (i) The Standard Operating Procedures shall contain the following information. Where there are significant differences in equipment and procedures between the same type of UAV system operated, the SOP shall clearly indicate the UAV system it is applicable to.
- (ii) Required information, if contained in another publication that is available at the control station during flight, need not be repeated in the SOP.
- (iii) The SOP may form part of the operations manual.
- (iv) The SOP shall contain the following as applicable to the specific UAV type.
- (v) General
 - (A) table of contents;
 - (B) list of effective pages;
 - (C) amending procedure; and
 - (D) preamble.
- (vi) Normal Procedures
 - I. assembly;
 - II. pre-flight tests;
 - III. weight and balance control requirements;
 - IV. take-off/launch, flight and recovery;
 - V. crew coordination such as standard briefings and calls and handovers;
 - VI. balked landing procedures;
 - VII. refuelling/battery charging or replacement; and
 - VIII. use of check lists.
- (vii) Abnormal and Emergency Procedures
 - I. emergency landing/recovery;
 - II. equipment failure;
 - III. command and control link failure;
 - IV. loss of visual contact;
 - V. pilot incapacitation; and
 - VI. potential conflict with other aircraft.

APPENDIX E - SMALL UAV SYSTEM DECLARATION OF COMPLIANCE TEMPLATE

Small Unmanned Air Vehicle (UAV) System Declaration of Compliance

UAV System

Make: _____

Model: _____

Manufacturer

Name: _____

Address: _____

I hereby declare that the Type Definition for the UAV System herein described is in compliance with the Design Standard for Small UAV Systems.

The Type Definition and record of all tests and analyses are in my possession and available for inspection or retention by the Minister.

I understand and agree that by signing this declaration I am responsible for ensuring that the Type Definition of this UAV System model continues to comply with the UAV System Design Standards as long as it appears on the Transport Canada Listing of Compliant UAV Systems.

Signature of Manufacturer

Date

APPENDIX F - SMALL UAV SYSTEM STATEMENT OF CONFORMITY TEMPLATE

Small Unmanned Air Vehicle (UAV) System Declaration of Compliance

UAV System

Make: _____

Model: _____

Serial Number: _____

Manufacturer

Name: _____

Address: _____

Manufacturer's Statement

The assembled small UAV System herein described conforms with the Type Definition as declared in the Declaration of Compliance for the make and model and has been found to conform to the Design Standards for Small UAV Systems and is fit for flight.

Signature of Manufacturer

Date

Owner's Statement

The small UAV System has not been altered or modified from the configuration provided by the manufacturer and remains in conformance with the original design.

Signature of Owner

Date

APPENDIX G - SFOC TEMPLATE FOR COMPLIANT OPERATOR

TC Logo

SPECIAL FLIGHT OPERATIONS CERTIFICATE

Certificate Number

File Number

Pursuant to section 603.67 of the *Canadian Aviation Regulations*, this constitutes your Special Flight Operations Certificate (SFOC), for the operation of a small unmanned air vehicle (UAV) system operated within visual line-of-sight, issued under the authority of the Minister pursuant to the *Aeronautics Act*.

Approval of this Certificate is based on the information provided in your SFOC application (dated **dd/mm/yyyy**) and any accompanying documentation (**dated dd/mm/yyyy**).

Nothing in this Certificate shall be held to relieve the UAV operator from requirements to comply with the provisions of such Canadian Aviation Documents as may have been issued pursuant to the *Aeronautics Act* or the *Canadian Aviation Regulations*.

Pursuant to Section 6.71 of the *Aeronautics Act*, this Certificate may be suspended or cancelled at any time by the Minister for cause, including failure on the part of the UAV operator, its servants or agents to comply with the provisions of the *Aeronautics Act* and the *Canadian Aviation Regulations*. This Certificate is not transferable.

Legal Name and Address of the UAV System Operator

This Certificate is issued to (*enter UAV operator name, street address, city, province, postal code, country (if not Canada)*), hereafter referred to as the UAV operator.

Validity Period of this Certificate

This Certificate is valid from **dd/mm/yyyy** until **dd/mm/yyyy** or until it is suspended or cancelled.

Type and Purpose of the Operation Authorized

This Certificate is valid for the operation of the (*enter name/model of UAV system*) for the purpose of (*enter purpose of flight operation, and if applicable, number of flights*) at (*enter geographical boundary (site, province, region, or national) where the operation is being conducted*), subject to the conditions of this Certificate.

This Certificate is issued subject to the following conditions;

Specific Conditions

- (1) The UAV shall only be operated within visual line-of-sight.
- (2) The pilot of the UAV shall give way to manned aircraft at all times.

- (3) The pilot shall only operate the UAV in visual meteorological conditions. (**Note** - *If the Inspector approves lower limits (in accordance with section 6.20(2) of this SI), this condition shall be modified to stipulate the authorized ceiling and visibility.*)
- (4) The UAV shall only be operated during the (day/night). (**Note** - *If both day and night operations are approved this condition shall be removed and additional night conditions listed at the end of this template shall be inserted.*)
- (5) Operations within Class F Restricted airspace dedicated for UAV testing and development are prohibited under this Certificate.
- (6) Operations in restricted or Class F Restricted airspace are prohibited unless specifically authorized under this Certificate. (**Note** – *Inspectors will be required to add the appropriate conditions to ensure safe operations are conducted in any such airspace.*)
- (7) Operations within Class A and Class B airspace are prohibited.
- (8) The UAV operator shall coordinate with the air traffic services unit responsible for supplying air traffic services for the area of operation well in advance of proposed operations. The validity of this Certificate is contingent upon such coordination.
- (9) The UAV operator shall, prior to commencing operations at each new operating location, conduct a site survey in accordance with the procedures outlined in the Certificate application.
- (10) The UAV shall not be operated in any special aviation event requiring an SFOC under Part VI, Subpart 3, Division 1 of the *Canadian Aviation Regulations*.

General Operating Conditions

- (11) A copy of this Certificate shall be on site any time the UAV is in operation.
- (12) The UAV operator shall notify this office within 10 working days after:
 - (a) changing its legal name, trade name, main base, any contact information, and
 - (b) ceasing to operate models of UAV systems authorized under this Certificate.
- (13) The UAV operator shall not require any pilot to operate the controls of the UAV if either the pilot or the UAV operator 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.
- (14) 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.
- (15) Every crewmember engaged in the operation of the UAV system shall, during flight time, comply with the instructions of the pilot-in-command.
- (16) Only one UAV shall be operated in-flight by a single pilot at any one time.
- (17) No pilot shall operate the UAV unless it is operated in accordance with the operating limitations as set out in the UAV system flight manual.
- (18) The UAV operator shall not permit the use of a portable electronic device at the control station of a UAV system where the device may impair the functioning of the systems or equipment.
- (19) No pilot shall create a hazard to persons or property on the surface by dropping an object from the UAV in flight.
- (20) The UAV operator shall not operate the UAV system, where visual observers are used as part of the sense and avoid function unless reliable communication is established and maintained between the visual observer and the pilot and standard operating procedures are followed.

- (21) The UAV operator shall ensure that visual observers perform observation duties for only one (1) UAV.
- (22) The UAV operator shall not permit visual observer functions to be performed from a moving surface vehicle.
- (23) Prior to conducting flight, the pilot shall ensure that the UAV System is in an airworthy condition.
- (24) The UAV operator 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.
- (25) The UAV shall not be equipped with an ELT.
- (26) No pilot shall conduct a take-off/launch of the UAV unless there is a means of:
 - (a) Controlling the flight of the UAV;
 - (b) Monitoring the UAV system;
 - (c) Navigating;
 - (d) Communication, as required by the class of airspace or regulation;
 - (e) Detecting hazardous environmental flight conditions;
 - (f) Mitigating the risk of loss of control of the UAV trajectory, where applicable;
 - (g) Sensing and avoiding other aircraft;
 - (h) Avoiding flight into obstacles and terrain;
 - (i) Aircraft lighting or illumination, for operations between sunset and sunrise, sufficient to maintain safe visual line-of-sight operations; and
 - (j) Remaining clear of cloud to the distance required for the airspace and operation.
- (27) The UAV operator shall ensure that the UAV is not flown if it has been subjected to any abnormal occurrence unless it has been inspected for damage.
- (28) The UAV operator shall keep a technical record for the UAV system.
- (29) The UAV operator shall maintain records of their flight operations to include the following information:
 - (a) Location, date, times, crew, and aircraft type for each flight;
 - (b) Flight hours accumulated per aircraft; and
 - (c) Pilot(s) flight hours per day, month and year.
- (30) The UAV operator shall maintain the records identified in the condition above for a period of time equal to the validity period of this Certificate plus one (1) year beyond the expiry date.
- (31) The UAV operator shall have subscribed for adequate liability insurance covering risks of public liability at the levels described in subsection 606.02(8) of the *Canadian Aviation Regulations*.
- (32) The UAV operator shall adhere to the security plan in accordance with the information provided in the SFOC application.
- (33) The UAV operator shall conduct flight operations in accordance with its operations manual.

- (34) The UAV operator shall maintain an adequate organizational structure.
- (35) The UAV operator shall employ managerial personnel in accordance with the SFOC application.
- (36) The UAV operator shall conduct training in accordance with its training program.
- (37) The UAV operator shall maintain UAV systems that are properly equipped for the area of operation and the type of operation.
- (38) The UAV operator shall employ crew members who are qualified for the area of operation and the type of operation.
- (39) The UAV operator shall conduct a safe operation.
- (40) The UAV operator is responsible for obtaining permission from the owner(s) of the property on which the UAV intends to take-off from and/or land on.
- (41) Any NOTAM requirement for operations under this Certificate shall be determined by Transport Canada prior to issuance.

General Flight Conditions

- (42) 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.
- (43) No pilot shall conduct a take-off/launch of the UAV that has frost, ice or snow adhering to any of its critical surfaces.
- (44) No pilot shall conduct a take-off/launch of the UAV if explosive, corrosive or bio-hazard payloads are carried onboard. (**Note** – See Section 9.7(2)(d)(iv)(A) of this SI for further clarification).
- (45) 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 manoeuvres or flight termination shall be initiated.
- (46) The pilot shall confirm that no unacceptable radio frequency interference is present prior to flight, nor is likely to be present during flight.
- (47) No pilot shall conduct the take-off/launch of the UAV unless the UAV system flight manual is immediately available to the flight crew members at their duty stations.
- (48) The pilot-in-command of the UAV shall, before commencing a flight, be familiar with the available information that is appropriate to the intended flight.
- (49) No pilot shall operate the UAV in known or forecast icing conditions. **OR** No pilot shall operate the UAV in known or forecast icing conditions unless the flight is planned and conducted such that persons or property on the ground and other airspace users are not endangered. (**Note:** *Inspectors shall select the appropriate condition based on the information provided in the SFOC application*).
- (50) The pilot, if being provided Air Traffic Control instructions or clearances, shall comply with section 602.31 of the *Canadian Aviation Regulations*.
- (51) No pilot shall enter transponder airspace without the UAV being equipped with a transponder and automatic pressure-altitude reporting equipment, unless authorization has been received from the applicable air traffic control unit.
- (52) The UAV pilot-in-command, before commencing the flight, shall provide the air traffic service unit (s) affected by the flight operation with the same information that would be required if the pilot was filing an ICAO (International Civil Aviation Organization) Flight Plan.

- (53) Where the UAV is operated at or in the vicinity of an aerodrome, the pilot shall ensure that the UAV is flown in a manner so as to remain clear of the take-off, approach and landing routes and the pattern of traffic formed by manned aircraft operating at the aerodrome.
- (54) The pilot shall, if operating in the vicinity of an uncontrolled aerodrome, comply with sections 602.97 through 602.101 of the *Canadian Aviation Regulations*.
- (55) Whenever two-way radio communications is required, the pilot shall ensure that the appropriate frequency is continuously monitored throughout the duration of the flight.
- (56) 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.
- (57) 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.
- (58) 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.
- (59) No pilot shall operate the UAV over a built-up area or over an open-air assembly of persons unless the UAV is operated at an altitude from which, in the event of an engine failure or any other emergency necessitating an immediate landing/recovery, the UAV can land without creating a hazard to persons or property.
- (60) The pilot or visual observer(s) must maintain continuous unaided visual contact with the UAV sufficient to be able to maintain operational control of the aircraft, know its location and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.
- (61) No pilot shall operate the UAV over a forest fire area, or over any area that is located within five nautical miles of a forest fire area (**Note** - *Inspector shall remove this condition if the purpose of the operation is to support operations within forest fire areas*).

Personnel Conditions

- (62) The UAV operator shall ensure that all pilots, visual observers, maintainers, payload operators are a minimum of 18 years of age.
- (63) No pilot shall operate the UAV unless they maintain the medical fitness requirements for a Category 4 Self Declaration, Category 4 Medical Certificate or higher.
- (64) All persons connected with this operation shall be familiar with the contents of this Certificate.

UAV System Conditions

- (65) The UAV operator shall ensure that all maintenance, servicing and disassembly-assembly of the UAV and associated components are performed in accordance with procedures described in the SFOC application, and at a minimum, the manufacturer's specifications and schedule.
- (66) The UAV operator shall ensure that the maintenance of avionics components, other than removal and installation, is performed by an Aircraft Maintenance Organization or other qualified organization.
- (67) The UAV operator shall ensure that the requirements of any airworthiness directives, or equivalent, issued by the manufacturer have been completed.

- (68) The UAV operator shall ensure that any modifications to the UAV system are carried out in accordance with the manufacturer's instructions and that no unapproved modifications are carried out.
- (69) The UAV operator shall have and maintain a current UAV system flight manual and maintenance manual.
- (70) The UAV operator shall ensure that all UAV system equipment required for safe flight operations is serviceable.

Incident/Accident Reporting

- (71) The UAV operator shall report to this office, as soon as possible, details of any of the following aviation occurrences during the operation of the UAV:
 - a) Injuries to any person requiring medical attention;
 - b) Unintended contact between the UAV and persons, livestock, vehicles, vessels or other structures;
 - c) Unanticipated damage incurred to the airframe, control station, payload or command and control links that adversely affects the performance or flight characteristics of the UAV;
 - d) Anytime the UAV is not kept within the geographic boundaries and/or altitude limits as outlined in this Certificate;
 - e) Any collision or risk of collision with another aircraft;
 - f) Anytime the UAV becomes uncontrollable, experiences a fly-away or is missing; and
 - g) Any other incident that results in a Canadian Aviation Daily Occurrence Report (CADORS).
- (72) The UAV operator shall not operate the UAV following any of the aviation occurrences listed in the condition above, until such time as this office approves its further operation. Any such approval for resumption of operations shall be documented.

Yours truly,

Signature

Signature Block
for Minister of Transport, Infrastructure and Communities

Special Operational Conditions

Note:

The following additional operational conditions may not be appropriate for all operations, therefore, Inspectors will need to import the applicable conditions into the above template. Where titles have been underlined, a new section should be incorporated into the SFOC using the underlined title. Where the titles have not been underlined the conditions should be added into General Flight Conditions Section of the SFOC.

Condition for First Person View Devices

- (1) No pilot shall use a first person view device, unless accompanied by a visual observer who is providing the sense and avoid function.

Conditions for Night VFR Flights

- (1) Where the UAV is equipped with lights, the UAV pilot shall ensure that they are on at all times during night operations.
- (2) Where the UAV is not equipped with lights, the UAV pilot must ensure that there is a means of illumination during night operations, sufficient to maintain visual contact with the UAV.
- (3) A suitable portable emergency light source shall be available to the crew members when the aircraft is operated at night.
- (4) The pilot operating the UAV at night must not suffer from the visual limitations of depth perception, colour blindness or lack of visual acuity in low light conditions.
- (5) Visual observers providing the sense and avoid function during night operations are prohibited from using night vision goggles.

Conditions for Operations in Class F Restricted Airspace:

NOTE TO INSPECTORS: Operations within Class F Restricted airspace dedicated for UAV testing and development will require additional conditions to ensure safe operations. At the time of publishing these were not available and will be implemented through an Internal Process Bulletin (IPB) to this SI.

Class F Restricted (Military) Conditions

NOTE TO INSPECTORS: Only when an application indicates that the UAV operator proposes to operate in Class F Restricted Military airspace, and the coordination has been completed in accordance with section 6.11 of this SI, will these conditions be added to the SFOC.

- (1) The UAV operator shall obtain written authorization from Range Control and/or the Base/Wing Commander prior to conducting operations.
- (2) All operations will be conducted in accordance with range safety rules and restrictions unless they are repugnant with the conditions in this Certificate.
- (3) Where operations in Class F airspace intend to operate overhead a Canadian military establishment, the UAV operator shall obtain written permission from the Department of National Defence prior to commencing operations.
- (4) The UAV operator shall not commence operations within the restricted airspace unless they are in possession of a 1 Canadian Air Division letter of endorsement.

Class F Restricted (General) Condition

- (1) The UAV operator shall obtain approval from the User agency, responsible for the Class F Restricted airspace in which operations are to be conducted, prior to commencing operations.

**Conditions for Restricted Airspace Established under Section 5.1 of the *Aeronautics Act* or
Section 601.16 of the CARs.**

Note:

Inspectors may need to include additional conditions based on the proposed operation in the restricted airspace.

APPENDIX H - SFOC TEMPLATE FOR COMPLEX UAV OPERATOR

TC Logo

SPECIAL FLIGHT OPERATIONS CERTIFICATE

Certificate Number

File Number

Pursuant to section 603.67 of the *Canadian Aviation Regulations*, this constitutes your Special Flight Operations Certificate (SFOC), for the operation of an unmanned air vehicle (UAV) system, issued under the authority of the Minister pursuant to the *Aeronautics Act*.

Approval of this Certificate is based on the information provided in your SFOC application (dated **dd/mm/yyyy**) and any accompanying documentation (**dated dd/mm/yyyy**).

Nothing in this Certificate shall be held to relieve the UAV operator from requirements to comply with the provisions of such Canadian Aviation Documents as may have been issued pursuant to the *Aeronautics Act* or the *Canadian Aviation Regulations*.

Pursuant to Section 6.71 of the *Aeronautics Act*, this Certificate may be suspended or cancelled at any time by the Minister for cause, including failure on the part of the UAV operator, its servants or agents to comply with the provisions of the *Aeronautics Act* and the *Canadian Aviation Regulations*. This Certificate is not transferable.

Legal Name and Address of the UAV System Operator

This Certificate is issued to (*enter UAV operator name, street address, city, province, postal code, country (if not Canada)*), hereafter referred to as the UAV operator.

Validity Period of this Certificate

This Certificate is valid from **dd/mm/yyyy** until **dd/mm/yyyy** or until it is suspended or cancelled.

Type and Purpose of the Operation Authorized

This Certificate is valid for the operation of the (*enter name/model of UAV system*) for the purpose of (*enter purpose of flight operation, and if applicable, number of flights*) at (*enter geographical boundary (site, province, region, or national) where the operation is being conducted*), subject to the conditions of this Certificate.

This Certificate is issued subject to the following conditions;

NOTE TO INSPECTORS - *The sample conditions below specifically apply to a small UAV operated within visual line-of-sight. Sample conditions to be considered for all other operations (e.g. beyond visual line-of-sight operations, participation in air shows, standing SFOCs, operations in Class F Restricted airspace dedicated to UAV research and development, UAVs above 25kg, IFR operations, etc.) can be found at*

the end of this template. These may be additional or replacement conditions to those provided below. Furthermore, conditions that are not applicable will need to be removed (e.g. conditions for airspace in which the UAV is not operating, etc).

Specific Conditions

- (1) The UAV shall only be operated within visual line-of-sight.
- (2) The pilot of the UAV shall give way to manned aircraft at all times.
- (3) The pilot shall only operate the UAV in visual meteorological conditions. (**Note** - If the Inspector approves lower limits (in accordance with section 6.20(2) of this SI), this condition shall be modified to stipulate the authorized ceiling and visibility.
- (4) The UAV shall only be operated during the (day/night). (**Note** - If both day and night operations are approved this condition shall be removed and additional night conditions listed at the end of this template shall be inserted).
- (5) Operations within Class F Restricted airspace dedicated for UAV testing and development are prohibited under this Certificate.
- (6) Operations in restricted or Class F Restricted airspace are prohibited unless specifically authorized under this certificate. (**Note** – Inspectors will be required to add the appropriate conditions to ensure safe operations are conducted in any such airspace).
- (7) Operations within Class A and Class B airspace are prohibited.
- (8) No pilot shall operate the UAV above 400 feet above ground level (AGL). (**Note** - This shall be considered the standard altitude limit, however, Inspectors may need to specify a different limit.)
- (9) The UAV operator shall coordinate with the air traffic services unit responsible for supplying air traffic services for the area of operation well in advance of proposed operations. The validity of this Certificate is contingent upon such coordination.
- (10) The UAV operator shall conduct a site survey in accordance with the procedures outlined in the SFOC application prior to commencing operations at each location.
- (11) The UAV shall not be operated in any special aviation event requiring an SFOC under Part VI, Subpart 3, Division 1 of the *Canadian Aviation Regulations*.

General Operating Conditions

- (12) A copy of this Certificate shall be on site any time the UAV is in operation.
- (13) The UAV operator shall notify this office within 10 working days after:
 - (a) changing its legal name, trade name, main base, any contact information, and
 - (b) ceasing to operate models of UAV systems authorized under this Certificate.
- (14) The UAV operator shall not require any pilot to operate the controls of the UAV if either the pilot or the UAV operator 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.
- (15) 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.
- (16) Every crewmember engaged in the operation of the UAV system shall, during flight time, comply with the instructions of the pilot-in-command.
- (17) Only one UAV shall be operated in-flight by a single pilot at any one time.

- (18) No pilot shall operate the UAV unless it is operated in accordance with the operating limitations specified in the SFOC application.
- (19) The UAV operator shall not permit the use of a portable electronic device at the control station of a UAV system where the device may impair the functioning of the systems or equipment.
- (20) No pilot shall create a hazard to persons or property on the surface by dropping an object from the UAV in flight.
- (21) The UAV operator shall not operate the UAV system, where visual observers are used as part of the sense and avoid function unless reliable communication is established and maintained between the visual observer and the pilot and standard operating procedures are followed.
- (22) The UAV operator shall ensure that visual observers perform observation duties for only one UAV.
- (23) The UAV operator shall not permit visual observer functions to be performed from a moving surface vehicle.
- (24) Prior to conducting flight, the pilot shall ensure that the UAV System is in an airworthy condition.
- (25) The UAV operator 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 limitations specified in the SFOC application or UAV system flight manual; and
 - (b) a hand-held fire extinguisher of a type suitable for extinguishing fires that are likely to occur.
- (26) The UAV shall not be equipped with an ELT.
- (27) No pilot shall conduct a take-off/launch of the UAV unless there is a means of:
 - (a) Controlling the flight of the UAV;
 - (b) Monitoring the UAV system;
 - (c) Navigating;
 - (d) Communication, as required by the Class of airspace or regulation;
 - (e) Detecting hazardous environmental flight conditions;
 - (f) Mitigating the risk of loss of control of the UAV trajectory, where applicable;
 - (g) Sensing and avoiding other aircraft;
 - (h) Avoiding flight into obstacles and terrain;
 - (i) Aircraft lighting or illumination, for operations between sunset and sunrise, sufficient to maintain safe visual line-of-sight operations; and
 - (j) Remaining clear of cloud to the distance required for the airspace and operation.
- (28) The UAV operator shall ensure that the UAV is not flown if it has been subjected to any abnormal occurrence unless it has been inspected for damage.
- (29) The UAV operator shall maintain records of their flight operations to include the following information:
 - (a) Location, date, times, crew, and aircraft type for each flight;
 - (b) Flight hours accumulated per aircraft; and
 - (c) Pilot(s) flight hours per day, month and year.

- (30) The UAV operator shall maintain the records identified in the condition above for a period of time equal to the validity period of this Certificate plus one (1) year beyond the expiry date.
- (31) The UAV operator shall have subscribed for adequate liability insurance covering risks of public liability at the appropriate level, as described in section 606.02 of the *Canadian Aviation Regulations*.
- (32) The UAV operator shall adhere to the security plan in accordance with the information provided in the SFOC application.
- (33) The UAV operator shall adhere to the emergency contingency plan in accordance with the information provided in the SFOC application.
- (34) The UAV operator shall maintain an adequate management organization that is capable of exercising supervision and operational control over persons participating in the operation.
- (35) The UAV operator shall maintain UAV systems that are properly equipped for the area of operation and the type of operation.
- (36) The UAV operator shall conduct a safe operation.
- (37) The UAV operator 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.
- (38) The UAV operator is responsible for obtaining permission from the owner(s) of the property on which the UAV intends to take-off from and/or land on.
- (39) Any NOTAM requirement for operations under this Certificate shall be determined by Transport Canada prior to issuance.

General Flight Conditions

- (40) 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.
- (41) The pilot shall follow the normal and emergency procedures in accordance with the information provided in the SFOC application.
- (42) The pilot shall follow the lost link procedures in accordance with the information provided in the SFOC application.
- (43) 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 manoeuvres or flight termination shall be initiated.
- (44) No pilot shall activate a flight termination system, if the UAV is so equipped, in such a manner as to endanger other airspace users or persons or property on the ground.
- (45) No pilot shall conduct a take-off/launch of the UAV that has frost, ice or snow adhering to the any of its critical surfaces.
- (46) No pilot shall conduct a take-off/launch of the UAV if explosive, corrosive or bio-hazard payloads are carried onboard.
- (47) The pilot shall confirm that no unacceptable radio frequency interference is present prior to flight, nor is likely to be present during flight.
- (48) The pilot-in-command of the UAV shall be familiar with the available information that is appropriate to the intended flight, before commencing a flight.
- (49) No pilot shall operate the UAV in known or forecast icing conditions.

- (50) The pilot, if being provided Air Traffic Control instructions or clearances, shall comply with section 602.31 of the *Canadian Aviation Regulations*.
- (51) No pilot shall enter transponder airspace without the UAV being equipped with a transponder and automatic pressure-altitude reporting equipment, unless authorization has been received from the applicable air traffic control unit.
- (52) The pilot-in-command shall provide the air traffic service unit (s) affected by the flight operation with the same information that would be required if the pilot was filing an ICAO (International Civil Aviation Organization) Flight Plan, before commencing a flight.
- (53) Where the UAV is operated at or in the vicinity of an aerodrome, the pilot shall ensure that the UAV is flown in a manner so as to remain clear of the take-off, approach and landing routes and the pattern of traffic formed by manned aircraft operating at the aerodrome.
- (54) The pilot shall comply with sections 602.97 through 602.101 of the *Canadian Aviation Regulations* if operating in the vicinity of an uncontrolled aerodrome.
- (55) The pilot shall ensure that the appropriate frequency is continuously monitored throughout the duration of the flight, whenever two-way radio communications is required.
- (56) 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.
- (57) 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.
- (58) 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.
- (59) No pilot shall operate the UAV over a built-up area or over an open-air assembly of persons.
- (60) The pilot or visual observer(s) must maintain continuous unaided visual contact with the UAV sufficient to be able to maintain operational control of the aircraft, know its location and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.
- (61) No pilot shall operate the UAV over a forest fire area, or over any area that is located within five nautical miles of a forest fire area (**Note** - *Inspector shall remove this condition if the purpose of the operation is to support operations within forest fire areas*).

Personnel Conditions

- (62) The UAV operator shall ensure that all personnel are appropriately trained and qualified for the area of operation and the type of operation.
- (63) The UAV operator shall ensure that all pilots, visual observers, maintainers, payload operators are a minimum of 18 years of age.
- (64) No pilot shall operate the UAV unless they are medically fit to conduct their required duties.
- (65) All persons connected with this operation shall be familiar with the contents of this Certificate.

UAV System Conditions

- (66) The UAV operator shall ensure that all maintenance, servicing and disassembly-assembly of the UAV and associated components are performed in accordance with procedures described in the SFOC application.

- (67) The UAV operator shall ensure that the requirements of any airworthiness directives, or equivalent, issued by the manufacturer have been completed.
- (68) The UAV operator shall ensure that all UAV system equipment required for safe flight operations is serviceable.

Incident/Accident Reporting

- (69) The UAV operator shall report to this office, as soon as possible, details of any of the following aviation occurrences during the operation of the UAV:
 - a) Injuries to any person requiring medical attention;
 - b) Unintended contact between the UAV and persons, livestock, vehicles, vessels or other structures;
 - c) Unanticipated damage incurred to the airframe, control station, payload or command and control links that adversely affects the performance or flight characteristics of the UAV;
 - d) Anytime the UAV is not kept within the geographic boundaries and/or altitude limits as outlined in this Certificate;
 - e) Any collision or risk of collision with another aircraft;
 - f) Anytime the UAV becomes uncontrollable, experiences a fly-away or is missing; and
 - g) Any other incident that results in a Canadian Aviation Daily Occurrence Report (CADORS).
- (70) The UAV operator shall not operate the UAV following any of the aviation occurrences listed in the condition above, until such time as this office approves its further operation. Any such approval for resumption of operations shall be documented.

Yours truly,

Signature

Signature Block
for Minister of Transport, Infrastructure and Communities

Additional Operational Conditions

NOTE TO INSPECTORS: *The following additional conditions will not be appropriate to all operations, therefore, Inspectors will need to import the applicable conditions into the appropriate section of the above template and delete and/or replace any conditions in the above template that are not applicable. Additionally, depending on the nature of the operation, Inspectors may need to add conditions not addressed herein.*

Condition for First Person View Devices:

- (1) No pilot shall use a first person view device, unless accompanied by a visual observer who is providing the sense and avoid function.

Conditions for Night VFR Flights:

- (1) Where the UAV is equipped with lights, the UAV pilot shall ensure that they are on at all times during night operations.
- (2) Where the UAV is not equipped with lights, the UAV pilot must ensure that there is a means of illumination during night operations, sufficient to maintain visual contact with the UAV.
- (3) A suitable portable emergency light source shall be available to the crew members when the aircraft is operated at night.
- (4) The pilot operating the UAV at night must not suffer from the visual limitations of depth perception, colour blindness or lack of visual acuity in low light conditions.
- (5) Visual observers providing the sense and avoid function during night operations are prohibited from using night vision goggles.

Conditions for Beyond Visual Line-of-Sight Operations for Small UAVs:

NOTE TO INSPECTORS: *In accordance with section 6.2 (2)(b) of this SI, Inspectors may remove condition (1) below if the Certificate applicant can provide sufficient risk mitigation measures (e.g. ground-based radar).*

- (1) The pilot shall not operate the UAV beyond visual line-of-sight outside restricted airspace.
- (2) The UAV operator shall ensure that beyond visual line-of-sight operation is conducted over non-populated areas.
- (3) The pilot shall ensure that the UAV is operated in visual meteorological conditions along the entire route of flight.
- (4) The pilot shall not operate the UAV beyond visual line-of-sight within controlled airspace.
- (5) The UAV operator shall only conduct beyond visual line-of-sight operations within five (5) nm of the point of departure.
- (6) The pilot shall conduct the take-off/launch and landing/recovery under visual line-of-sight.
- (7) The UAV operator shall, when conducting the site survey, ensure that direct radio line-of-sight capability will be maintained throughout the operating area.

Conditions for Ground-Based Radar:

- (1) The UAV operator shall only use a ground based radar capability, to support the sense and avoid function, within Class G airspace outside 5 nm from the centre of any aerodrome.
- (2) The pilot shall ensure that the UAV, while operating beyond visual line-of-sight, remains a minimum of three (3) nm away from all aircraft.
- (3) The pilot shall land as soon as possible upon the ground based radar capability becoming unserviceable.
- (4) The UAV operator shall ensure that the ground based radar system provides horizontal and vertical coverage of the entire operating area.
- (5) The UAV operator shall ensure all applicable personnel are trained in the operation and use of the ground based radar system.

Note:

Inspectors may need to include additional conditions based on the proposed operation of the ground-based radar system.

Conditions for Large UAV Systems (Comparable in size to manned aircraft)

- (1) The pilot of the UAV shall comply with the right of way rules in Section 602.19 of the *Canadian Aviation Regulations*.
- (2) The UAV operator shall keep a technical record for the UAV system.
- (3) The UAV operator shall conduct flight operations in accordance with its operations manual.
- (4) No pilot shall conduct the take-off/launch of the UAV unless the UAV system flight manual is immediately available to the flight crew members at their duty stations.
- (5) No pilot shall operate the UAV over a built-up area or over an open-air assembly of persons unless the UAV is operated at an altitude from which, in the event of an engine failure or any other emergency necessitating an immediate landing/recovery, the UAV can land without creating a hazard to persons or property
- (6) The UAV operator shall ensure that all maintenance, servicing and disassembly-assembly of the UAV and associated components are performed in accordance with procedures described in the SFOC application, and at a minimum, the manufacturer's specifications and schedule.
- (7) The UAV operator shall ensure that the maintenance is performed by an AMO or other qualified organization.
- (8) The UAV operator shall ensure that the requirements of any airworthiness directives, or equivalent, issued by the manufacturer have been completed.
- (9) The UAV operator shall ensure that any modifications to the UAV system are carried out in accordance with the manufacturer's instructions and that no unapproved modifications are carried out.
- (10) The UAV operator shall have and maintain a current UAV system flight manual and maintenance manual.
- (11) The UAV operator shall ensure that all UAV system equipment required for safe flight operations is serviceable.
- (12) No pilot shall operate the UAV above **XXX** feet above ground level (AGL). (**Note** – *Inspectors shall enter the authorized maximum altitude.*)
- (13) No pilot shall operate the UAV in known or forecast icing conditions. **OR** No pilot shall conduct a take-off/launch or continue a flight of a UAV where icing conditions are reported to exist or are forecast to be encountered along the route of flight unless the pilot determines that the aircraft is adequately equipped to operate in those icing conditions. (**Note:** *Inspectors shall select the appropriate condition based on the information provided in the SFOC application and section 6.20(3) of this SI.*)
- (14) No pilot shall operate the TCAS/ACAS in the Resolution Advisory (RA) mode.

Conditions for IFR Flight:

NOTE TO INSPECTORS: *Inspectors need to assess the UAV operator's ability and the UAV system's capability to safely conduct IFR operations based on the information provided in the*

SFOC application. The following sample conditions shall be imposed once such an assessment has been made. Inspectors should add additional conditions as warranted.

- (1) The pilot shall be qualified, current and licensed with a valid instrument rating.
- (2) The UAV operator shall ensure that the mandatory Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) equipment required for the airspace in which it intends to operate, is installed and functional.
- (3) The UAV operator shall not operate the UAV unless the applicable navigation database and/or charts are current and immediately available to the pilot.
- (4) The pilot shall file an IFR flight plan in accordance with section 602.73 of the *Canadian Aviation Regulations*.
- (5) No pilot shall operate the UAV under IFR unless an ATS Unit clearance has been received and acknowledged.
- (6) The pilot shall ensure direct two-way radio communication with the applicable ATS Unit(s) is established and maintained.
- (7) The pilot shall ensure that back-up communication capabilities with the ATS Unit, for the purpose of lost link and/or lost communication, are established and operational during all phases of flight.
- (8) The pilot shall ensure that the UAV is equipped with an operational mode 3/C transponder, with altitude encoding, set to the Air Traffic Control (ATC) assigned squawk code.
- (9) The pilot shall check all NOTAM and Receiver Autonomous Integrity Monitoring (RAIM) when GPS is used as a sole source navigation solution,
- (10) Flight into GPS test areas or areas with degraded RAIM (applicable to the phase of flight) is prohibited.
- (11) Sterile cockpit procedures must be observed during all critical phases of flight.
- (12) The UAV pilot shall follow the lost link/lost communications procedures in accordance with the information provided in the SFOC application.

Conditions for Operations in Class F Restricted Airspace:

NOTE TO INSPECTORS: *Operations within Class F Restricted airspace dedicated for UAV testing and development requires additional conditions to ensure safe operations. These will be implemented at a later date.*

- (13) The UAV operator shall obtain approval from the User agency, responsible for the Class F Restricted airspace in which operations are to be conducted, prior to commencing operations.

Conditions for Restricted Airspace Established under Section 5.1 of the *Aeronautics Act* or Section 601.16 of the CARs.

Note:

Inspectors may need to include additional conditions based on the proposed operation in the restricted airspace.

Class F Restricted (Military) Conditions

NOTE TO INSPECTORS: *Only when an application indicates that the UAV operator proposes to operate in Class F Restricted (Military) airspace, and the coordination has been completed in accordance with section 6.11 of this SI, will these conditions be added to the SFOC.*

- (1) The UAV operator shall obtain written authorization from Range Control and/or the Base/Wing Commander prior to conducting operations.
- (2) All operations will be conducted in accordance with range safety rules and restrictions unless they are repugnant with the conditions in this Certificate.
- (3) Where operations in Class F Restricted airspace intend to operate overhead a Canadian military establishment, the UAV operator shall obtain written permission from the Department of National Defence prior to commencing operations.
- (4) The UAV operator shall not commence operations within the restricted airspace unless they are in possession of a 1 Canadian Air Division letter of endorsement.

Class F Restricted (General) Condition

- (5) The UAV operator shall obtain approval from the User agency, responsible for the Class F Restricted airspace in which operations are to be conducted, prior to commencing operations.

Conditions for Restricted Airspace Established under Section 5.1 of the *Aeronautics Act* or Section 601.16 of the CARs.

NOTE TO INSPECTORS:

Inspectors may need to include additional conditions based on the proposed operation in the restricted airspace.

Conditions for Aerial Demonstrations/Air Shows:

NOTE TO INSPECTORS: *UAV participation at air shows requires a dedicated SFOC. Inspectors shall use the core template above as the starting point, remove any conditions that are not applicable and then, add the following conditions:*

- (1) The pilot shall follow the lost link procedures that have been developed for the air show site.
- (2) The UAV operator shall develop and utilize a contingency plan ensuring that all defined contingency points (e.g. lost link recovery point, engine-out recovery area or ditch point) be located away from any gathering of people and structures on the ground.
- (3) The pilot shall complete a successful command and control link check and confirm that no radio frequency interference is present prior to flight, nor is likely to be present during flight.
- (4) The UAV operator shall restrict access to the UAV operating area to only those crew and personnel required for the safe operation of the UAV.

- (5) The pilot shall ensure that the UAV is not airborne while other aircraft are either airborne or on the ground within the manoeuvring or demonstration area of the UAV.
- (6) The UAV operator shall designate a dedicated visual observer whenever the UAV is airborne.
- (7) The UAV operator shall ensure reliable and timely communication is established and maintained between the UAV pilot and the visual observer.
- (8) The pilot shall comply with the conditions in the "Special Flight Operations Certificate – Special Aviation Event - Air Show" issued for the event under Section 603.02 of the *Canadian Aviation Regulations* applicable to the air show participants (e.g. attendance at safety briefings, weather limitations, communications with tower/air boss, safety rules, etc.).
- (9) The UAV operator shall provide the air show organizer with a copy of this Certificate.
- (10) The UAV operator shall ensure that all planned flight paths, mission profiles and flight trajectories are directed away from any gathering of people and structures on the ground.
- (11) The pilot is prohibited from:
 - (a) Performing aerobatic manoeuvres with the UAV; and
 - (b) Carrying pyrotechnics on the UAV or participating in pyrotechnic demonstrations or displays.
- (12) Lateral Distances
 - (a) The pilot shall operate the UAV (helicopter or other vertical lift small UAV, with protection around the rotors to minimize dispersion in the case of a failure or malfunction) at a minimum lateral distance:
 - (i) of 50 feet from any assembly of people or crowd line when operating below 50 feet AGL; **OR**
 - (ii) equal to the AGL altitude of the operation from any assembly of people or crowd line when operating between 50 and 300 feet (AGL); **OR**
 - (iii) of 300 feet from any assembly of people or crowd line when operating above 300 feet AGL, **OR**
 - (b) The pilot shall operate the UAV (small UAVs, up to 60 mph (97 Km/h), including a helicopter or other vertical lift UAV without protection around the rotors) at a minimum lateral distance of 300 feet from any assembly of people or crowd line.

APPENDIX I - SFOC TEMPLATE FOR SIMPLIFIED UAV OPERATOR

TC Logo

SPECIAL FLIGHT OPERATIONS CERTIFICATE

Certificate Number

File Number

Pursuant to section 603.67 of the *Canadian Aviation Regulations*, this constitutes your Special Flight Operations Certificate (SFOC), for the operation of a small unmanned air vehicle (UAV) system operated within visual line-of-sight, issued under the authority of the Minister pursuant to the *Aeronautics Act*.

Approval of this Certificate is based on the information provided in your SFOC application (dated **dd/mm/yyyy**) and any accompanying documentation (**dated dd/mm/yyyy**).

Nothing in this Certificate shall be held to relieve the UAV operator from requirements to comply with the provisions of such Canadian Aviation Documents as may have been issued pursuant to the *Aeronautics Act* or the *Canadian Aviation Regulations*.

Pursuant to Section 6.71 of the *Aeronautics Act*, this Certificate may be suspended or cancelled at any time by the Minister for cause, including failure on the part of the UAV operator, its servants or agents to comply with the provisions of the *Aeronautics Act* and the *Canadian Aviation Regulations*. This Certificate is not transferable.

Legal Name and Address of the UAV System Operator

This Certificate is issued to (*enter UAV operator name, street address, city, province, postal code, country (if not Canada)*), hereafter referred to as the UAV operator.

Validity Period of this Certificate

This Certificate is valid from **dd/mm/yyyy** until **dd/mm/yyyy** or until it is suspended or cancelled.

Type and Purpose of the Operation Authorized

This Certificate is valid for the operation of the (*enter name/model of UAV system*) for the purpose of (*enter purpose of flight operation, and if applicable, number of flights*) at (*enter geographical boundary (site, province, region, or national) where the operation is being conducted*), subject to the conditions of this Certificate.

This Certificate is issued subject to the following conditions:

Specific Conditions

- (1) The UAV shall only be operated within visual line-of-sight.
- (2) The pilot of the UAV shall give way to manned aircraft at all times.

- (3) The pilot shall only operate the UAV in visual meteorological conditions. (**Note** - *If the Inspector approves lower limits (in accordance with section 6.20(2) of this SI), this condition shall be modified to stipulate the authorized ceiling and visibility.*
- (4) The UAV shall only be operated during the (day/night). (**Note** - *If both day and night operations are approved, Inspectors shall remove this condition and insert additional night conditions listed at the end of this template).*
- (5) The UAV shall only be operated in Class G airspace.
- (6) Operations within Class F Restricted airspace dedicated for UAV testing and development are prohibited under this Certificate.
- (7) No pilot shall operate the UAV above 300 feet above ground level (AGL).
- (8) The UAV operator shall conduct a site survey in accordance with the procedures outlined in the SFOC application prior to commencing operations at each location.
- (9) The UAV shall not be operated in any special aviation event requiring an SFOC under Part VI, Subpart 3, Division 1 of the *Canadian Aviation Regulations*.
- (10) The UAV shall only be operated from a single control station and control relays to extend the operational area are prohibited.
- (11) The UAV shall only be operated at a maximum calibrated airspeed at full power in level flight of 87 knots or less.
- (12) The UAV shall not be operated within three (3) nm of an aerodrome.

General Operating Conditions

- (13) A copy of this Certificate shall be on site any time the UAV is in operation.
- (14) The UAV operator shall notify this office within 10 working days after:
 - (a) changing its legal name, trade name, main base, any contact information; and
 - (b) ceasing to operate models of UAV systems authorized under this Certificate.
- (15) The UAV operator shall not require any pilot to operate the controls of the UAV if either the pilot or the UAV operator 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.
- (16) 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.
- (17) Every crewmember engaged in the operation of the UAV system shall, during flight time, comply with the instructions of the pilot-in-command.
- (18) Only one UAV shall be operated in-flight by a single pilot at any one time.
- (19) No pilot shall operate the UAV unless it is operated in accordance with the operating limitations specified in the SFOC application.
- (20) The UAV operator shall not permit the use of a portable electronic device at the control station of a UAV system where the device may impair the functioning of the systems or equipment.
- (21) The UAV operator shall not operate the UAV system, where visual observers are used as part of the sense and avoid function unless reliable communication is established and maintained between the visual observer and the pilot and standard operating procedures are followed.
- (22) The UAV operator shall ensure that visual observers perform observation duties for only one UAV.

- (23) The UAV operator shall not permit visual observer functions to be performed from a moving surface vehicle.
- (24) Prior to conducting flight, the pilot shall ensure that the UAV System is in an airworthy condition.
- (25) The UAV operator 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 limitations specified in the SFOC application or UAV system flight manual; and
 - (b) a hand-held fire extinguisher of a type suitable for extinguishing fires that are likely to occur.
- (26) The UAV shall not be equipped with an ELT.
- (27) No pilot shall conduct a take-off/launch of the UAV unless there is a means of:
 - (a) Controlling the flight of the UAV;
 - (b) Monitoring the UAV system;
 - (c) Navigating;
 - (d) Communication, as required by the Class of airspace or regulation;
 - (e) Detecting hazardous environmental flight conditions;
 - (f) Mitigating the risk of loss of control of the UAV trajectory, where applicable;
 - (g) Sensing and avoiding other aircraft;
 - (h) Avoiding flight into obstacles and terrain;
 - (i) Aircraft lighting or illumination, for operations between sunset and sunrise, sufficient to maintain safe visual line-of-sight operations; and
 - (j) Remaining clear of cloud to the distance required for the airspace and operation.
- (28) The UAV operator shall ensure that the UAV is not flown if it has been subjected to any abnormal occurrence unless it has been inspected for damage.
- (29) The UAV operator shall maintain records of their flight operations to include the following information:
 - (a) Location, date, times, crew, and aircraft type for each flight;
 - (b) Flight hours accumulated per aircraft; and
 - (c) Pilot(s) flight hours per day, month and year.
- (30) The UAV operator shall maintain the records identified in the condition above for a period of time equal to the validity period of this Certificate plus one (1) year beyond the expiry date.
- (31) The UAV operator shall have subscribed for adequate liability insurance covering risks of public liability at the levels described in subsection 606.02(8) of the *Canadian Aviation Regulations*.
- (32) The UAV operator shall adhere to the security plan in accordance with the information provided in the SFOC application.
- (33) The UAV operator shall adhere to the emergency contingency plan in accordance with the information provided in the SFOC application.
- (34) The UAV operator shall maintain an adequate management organization that is capable of exercising supervision and operational control over persons participating in the operation.

- (35) The UAV operator shall maintain UAV systems that are properly equipped for the area of operation and the type of operation.
- (36) The UAV operator shall conduct a safe operation.
- (37) The UAV operator 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.
- (38) The UAV operator is responsible for obtaining permission from the owner(s) of the property on which the UAV intends to take-off from and/or land on.
- (39) Any NOTAM requirement for operations under this Certificate shall be determined by Transport Canada prior to issuance.

General Flight Conditions

- (40) 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.
- (41) The pilot shall follow the normal and emergency procedures in accordance with the information provided in the SFOC application.
- (42) The pilot shall follow the lost link procedures in accordance with the information provided in the SFOC application.
- (43) 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 manoeuvres or flight termination shall be initiated.
- (44) No pilot shall activate a flight termination system, if the UAV is so equipped, in such a manner as to endanger other airspace users or persons or property on the ground.
- (45) No pilot shall conduct a take-off/launch of the UAV that has frost, ice or snow adhering to any of its critical surfaces.
- (46) No pilot shall conduct a take-off/launch of the UAV if explosive, corrosive or bio-hazard payloads are carried onboard or any payloads that can be jettisoned, dispersed or dropped.
- (47) The pilot shall confirm that no unacceptable radio frequency interference is present prior to flight, nor is likely to be present during flight.
- (48) The pilot-in-command of the UAV shall be familiar with the available information that is appropriate to the intended flight, before commencing a flight.
- (49) No pilot shall operate the UAV in known or forecast icing conditions.
- (50) Where the UAV is operated in the vicinity of an aerodrome, the pilot shall ensure that the UAV is flown in a manner so as to remain clear of the take-off, approach and landing routes and the pattern of traffic formed by manned aircraft operating at the aerodrome.
- (51) The pilot shall comply with sections 602.97 through 602.101 of the *Canadian Aviation Regulations* if operating in the vicinity of an uncontrolled aerodrome.
- (52) The pilot shall ensure that the appropriate frequency is continuously monitored throughout the duration of the flight, whenever two-way radio communications is required.
- (53) 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.
- (54) 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.
- (55) 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.
- (56) No pilot shall operate the UAV over a built-up area or over an open-air assembly of persons.
- (57) The pilot or visual observer(s) must maintain continuous unaided visual contact with the UAV sufficient to be able to maintain operational control of the aircraft, know its location and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.
- (58) No pilot shall operate the UAV over a forest fire area, or over any area that is located within five nautical miles of a forest fire area (**Note** - *Inspector shall remove this condition if the purpose of the operation is to support operations within forest fire areas*).

Personnel Conditions

- (59) The UAV operator shall ensure that all personnel are appropriately trained and qualified for the area of operation and the type of operation.
- (60) The UAV operator shall ensure that all pilots, visual observers, maintainers, payload operators are a minimum of 18 years of age.
- (61) No pilot shall operate the UAV unless they are medically fit to conduct their required duties.
- (62) All persons connected with this operation shall be familiar with the contents of this Certificate.

UAV System Conditions

- (63) The UAV operator shall ensure that all maintenance, servicing and disassembly-assembly of the UAV and associated components are performed in accordance with procedures described in the SFOC application.
- (64) The UAV operator shall ensure that the requirements of any airworthiness directives, or equivalent, issued by the manufacturer have been completed.
- (65) The UAV operator shall ensure that all UAV system equipment required for safe flight operations is serviceable.

Incident/Accident Reporting

- (66) The UAV operator shall report to this office, as soon as possible, details of any of the following aviation occurrences during the operation of the UAV:
 - a) Injuries to any person requiring medical attention;
 - b) Unintended contact between the UAV and persons, livestock, vehicles, vessels or other structures;
 - c) Unanticipated damage incurred to the airframe, control station, payload or command and control links that adversely affects the performance or flight characteristics of the UAV;
 - d) Anytime the UAV is not kept within the geographic boundaries and/or altitude limits as outlined in this Certificate;
 - e) Any collision or risk of collision with another aircraft;
 - f) Anytime the UAV becomes uncontrollable, experiences a fly-away or is missing; and
 - g) Any other incident that results in a Canadian Aviation Daily Occurrence Report (CADORS).
- (67) The UAV operator shall not operate the UAV following any of the aviation occurrences listed in the condition above, until such time as this office approves its further operation. Any such approval for resumption of operations shall be documented.

Yours truly,

Signature

Signature Block
for Minister of Transport, Infrastructure and Communities

Special Operational Conditions

NOTE TO INSPECTORS:

The following additional conditions may not be appropriate to all operations, therefore, Inspectors will need to import the applicable conditions into the appropriate section of the above template.

Condition for First Person View Devices:

- (1) No pilot shall use a first person view device, unless accompanied by a visual observer who is providing the sense and avoid function.

Conditions for Night VFR Flights:

- (1) Where the UAV is equipped with lights, the UAV pilot shall ensure that they are on at all times during night operations.
- (2) Where the UAV is not equipped with lights, the UAV pilot must ensure that there is a means of illumination during night operations, sufficient to maintain visual contact with the UAV.
- (3) A suitable portable emergency light source shall be available to the crew members when the aircraft is operated at night.
- (4) The pilot operating the UAV at night must not suffer from the visual limitations of depth perception, colour blindness or lack of visual acuity in low light conditions.
- (5) Visual observers providing the sense and avoid function during night operations are prohibited from using night vision goggles.

**APPENDIX J - SFOC TEMPLATE FOR MODEL AERONAUTICS ASSOCIATION OF CANADA (MAAC)
/ ACADEMY OF MODEL AERONAUTICS (AMA) MEMBERS**

TC Logo

SPECIAL FLIGHT OPERATIONS CERTIFICATE

Certificate Number

File Number

Pursuant to section 603.67 of the *Canadian Aviation Regulations*, this constitutes your Special Flight Operations Certificate (SFOC), for the operation of an unmanned air vehicle (UAV) system operated within visual line-of-sight, issued under the authority of the Minister pursuant to the *Aeronautics Act*.

Nothing in this Certificate shall be held to relieve the UAV operator from requirements to comply with the provisions of such Canadian Aviation Documents as may have been issued pursuant to the *Aeronautics Act* or the *Canadian Aviation Regulations*.

Pursuant to Section 6.71 of the *Aeronautics Act*, this Certificate may be suspended or cancelled at any time by the Minister for cause, including failure on the part of the UAV operator, its servants or agents to comply with the provisions of the *Aeronautics Act* and the *Canadian Aviation Regulations*. This Certificate is not transferable.

Legal Name and Address of the UAV System Operator

This Certificate is issued to (*enter UAV operator name, street address, city, province, postal code, country (if not Canada)*), hereafter referred to as the UAV operator.

Validity Period of this Certificate

This Certificate is valid from ***dd/mm/yyyy*** until ***dd/mm/yyyy*** or until it is suspended or cancelled.

Type and Purpose of the Operation Authorized

This Certificate is valid for the operation of the (*enter name/model of UAV system*) for the purpose of (*enter purpose of flight operation, and if applicable, number of flights*) at (*enter geographical boundary (site, province, region, or national) where the operation is being conducted*), subject to the conditions of this Certificate.

This Certificate is issued subject to the following conditions;

NOTE TO INSPECTORS – *For an SFOC approved under this process, the SFOC applicant, UAV operator and the pilot are considered to be the same person.*

- (1) The pilot shall ensure that their MAAC/AMA membership remains valid and is in good standing.
- (2) The UAV shall be operated in accordance with the most recent version of the Model Aeronautics Association of Canada documents including;

- (a) Safety Code,
 - (b) R/C Giant Scale Model Aircraft Guidelines,
 - (c) Field Safety and Operation Rules,
 - (d) FPV Guidelines, and
 - (e) Event rules when participating in a MAAC sanctioned event.
- (3) The pilot shall ensure that the Contest Director has authorized the participation of the UAV, when participating in a MAAC sanctioned event.
 - (4) The pilot shall conduct a safe operation.
 - (5) 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.
 - (6) The UAV shall only be operated within visual line-of-sight.
 - (7) The pilot of the UAV shall give way to manned aircraft at all times.
 - (8) The pilot shall only;
 - (a) Operate the UAV in visual meteorological conditions, **OR**:
 - (b) *If the Inspector approves lower limits (in accordance with section 6.20(2) of this SI), this condition shall be modified to stipulate the authorized ceiling and visibility, **OR***
 - (c) *where the SFOC application is only for flying at an event, the Inspector may consider importing the following condition into the SFOC; "The pilot shall only operate the UAV in accordance with the weather conditions approved by the Contest Director".*
 - (9) The UAV shall only be operated during the day.
 - (10) The UAV shall only be operated in Class G airspace, when not participating in a MAAC sanctioned event.
 - (11) No pilot shall operate the UAV higher than 300 feet above ground level (AGL), unless participating at a MAAC sanctioned event.
 - (12) The UAV shall not be operated in any special aviation event requiring an SFOC under Part VI, Subpart 3, Division 1 of the *Canadian Aviation Regulations*.
 - (13) A copy of this Certificate shall be on site any time the UAV is in operation.
 - (14) No pilot shall operate the controls of the UAV if the pilot has any reason to believe that they are suffering or are likely to suffer from fatigue so that they are unfit to perform their duties.
 - (15) 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.
 - (16) The pilot shall have subscribed for adequate liability insurance covering risks of public liability at the levels described in subsection 606.02(8) of the *Canadian Aviation Regulations*.
 - (17) The pilot shall adhere to the security plan in accordance with the information provided in the SFOC application.
 - (18) The pilot shall adhere to the emergency contingency plan in accordance with the information provided in the SFOC application.
 - (19) No pilot shall operate the UAV at a lateral distance of less than 100 feet from inhabited structures such as buildings, vehicles, vessels and any persons not associated with the operation.
 - (20) No pilot shall operate the UAV over a built-up area or over an open-air assembly of persons.

- (21) The pilot or visual observer(s) must maintain continuous unaided visual contact with the UAV sufficient to be able to maintain operational control of the aircraft, know its location and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.
- (22) All persons connected with this operation shall be familiar with the contents of this Certificate.
- (23) The pilot/operator 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.
- (24) The pilot shall report to this office, as soon as possible, details of any of the following aviation occurrences during the operation of the UAV:
 - a) Injuries to any person requiring medical attention;
 - b) Unintended contact between the UAV and persons, livestock, vehicles, vessels or other structures;
 - c) Unanticipated damage incurred to the UAV or other essential parts of the UAV system that renders it unfit for flight; and
 - d) Anytime the UAV is not kept within the geographic boundaries and/or altitude limits as outlined in this Certificate.
- (25) The UAV operator shall not operate the UAV following any of the aviation occurrences listed in the condition above, until such time as this office approves its further operation. Any such approval for resumption of operations shall be documented.

Yours truly,

Signature

Signature Block
for Minister of Transport, Infrastructure and Communities

APPENDIX K - CHASE AIRCRAFT OPERATIONS AND SAMPLE CONDITIONS

- (1) Where it is determined that a chase aircraft will be used to mitigate the risk associated with a beyond visual line-ofsight (BVLOS) operation, the UAV operator will need to have developed chase aircraft Standard Operating Procedures (SOP) and submit a copy to the Inspector.
- (2) The SOPs should address, at a minimum, topics such as:
 - (a) selection of the appropriate chase aircraft;
 - (b) training for pilots and visual observers including qualifications and currency, communication procedures between all parties (visual observers, pilots, ATS unit);
 - (c) take-off/launch sequence, rendezvous procedures, landing/recovery procedures;
 - (d) the transition of duties between ground-based and airborne visual observers, responsibilities of the visual observers and pilots;
 - (e) minimum weather criteria;
 - (f) right-of-way rules (Section 6.20 of this SI and/or section 602.19 of the CARs); and
 - (g) normal and emergency procedures.
- (3) The Certificate applicant will need to outline the procedures for the proposed operation in sufficient detail so as to allow the Inspector to make an assessment of the additional risk associated with the introduction of a chase aircraft. Chase operations will only be authorized for flights in Visual Meteorological Conditions (VMC) and during daylight hours.
- (4) The UAV must be of a size large enough and visible enough to allow the airborne observer the ability to maintain constant visual contact with the aircraft and to allow the chase aircraft pilot the ability to maintain a safe distance from the UAV.
- (5) Safe flight is the shared responsibility of the pilot-in-command (PIC) of the UAV and the PIC of the chase aircraft. Further, the chase aircraft PIC will be responsible for safe flight of the chase aircraft and for maintaining a safe formation position with the UAV. An onboard visual observer will be responsible for providing sense and avoid functions for the UAV.
- (6) If the visual observer is positioned in a chase aircraft the following apply:
 - (a) The chase aircraft must maintain a reasonable proximity, and must position itself relative to the unmanned aircraft to reduce the hazard of collision while operating near other aircraft;
 - (b) The visual observer's duties must be dedicated only to the task of observation and required communication with the UAV Pilot; and
 - (c) Concurrent duties as pilot of a chase plane and visual observer are not authorized.
- (7) Detailed information pertaining to the proposed operation shall be provided in the SFOC application, including answers to the following:
 - (a) Chase Aircraft Operator and Pilot-in-Command
 - (i) The aircraft operator and pilot must comply with the applicable sections of the CARs regulating the flight activity being conducted. (e.g. section 602.24 of the CARs).
 - (b) Personnel Training
 - (i) What training has been given to the chase aircraft pilot regarding the UAV flight characteristics?

- (ii) What training has been given regarding communication techniques and procedures for communications between the PIC of the UAV, PIC of the chase aircraft and the ground-based and airborne visual observers?
 - (iii) What training and experience does the onboard visual observer have in observation techniques?
- (c) Pre-Flight Briefing
- (i) Do the SOPs address the pre-flight briefing?
 - (ii) The pre-flight briefing should outline details such as:
 - (A) coordination and transfer of duties between ground-based and airborne visual observers;
 - (B) communications procedures between PICs and ATS Units, where required;
 - (C) emergency procedures for both aircraft (e.g. lost link, loss of visual contact, loss of communications);
 - (D) altitudes and airspeed for both aircraft;
 - (E) UAV control latencies; and
 - (F) weather-related factors such as winds aloft, cloud layers and sun angles.
 - (iii) Maintaining Visual Flight Rules (VFR) in VMC is mandatory, therefore aircraft positioning to avoid cloud layers will need to be taken into consideration.
- (d) Take-off/Launch and Rendezvous
- (i) What is the take-off/launch sequence?
 - (A) How does the chase aircraft rendezvous with the UAV?
 - (B) Does the UAV establish a predictable holding pattern or a flight path in order for the chase aircraft to visually acquire it and then manoeuvre to rendezvous with it?
 - (C) The rendezvous location will need to consider local traffic patterns and be within visual line-of-sight of the ground-based visual observers.
 - (ii) At what speed and altitude will the UAV operate?
 - (iii) What distance (vertical separation) will be used to separate the aircraft until the chase aircraft visually acquires the UAV?
 - (iv) What communication procedures are in place for notifying the UAV PIC when visual acquisition is complete by the chase aircraft PIC?
 - (v) How will the transfer of responsibility for sense and avoid functions between the ground-based visual observers and the chase aircraft visual observers be handled?
- (e) Normal Procedures
- (i) All UAV manoeuvres must be planned and announced to the chase aircraft pilot prior to execution so that the chase aircraft pilot can assess the UAV behaviour.
 - (ii) The chase aircraft observer will provide see and avoid information to the UAV pilot to avoid other traffic/obstacles as well as assist the pilot in remaining clear of cloud.
 - (iii) Where the UAV pilot is operating the UAV from onboard the chase aircraft, how will the Certificate applicant ensure that the chase aircraft remains within radio control

range of the UAV to maintain appropriate signal coverage for flight control or activation of the flight termination system?

- (iv) What communication requirements will be necessary for the chase aircraft (e.g. with the appropriate ATS Unit)?
- (v) What position of the chase aircraft with regards to the UAV has been established in order to provide safe separation between aircraft? For example, is the safest observation position for the chase aircraft above, below, directly behind or offset from the UAV? The chase aircraft PIC is always responsible for determining the appropriate position to maintain safe separation from the UAV.
- (vi) What distance will the chase aircraft need to remain from the UAV in order to provide visual detection of conflicting aircraft in the path of the UAV?
- (vii) What distance will the chase aircraft need to remain from the UAV in order to ensure collision avoidance should a UAV malfunction occur?
- (viii) What procedures are in place regarding how manoeuvring commands will be made to the UAV PIC, and who makes them, in order for the UAV to avoid other airborne traffic?

(f) Abnormal and Emergency Procedures

- (i) Abnormal and emergency procedures related to both the chase aircraft and the operation of the UAV will need to be defined to the extent that predictability is required, in particular, those areas related to lost link and loss of sense and avoid capabilities. Typically, if either aircraft develops a malfunction, the UAV mission should be aborted in order to focus efforts on the safe resolution of the abnormal/emergency condition. General considerations include:

- (A) What is the role of the chase aircraft if the UAV loses link(s) and enters lost link mode or return home mode? The chase aircraft will need to maintain a safe distance from the UAV since the UAV behaviour may become abrupt or erratic during lost link.
- (B) Who needs to be informed of the lost link failure? For example, the PICs need to communicate immediately if lost link is suspected. Applicable ATS Units will need to be informed of the lost link and the chase pilot PIC will need to confirm that the UAV is responding as expected (e.g. following the lost link profile).
- (C) What happens if the link is restored? Will the chase aircraft continue to maintain a safe position on the UAV until the UAV has landed?
- (D) If the UAV does not follow its lost link profile or the UAV trajectory is lost for any other reason and the UAV flies away, under what circumstances will the chase aircraft continue to follow the UAV? Who needs to be notified? As an example, the chase aircraft PIC may not be able to maintain formation flight with the UAV due to inclement weather. In any case, the chase aircraft PIC would need to inform ATS Units and provide flight information on the UAV (e.g. heading, altitude, etc.).
- (E) If the UAV flight is terminated (e.g. engine failure), what procedures will be followed by the UAV PIC and the chase aircraft PIC? Will the chase aircraft follow the UAV to the predetermined flight termination point? Will the chase aircraft follow the UAV in order to provide information to the UAV PIC regarding landing/recovery locations (e.g. away from built-up areas)? If the UAV crashes, what is the role for the chase aircraft for assisting in the emergency response?

- (F) In the event of chase aircraft abnormalities, the PIC of the chase aircraft will need to abide by the aircraft manufacturer's UAV system flight manual in response to non-critical failures/fault conditions (e.g. those requiring a land as soon as practical response). What procedures are in place for the UAV (e.g. does the flight continue or does the UAV land)?
 - (G) If the chase aircraft has an emergency that results in the inability to continue to perform the sense and avoid function (e.g. the chase aircraft must terminate operations) what procedures will the UAV PIC follow to recover the UAV in a safe manner? Who needs to be notified?
 - (H) What procedures are in place for loss of voice communications between the UAV PIC and the chase aircraft PIC and each PIC with the ATS unit? Have potential losses been pre-briefed (e.g. who will relay information to whom)? Will a partial loss result in both aircraft landing as soon as possible? What if there is a total loss of communication and the chase aircraft goes NORDO? What procedures are in place for this situation?
 - (I) What procedures are in place if the chase PIC and observer lose sight of the UAV? For example, would the chase pilot immediately establish altitude separation (climb or descend) and notify both the UAV PIC and the ATS Unit? What manoeuvres will be necessary to re-establish visual contact? Will the UAV PIC provide necessary flight information about the UAV to the chase aircraft PIC in order to rejoin the aircraft? If rendezvous attempts fail in a timely manner then what procedures are in place to terminate the flight of the UAV or recover the UAV using predictable procedures (e.g. lost link, diversion to an alternate aerodrome, etc.)?
 - (J) If the chase aircraft has an emergency which results in the inability to continue to perform the sense and avoid function, what procedures will be in-place to recover the UAV in a safe manner? Who will need to be notified?
- (g) Landing/Recovery
- (i) Procedures will be required for when the ground-based observer(s) establish visual contact with the UAV and are ready to accept responsibility for providing sense and avoid functions.
 - (ii) The PICs of the aircraft will need to determine the sequence of landing between the UAV and the chase aircraft and at what point during the operation the chase aircraft responsibilities end.

Sample Conditions Required When Using Chase Aircraft

- (1) The UAV operator shall ensure that visual observers perform observation duties for only one UAV.
- (2) Weather minimums for the chase aircraft shall be in accordance with sections 602.114 or 602.115 of the *Canadian Aviation Regulations*.
- (3) No more than one (1) UAV shall be operated in-flight at any one (1) time.
- (4) Operations conducted with a chase aircraft shall be conducted in accordance with the UAV Operator's Standard Operating Procedures.
- (5) No Chase aircraft operations are permitted in Class A airspace.

APPENDIX L - INTERNATIONAL OPERATIONS

International Civil Aviation Organization (ICAO) - Remotely Piloted Aircraft System

- (1) Article 8 of the Chicago Convention addresses pilotless aircraft. It states:
 - (a) *No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.*
 - (b) *Since 2008 ICAO has been working to provide the international regulatory framework for international UAV systems (known as remotely piloted aircraft systems (RPAS), through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material. SARPs development will apply to all international UAV operations including, but not limited to specialized services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement and commercial air transport of cargo. The focus of ICAO's work is on beyond visual line-of-sight operations.*
- (2) On March 10, 2011, ICAO published Unmanned Aircraft Systems Circular 328 AN/190. The Circular was developed to apprise States of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes. A copy of the circular is available on ICAO's website at: www.icao.int
- (3) On November 15, 2012, amendments to ICAO Annexes 2 and 7 became effective. The amendments introduce RPAS related definitions, general operating rules for Unmanned Aircraft Systems engaged in international aviation and marking and registration requirements. Appendix 4 of Annex 2 includes information regarding the authorizations required to fly a Unmanned Aircraft Systems over another State.
- (4) Canada has filed a difference with ICAO against the SARPs that apply to authorizations of foreign aircraft indicating that compliance would be achieved at a later date. Until that time the intent of the SARPs will be met by the issuance of an SFOC.
- (5) ICAO Annex 5 has also been amended to include a note on the investigation of UAV accidents and serious incidents.

Flight over the High Seas

- (1) Article 2 of the Convention on International Civil Aviation states "*For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State*".
- (2) Canadian Sovereign airspace extends out to 12 nm. International airspace is outside 12 nm over the high seas. Over the high seas, ICAO Annex 2 rules apply without exception. Section 602.38 of the CARs states:
 - (a) "*The pilot-in-command of a Canadian aircraft that is in flight over the high seas shall comply with the applicable Rules of the Air set out in Annex 2 to the Convention and the applicable Regional Supplementary Procedures set out in Document 7030/4 of the International Civil Aviation Organization (ICAO)*".
- (3) Article 3, of the Convention on International Civil Aviation states, "*The contracting States undertake, when issuing regulations for their state aircraft (i.e. military), that they will have due regard for the safety of navigation of civil aircraft*".
- (4) In Canada, civil UAV operators are not authorized to operate under "due regard" over the high seas. They must follow ICAO Annex 2 Rules of the Air.

- (5) Article 12, of the Convention on International Civil Aviation states “*Each contracting State undertakes to adopt measures to insure that every aircraft flying over or manoeuvring within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and maneuver of aircraft here in force. Each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest extent possible, with those established from time to time under this Convention. Over the high seas, the rules in force shall be those established under this Convention. Each contracting State undertakes to insure the prosecution of all persons violating the regulations applicable*”.

Canadian UAV Operators Conducting International Operations

- (6) For Canadian UAV operators conducting operations over the high seas or Canadian UAV operators conducting operations in international airspace in Flight Information Regions (FIRs) delegated to Canada (e.g. where NAV CANADA is the service provider), the following applies:
- (a) Aeronautics Act - The Aeronautics Act States:
- 4. (1) ... this Part applies in respect of aeronautics to all persons and to all aeronautical products and other things in Canada, to all persons outside Canada who hold Canadian aviation documents and to all Canadian aircraft and passengers and crew members thereon outside Canada.*
- (2) Every person exercising the privileges accorded by a Canadian aviation document in a foreign state and every Canadian aircraft operated in a foreign state shall comply with or be operated in accordance with the applicable aeronautics laws of that state.*
- (3) Nothing in this Part shall be construed as requiring a person or aircraft to contravene or be operated in contravention of a law of a foreign state that applies to or in respect of the person or aircraft.*
- 4.1 Every person who commits an act or omission outside Canada that if committed in Canada would be a contravention of a provision under this Part shall be deemed to have committed a contravention of the provision under this Part and may be proceeded against and punished in the place in Canada where the person is found as if the contravention had been committed in that place.*
- (7) SFOC requirements applicable to UAV operations conducted in Canadian airspace remain applicable to flights conducted in international airspace, including those conducted in the Flight Information Regions (FIR) delegated to Canada or any other country. Operators must follow ICAO Annex 2 Rules of the Air and must have approval from the State of the Operator before conducting operations over the high seas.

Notes:

- (a) Over the high seas, the lower limit of all North Atlantic Oceanic Control Areas (OCA) is FL55 with no upper limit. Throughout the NAT Region, airspace at and above FL55 is Class A controlled airspace, and below FL55 is Class G uncontrolled airspace.*
- (b) Flights shall be conducted in accordance with the instrument flight rules (even when not operating in instrument meteorological conditions (IMC) when operated at or above FL60.*
- (c) ATC Unit clearances to climb or descend maintaining one's own separation while operating in Visual Meteorological Conditions (VMC) shall not be issued.*
- (8) For Canadian UAV operators conducting operations in the territorial airspace of another sovereign country or in the territorial airspace of another sovereign country that lies within FIRs delegated to Canada (e.g. where NAV CANADA is the service provider) the following applies:

- (a) The requirement of an SFOC remain applicable to flights conducted in the territorial airspace of another sovereign country that lies within FIRs delegated to Canada or airspace in FIRs delegated to other countries. Operators must follow ICAO Annex 2 Rules of the Air.
- (b) Additionally, the requirements of Article 8 regarding authority from the foreign contracting State apply.

Foreign UAV Operator Requirements

- (1) All flights into, from or over the territory of Canada and landings in such territory shall be carried out in accordance with the regulations of Canada regarding civil aviation. The requirement for an SFOC is applicable to all UAV operations conducted in Canadian airspace. The privileges extended to UAV operators are subject to each flight having been properly authorized and to whatever restrictions the Government of Canada may, from time to time, or in specific cases, deem to be warranted.
- (2) If the Certificate applicant is not legally eligible to conduct commercial UAV operations in the State of Registry, they will not be eligible to apply for an SFOC to conduct commercial operations in Canada. However, the same Certificate applicant may be eligible to conduct research and development operations in Canada under an SFOC issued for operations within established UAV test areas.
- (3) Nothing in an SFOC relieves the Foreign UAV operator from complying with all applicable immigration and work visa requirements stipulated by other Canadian laws and regulations.

Foreign Civil (including Foreign State Aircraft) UAV Flights Operating Wholly Within Canadian Airspace

- (1) The following requirements apply to all eligible foreign UAV operators intending to conduct UAV operations in Canada. The operator must:
 - (a) apply for, and obtain, an SFOC, including submitting documentation issued by the State of Registry Civil Aviation Authority;
 - (b) submit a Notice of Proposal to Conduct Outdoor Laser Operations(s), as applicable; and
 - (c) for foreign State aircraft, apply for, and obtain a Diplomatic Over-flight Clearance submitted through the Foreign State Embassy to the Department of Foreign Affairs, Trade and Development Canada.

Foreign Civil (including Foreign State Aircraft) UAV Flights Transiting Canadian Airspace or Conducting Technical Stops at Canadian Airports

- (2) All flights of UAVs operated by a eligible foreign UAV operator transiting Canadian airspace are to be conducted in accordance with the following procedures:
 - (a) apply for, and obtain, an SFOC, including submitting documentation issued by the State of Registry Civil Aviation Authority; and
 - (b) for foreign State aircraft, apply for, and obtain prior to flight, a Diplomatic Over-flight Clearance submitted through the Foreign State Embassy to the Department of Foreign Affairs, Trade and Development Canada.
- (3) In addition to the above requirements, flights conducting technical stops at Canadian aerodromes are required to consult with the Canada Border Services Agency (see Canada Flight Supplement for a list of aerodromes at which Customs control facilities are provided).

Note:

Regulations regarding foreign state aircraft or an aircraft operated by a foreign operator in an air transport service are outlined in Part VII, Subpart 1 – Foreign Air Operators. Inspectors should note that this Subpart was not written with UAVs in mind and does not apply to UAVs. As UAV operations are authorized under section 602.41 of the CARs, there is no requirement to issue or validate a foreign flight authority under this Subpart.

- (4) The requirements that apply to all foreign military UAV operators intending to conduct military UAV operations in Canada are approved by 1 Canadian Air Division(see section 3.5 of this SI). In addition, the military UAV operator must:
 - (a) Apply for, and obtain a Diplomatic Over-flight Clearance submitted through the Foreign State Embassy to the Department of Foreign Affairs, Trade and Development Canada.

Bilateral Agreements

- (5) At present, Canada has no bilateral agreements on UAVs.

NAFTA and Trans-Pacific Partnership

- (6) At present, UAVs are not included in these trade agreements.

Wilson, John MTIC:EX

From: Naylor, Jennifer A FLNR:EX
Sent: Wednesday, April 22, 2015 5:20 PM
To: Marek, Dave FLNR:EX
Subject: FW: Drone imagery and deciding what resolution to use for your information needs

For your reference on the use of drones in WMB. I have save a copy of his email.

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice: 250.286.9367 📱 Cell: 250.203-3221
Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Larry McCulloch [<mailto:larry.mcculloch@lmfms.ca>]
Sent: Wednesday, April 22, 2015 3:31 PM
To: Naylor, Jennifer A FLNR:EX
Cc: Osbourne, Kelly FLNR:EX
Subject: RE: Drone imagery and deciding what resolution to use for your information needs

Good question Jen. I sent it to you and Kelly just to begin a conversation. I see two potentially very useful applications. One is in post burn mop up and identifying hot spots like in the image (second clip) below that we took. And another is in identifying fuel loading. So far I have not had a chance to go to a recent cutblock and get immediate post-harvest fuel loading but I will do this at some point and show you what I mean. And regardless, I think up until crown closure, or in beetle killed stands, we could get a very good handle on fuel loads as well. (see the third clip below from a free growing stand). How I am thinking about it at the moment is that you either:

A. Create a picture atlas of fuel loading by fuel type and age that visually depicts fuel load classes (e.g.

Fuel hazard rating chart – point values in the table below derived from assessing fuel mass/ha, % slope, and aspect are compared to the fuel hazard threshold chart.

Dominant Woody Species – Cedar / Hemlock / Douglas Fir (S - 3 Slash / Fuel Type)

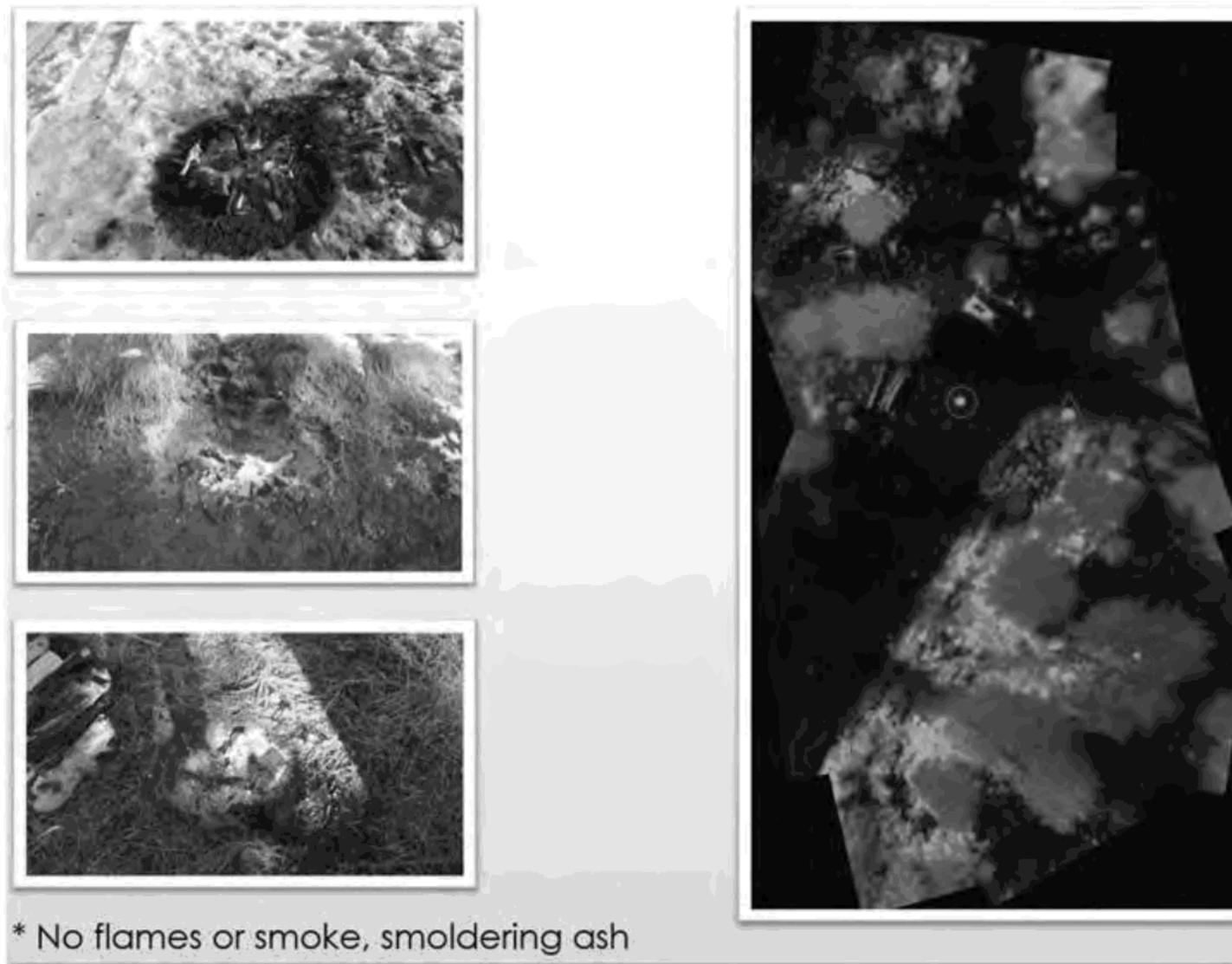
Tonnes/Ha	1-5 t/ha				6-19 t/ha				20-49 t/ha				50-99 t/ha			
	North	East	West / Flat	South	North	East	West / Flat	South	North	East	West / Flat	South	North	East	West / Flat	South
0-15	35	35	43	58	40	40	50	65	50	50	63	83	60	60	75	10
16-30	35	50	58	75	40	55	65	85	50	70	83	106	60	85	100	13
31-45	35	50	80	130	40	55	93	140	50	70	118	188	60	85	140	22
46%+	35	58	113	158	40	65	130	180	50	83	163	225	60	100	195	27

Fuel hazard threshold chart.

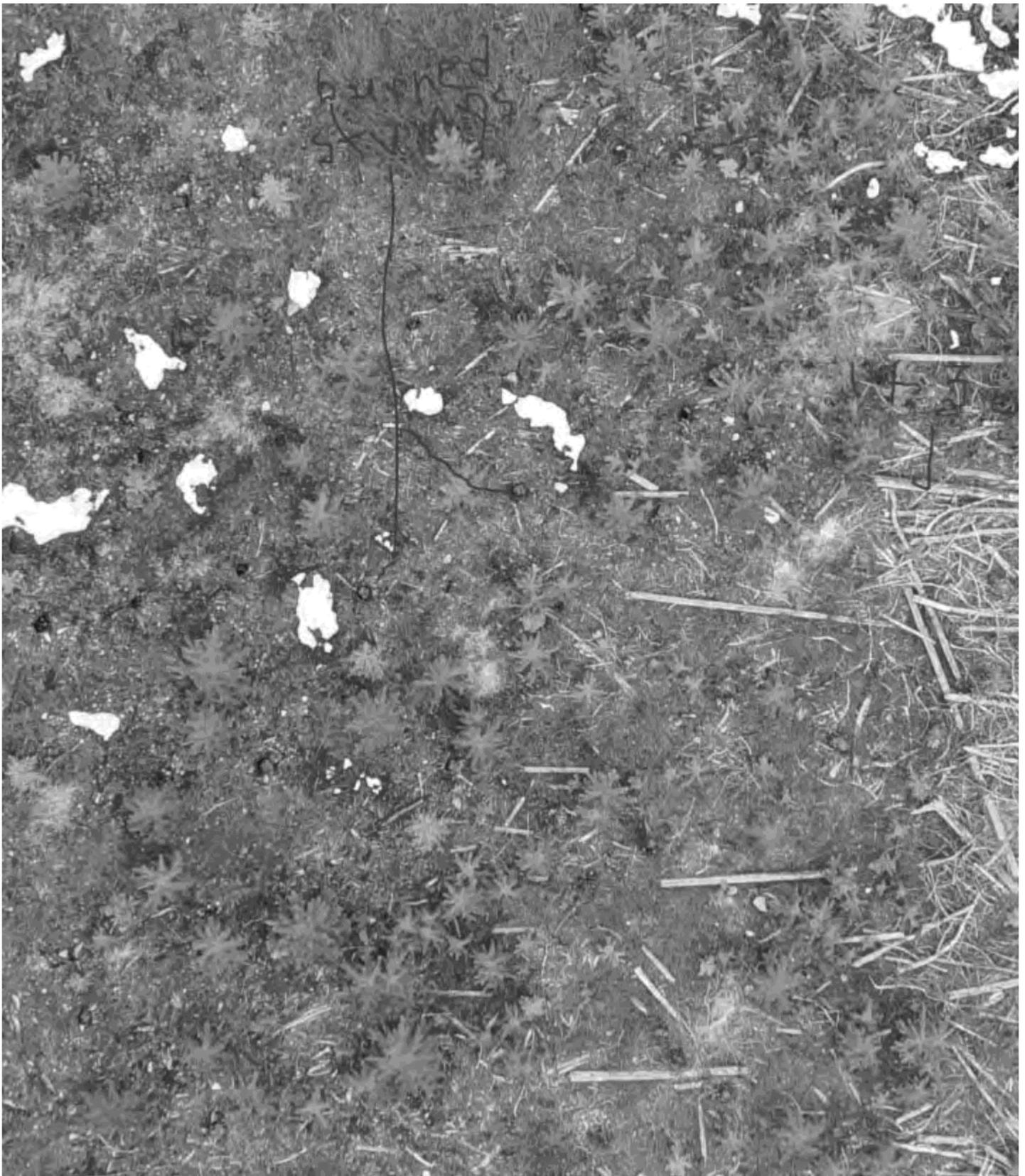
Risk Map Class	Fuel Hazard Threshold (Charts 1 or 2)
Low	100
Moderate	70
High	40
SEVERE	25

B. Or, B, we develop a more accurate photo based fuel loading algorithm by using spatial analyst to extract raster values that represent dead woody material on the ground, calculate surface area or volume (cus we can get length and diameter from the photos to calculate volume). If we use surface areas then we need to develop a regression function to relate field measured volumes with surface area visible on the photo. Another option in this approach is to simply establish photo plots (i.e. identify square plots or use transects like in the coarse woody debris transects I have been doing right on the photo or orthomosaic) and calculate volume directly from the photos. This would be the easiest approach although it would be a sample rather than a census and I think would be very accurate and very easy. For piles, you would just calculate the volume of the pile.

Example of thermal imaging taken this last Dec after lighting 3 small “camp fires”, waiting til they go out, and then flying over every 20 minutes to see what showed up. One was under the canopy, one was half and half, and one was in the open.



Clip from a photo taken 60m agl showing an area that was in a burn pile with blackened stumps, and beside it the unburned area with various sized fuels, the largest of which is 14.3 cm in diam (yes and a bit of snow, spring seems to have stalled up here).



Anyway, please give me a call if you would like to discuss it more. I would love to track down some funding to pursue this in conjunction with the fire tactical planning work I have been doing. It would fit perfectly into a pilot project I think. :)

L

-----Original Message-----

From: Naylor, Jennifer A FLNR:EX [<mailto:Jennifer.Naylor@gov.bc.ca>]

Sent: Wednesday, April 22, 2015 2:43 PM

To: XT:McCulloch, Larry FLNR:IN

Cc: WMBGEO WMB P FLNR:EX

Subject: RE: Drone imagery and deciding what resolution to use for your information needs

Larry,

Thanks for the email. For what purpose would you be proposing to use drone imagery? Do have infrared? WMB has not pursued the use of drone imagery in the past, but we are starting to think about it. This is being coordinated out of the aviation group.

Jen

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | *Voice:
250.286.9367 * Cell: 250.203-3221 Jennifer.Naylor@gov.bc.ca<<mailto:Jennifer.Naylor@gov.bc.ca>>

For Wildfire Management Branch Geospatial support email: [WMBGEO<mailto:FORWMBP.WMBGEO@gov.bc.ca>](mailto:FORWMBP.WMBGEO@gov.bc.ca)
(FORWMBP.WMBGEO@gov.bc.ca<<mailto:FORWMBP.WMBGEO@gov.bc.ca>>

Wilson, John MTIC:EX

From: Benson, Michael FLNR:EX
Sent: Friday, November 28, 2014 8:24 AM
To: Marek, Dave FLNR:EX; Horsman, Gary L FLNR:EX; Fraser, Rob D FLNR:EX; Bardossy, Robert FLNR:EX; Sommerville, Derek A FLNR:EX; McEwen, Cody FLNR:EX; Maclean, Alexander B FLNR:EX; Hansen, Tom FLNR:EX; Reinboldt, Thomas R FLNR:EX
Subject: FW: For Immediate Release: Simplification of UAS Rules – A Great Step Forward

FYI

Michael Benson

Superintendent Provincial Airtanker Program
BC Wildfire Management Branch
PWCC
(250) 312-3009
(250) 318-7164 (cell)



From: Duane Sinclair [mailto:Duane_Sinclair@gov.nt.ca]
Sent: Thursday, November 6, 2014 2:25 PM
To: Dave Bokovay (Dave.Bokovay@ciffc.ca)
Cc: Benson, Michael FLNR:EX; quentin.spila@gov.ab.ca; 'Forrest Pocha (forrest.pocha@gov.sk.ca)' (forrest.pocha@gov.sk.ca); 'Lorne Harris (lorne.harris@gov.yk.ca)' (lorne.harris@gov.yk.ca); Tetrault, Trevor (CON) (Trevor.Tetrault@gov.mb.ca); Robinson, Jason (MNR) (jason.robinson@ontario.ca); 'Daniel Normand (dnormand@sopfeu.qc.ca)' (dnormand@sopfeu.qc.ca); Chiasson, Gilles (DNR/MRN) (Gilles.Chiasson@gnb.ca); Moore, Ian E
Subject: FW: For Immediate Release: Simplification of UAS Rules – A Great Step Forward

Good Afternoon Gentlemen,

I thought I'd share this information on Unmanned Aircraft Systems (UAS) describing Transport Canada evolution of regulatory framework in Canada and steps going forward.

Here is a highlight of information on the Media release. English: <http://news.gc.ca/web/article-en.do?nid=900449> French: <http://nouvelles.gc.ca/web/article-fr.do?900449>

November 5, 2014, 2014 – Montréal, Quebec – Transport Canada

Transport Canada today announced, at the Unmanned Systems Canada conference in Montréal, two exemptions that simplify small unmanned air vehicle (UAV) operations and safely integrate UAVs into Canadian airspace.

Under the new exemptions, a Special Flight Operations Certificate will not be required for UAVs under 2 kilograms and certain operations involving UAVs under 25 kilograms. The new approach will apply to commercial operations and contribute to a strong safety regime for those on the ground and in the skies.

Once the changes come into effect later this month, operators must check on Transport Canada's website if the exemptions apply to them and respect specific safety conditions, including requirements to operate

within visual line-of-sight, maximum altitudes and away from built-up areas and aerodromes. In addition, Transport Canada is simplifying the application process and reducing the time it takes to issue Special Flight Operations Certificates for larger UAV operators.

In October, Minister Raitt launched the Government of Canada's national safety awareness campaign for UAVs, which aims to help Canadians better understand the risks and responsibilities of flying UAVs. For more information, please visit www.tc.gc.ca/SafetyFirst.

From this second url above, here is what it says:

Think safety first

More and more people are using unmanned aircraft for work or pleasure. Transport Canada regulates their use to keep the public and our airspace safe.

Unmanned aircraft (no pilot on board) go by many names—unmanned air vehicle (UAV), remotely piloted aircraft system, model aircraft, remote control aircraft, and drone. Call it what you want, but always think safety first.

Safety Guidelines

You are responsible to fly your aircraft safely and legally. In Canada, you must:

- Follow the rules set out in the *Canadian Aviation Regulations*.
- Respect the *Criminal Code* as well as all municipal, provincial, and territorial laws related to trespassing and privacy

Transport Canada expects you to follow these basic **Do's and Don'ts**.

Do:

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

Don't fly:

- Any closer than 5 miles (8 km) from any airport, heliport or aerodrome.
- Higher than 300 feet (90 metres) above the ground.
- Within restricted airspace (such as military bases, prisons, forest fire areas).
- Closer than 100 feet (30 metres) from vehicles, boats, buildings, structures or people.
- In populated areas or near large groups of people (such as at sporting events, concerts, festivals, firework shows).
- Where or when you could interfere with any first responders (fire department, police, etc) as they conduct their duties.
- Near moving vehicles. Avoid highways, bridges, busy streets or anywhere you could endanger or distract drivers.
-

We all have a responsibility to respect the *Criminal Code* as well as all municipal, provincial, and territorial laws regarding trespassing and privacy.

It goes on, but this is gaining traction fast and feel it is something we should be aware of.

Take care,

Duane Sinclair
Manager, Aviation Services
Forest Management Division
Department of Environment and Natural Resources
Government of the Northwest Territories
P.O. Box 7 | Fort Smith, NT | X0E 0P0
Tel: 1-867-872-7719 | Fax: 1-867-872-2148
E: Duane_Sinclair@gov.nt.ca

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----- Forwarded message -----

From: <leah@unmannedsystems.ca>
Date: Thu, Nov 6, 2014 at 12:46 PM
Subject: For Immediate Release: Simplification of UAS Rules – A Great Step Forward
To: leah@unmannedsystems.ca



For Immediate Release

Date: 6 November 2014

Subject: Simplification of UAS Rules – A Great Step Forward

On Wednesday November 5, during the 12th Annual Conference of Unmanned Systems Canada, Transport Canada's Director General for Civil Aviation, Mr. Martin J. Eley, described the upcoming steps in the evolution of the regulatory framework for Unmanned Aircraft Systems (UAS) in Canada. The new approach has three components: a) improved guidance material for all operators; b) exemptions from the Special Flight Operations Certificate (SFOC) for simplistic, lower risk, unmanned aircraft that do not to exceed 25kg.; and c) more stringent regulations for more complex operations. These changes are seen by Unmanned Systems Canada as a very positive move, balancing safety with practicality and owner responsibility. Details are outlined in the Transport Canada

Media release. English: <http://news.gc.ca/web/article-en.do?nid=900449>

French: <http://nouvelles.gc.ca/web/article-fr.do?900449>

“This approach will dramatically improve the ability for Canadian business to safely make use of this extremely capable technology while substantially reducing the time it takes to get authorizations for more complex operations”, said Mr. Stewart Baillie, Chairman of Unmanned Systems Canada. “Coupled with the safety awareness campaign announced two weeks ago, I believe that Canada now has one of the most effective and progressive UAS regulatory framework in the world”.

Unmanned Systems Canada has worked with Transport Canada and the aviation industry at large for over seven years on UAS regulatory matters. The framework described today is consistent with the principles developed over this period and approved through a public consultation body known as CARAC (Canadian Aviation Regulation Advisory Council).

Unmanned Systems Canada is the focal point for Unmanned Vehicle Systems in Canada. We are a Canadian-registered not-for-profit association with over 500 members, representing the interests of the UVS community.

For further information contact:

Susan Chapman, communications@unmannedsystems.ca Mobile: [+1-613-614-3724](tel:+1-613-614-3724).

Canada's national non-profit association representing public and private innovation in unmanned vehicle systems

Association nationale canadienne sans but lucratif pour l'innovation dans les secteurs public et privé en matière de systèmes de véhicules télécommandés

Wilson, John MTIC:EX

From: Benson, Michael FLNR:EX
Sent: Monday, July 7, 2014 1:22 PM
To: Marek, Dave FLNR:EX; Young, Bruce R FLNR:EX
Subject: RE: FPInnovations - UAV demo

Im happy to defer to Dave.

Michael Benson

Superintendent Provincial Airtanker Program
BC Wildfire Management Branch
PWCC
(250) 312-3009
(250) 318-7164 (cell)



From: Marek, Dave FLNR:EX
Sent: July-07-14 1:22 PM
To: Benson, Michael FLNR:EX; Young, Bruce R FLNR:EX
Subject: RE: FPInnovations - UAV demo
Nothing on my books either!!

From: Benson, Michael FLNR:EX
Sent: Monday, July 7, 2014 1:18 PM
To: Young, Bruce R FLNR:EX; Marek, Dave FLNR:EX
Subject: RE: FPInnovations - UAV demo
Great.

I am available if need be.

Michael Benson

Superintendent Provincial Airtanker Program
BC Wildfire Management Branch
PWCC
(250) 312-3009
(250) 318-7164 (cell)



From: Young, Bruce R FLNR:EX
Sent: July-07-14 1:16 PM
To: Marek, Dave FLNR:EX; Benson, Michael FLNR:EX
Subject: FW: FPInnovations - UAV demo
We should discuss to see if there is someone who can attend this on behalf of the Program.

From: Ray Ault [<mailto:Ray.Ault@fpinnovations.ca>]
Sent: Monday, June 30, 2014 3:18 PM
To: Young, Bruce R FLNR:EX
Cc: Chad Gardeski; Mark Ryans; Benson, Michael FLNR:EX
Subject: FPInnovations - UAV demo
Bruce,

Hope all is well, it is a while since we have talked. You had asked some questions related to the future of UAV at a December 2012 presentation and I thought you might be interested in current developments.

Attached is an invite to a UAV / UAS demo in Hinton on July 17th. This project is coordinated by our Forest Operations Division and the wildfire operations research program interest is specific to detecting hold over fires in harvest debris piles.

Please let me know if an observer from Wildfire Management Branch would be interested in attending. Given it is short notice, if someone from BC is unable to attend I will endeavor to keep Mike Benson in the loop as to how the project proceeds and we will be presenting the summers results at the October 21 advisory meeting in Edmonton. Mike usually attends this meeting for BC.

Have a safe summer, Ray



Ray Ault
Program Leader, Wildfire Operations Research
1176 Switzer Dr, Hinton (AB) T7V 1V3
☎ 780 817 1840 📠 780-865-8266
✉ ray.ault@fpinnovations.ca

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Wilson, John MTIC:EX

From: Skrepnek, Kevin FLNR:EX
Sent: Wednesday, April 22, 2015 9:32 AM
To: FLNR WMB Information Officers
Cc: Bodak, Dave FLNR:EX; Marek, Dave FLNR:EX
Subject: IB template: UAVs

Good morning all,

Kayla Pepper and KFC Aviation staff have worked on the following blurb around Unmanned Aerial Vehicle (“drone”) use in and around wildfires. It has been approved by GCPE.

I will be updating the IB templates shortly with Tom Winterhoff, but in the meantime if you are putting out any incident-specific IBs I would like to see this added down in the boilerplate.

All wildfires are considered to be “Flight Restricted” as per the Canadian Air Regulations. The area restricted is within a radius of five nautical miles around the fire and to an altitude of 3,000 ft above ground level. The operation of any aircraft not associated with suppression activities, including UAVs or ‘drones’, within this area is illegal. This activity could be dangerous, especially when low-flying firefighting aircraft are present

For more information, please contact Transport Canada or refer to the Wildfire Management Branch media safety guide

<http://bcwildfire.ca/MediaRoom/Backgrounders/Wildfire%20Safety%20Information%20for%20Media.pdf>

This will also act as a friendly reminder to the media of the safety protocols available in that guide.

Any questions, just give me a shout.

Cheers,



Kevin Skrepnek

Provincial Wildfire Information Officer

B.C. Wildfire Management Branch | Provincial Wildfire Coordination Centre

Office: 250-312-3052 Cell: 250-318-4782 Media: 250-312-3051

Wilson, John MTIC:EX

From: Skrepnek, Kevin FLNR:EX
Sent: Thursday, February 19, 2015 8:16 AM
To: Benson, Michael FLNR:EX; FLNR WMB Information Officers; FLNR WMB Managers; Hisch, Peter FLNR:EX; Marek, Dave FLNR:EX; Nessman, Todd C FLNR:EX; Osbourne, Kelly FLNR:EX; PWCO, HPR FLNR:EX; Ralfs, Brendan R FLNR:EX; Townsend, Gary FLNR:EX; Valour, Lesley FLNR:EX
Subject: Media Monitoring: February 19, 2015

Local company pitching drones to government, engineering firms

Kamloops This Week

The brainchild of CEO Robert Atwood and CFO Richard Sullivan — who were working for the wildfire-management branch of the Ministry of Forests Land and Natural Resource Operations when the idea struck them — Hummingbird Drones is now closing in on its first contracts.



Kevin Skrepnek

Provincial Wildfire Information Officer

B.C. Wildfire Management Branch | Provincial Wildfire Coordination Centre

Office: 250-312-3052 Cell: 250-318-4782 Media: 250-312-3051

Wilson, John MTIC:EX

From: Bruce Morrow s.22
Sent: Wednesday, April 8, 2015 9:42 AM
To: Marek, Dave FLNR:EX
Subject: Permission for UAV Use on Wildfires
Attachments: Marek-WMB SFOC letter FINAL April 8 2015.pdf

Dave,

As mentioned, I am involved with a drone company seeking to supply real time mapping services to the WMB. They are seeking a letter permitting them to fly in Class F airspace above wildfires. They need this letter to get a SFOC from transport Canada to do the flying. Don't know where you guys are with this but providing a letter will allow a SFOC to be issued that will allow test flights and possible wildfire use in 2015. No letter and everyone waits for another year.... I will call you. Bruce

Bruce Morrow Forest Consulting Ltd
6504 Barnhartvale Rd
Kamloops, B.C.
V2C 6V7
250 573-6066 - office
s.22
morrowforestconsulting.com

Hummingbird Drones

#81 – 665 McBeth Place
Kamloops, B.C.
Canada
V2C 5V9

April 2, 2015

Dave Marek
Superintendent, Aviation Management
3080 Airport Drive
Kamloops, B.C.
V2B 7X2

Mr. Marek,

Re: Unmanned Aerial Vehicle Flights Over Wildfires for the Wildfire Management Branch

Hummingbird Drones (Hummingbird) is a Kamloops based company providing unmanned aerial vehicle (UAVs or Drones) services to industry and government. Hummingbird will be submitting an Expression of Interest to the Wildfire Management Branch (WMB), as part of the upcoming REI on BC Bid, to supply real time aerial data collection and mapping services on wildfires.

In order to provide such services, Hummingbird needs a Special Flight Operations Certificate (SFOC) from Transport Canada. Transport Canada is willing to issue a SFOC to Hummingbird for the entire 2015 fire season (May 1 – November 30, 2015) to allow us to fly UAVs within the Class F restricted airspace above a wildfire, with the WMB's permission. The extensive SFOC application is near completion. As part of the application, Transport Canada requires a letter from the Wildfire Management Branch stating *'the WMB will consider using Hummingbird Drones to conduct unmanned aerial vehicle flights within Class F restricted air space above wildfires on an as required basis.'*

This letter does not place the WMB under any obligation to use Hummingbird, nor does it give permission to Hummingbird to operate above wildfires. It is simply an acknowledgement that the WMB may use or test these services during the 2015 wildfire season. An SFOC will not be provided to Hummingbird by Transport Canada without a letter from the WMB. The SFOC process will take 30-60 days to complete, so a timely decision is required to move this process forward in preparation for the 2015 fire season.

Hummingbird Drones has proven UAVs and technology that will greatly enhance the ability of the Wildfire Management Branch to safely and efficiently manage B.C.'s wildfire suppression activities through a wide range of real time digital mapping services. To test and prove the value of these services, the WMB needs to acknowledge in writing that they are willing to allow Hummingbird to operate in the restricted airspace above a wildfire subject to the WMB's own policies and procedures.

This will allow Hummingbird to apply for and receive a SFOC from Transport Canada to legally carry out flight operations.

I am requesting a letter, as described above, from the WMB that will allow us to move forward with our SFOC application so we can demonstrate our high quality services under actual wildfire conditions.

Thank you for your consideration.

A handwritten signature in black ink, appearing to read "R Atwood". The signature is stylized with a large, looped "R" and a cursive "Atwood".

Robert Atwood
President & CEO
250.877.7082

Wilson, John MTIC:EX

From: Skrepnek, Kevin FLNR:EX
Sent: Thursday, November 27, 2014 10:30 PM
To: Marek, Dave FLNR:EX
Cc: Pepper, Kayla FLNR:EX
Subject: RE: Air

Nicely done on their part, but one inconsistency for our business: the first link (the flow chart) indicates no flying within 9km of a forest fire (in the "DO NOT" section on the bottom of page 2) but in the main page (second link) it just says not to fly "near" a forest fire.



Kevin Skrepnek

Provincial Wildfire Information Officer
B.C. Wildfire Management Branch | Provincial Wildfire Coordination Centre
Office: 250-312-3052 Cell: 250-318-4782 Media: 250-312-3051

From: Marek, Dave FLNR:EX
Sent: Thursday, November 27, 2014 2:07 PM
To: Skrepnek, Kevin FLNR:EX
Subject: FW: Air

fyi

From: Sutherland, Andrew CSNR:EX
Sent: Thursday, November 27, 2014 1:58 PM
To: Marek, Dave FLNR:EX
Subject: Air

[http://www.tc.gc.ca/media/documents/ca-standards/Infographic Permission to fly a UAV Print English.pdf](http://www.tc.gc.ca/media/documents/ca-standards/Infographic%20Permission%20to%20fly%20a%20UAV%20Print%20English.pdf)

http://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-uav-2265.htm?campaign=2014-uav-socialmedia-twitter&WT.mc_id=pjflb#safety

Andrew Sutherland
Technology Services
Natural Resource Sector
Provincial Wildfire Coordination Centre
250 312-3049
250 318-3721 (cell)

Wilson, John MTIC:EX

From: Naylor, Jennifer A FLNR:EX
Sent: Monday, April 13, 2015 3:45 PM
To: Marek, Dave FLNR:EX
Subject: RE: Drones in the Field

Interesting, I have also contacted the imagery lead at GeoBC because they have been researching the use of drones for imagery and mapping data collection. I'll link the two of you, if he send me anything of value.

Cody Crocker will be attending on Thursday and possibly Devona on behalf of WMBGEO.

Jen

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice: 250.286.9367 📱 Cell: 250.203-3221
Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Marek, Dave FLNR:EX
Sent: Monday, April 13, 2015 3:40 PM
To: Naylor, Jennifer A FLNR:EX
Subject: RE: Drones in the Field

s.13,s.17

From: Naylor, Jennifer A FLNR:EX
Sent: Friday, April 10, 2015 4:39 PM
To: Marek, Dave FLNR:EX
Subject: RE: Drones in the Field

Who is "this company". I know of three other companies who have contacted me to let me know they have this service available if we are interested. I am unable to attend next week but I am trying to see if I can get one of our experienced Wildfire TEAMS GIS people from Kamloops to go on my behalf. We currently have no WMB GIS staff in Kamloops - I am working on changing that, an auxiliary for now and maybe a permanent position in the future.

Regards,

jen

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice: 250.286.9367 📱 Cell: 250.203-3221
Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Marek, Dave FLNR:EX
Sent: Friday, April 10, 2015 3:34 PM
To: Naylor, Jennifer A FLNR:EX
Subject: RE: Drones in the Field

s.13,s.17

s.13,s.1 Have a great weekend, dave

From: Naylor, Jennifer A FLNR:EX
Sent: Thursday, April 9, 2015 3:51 PM
To: Marek, Dave FLNR:EX
Cc: WMBGEO WMB P FLNR:EX
Subject: RE: Drones in the Field

Here was our conversation last year as an FYI. Melinda just mentioned there was discussion at a meeting in Kamloops where Andy Lowe mentioned that the use of drones was coming in the future but not this fire season. So I look forward to hearing about any developments, and I definitely think we need a standard response for inquiries and/or a point of contact for follow-up.

Thanks,

Jen

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice: 250.286.9367 📠 Cell: 250.203-3221
Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Marek, Dave FLNR:EX
Sent: Thursday, October 9, 2014 3:35 PM
To: Naylor, Jennifer A FLNR:EX; Benson, Michael FLNR:EX
Cc: Meier, Ian R FLNR:EX; Young, Bruce R FLNR:EX
Subject: RE: Drones in the Field

Thx Jen, I will reply for Mike. UAV's, drones etc etc, have been on our radar for a few years now. Ideas of their uses have been coming at our shop for about as long. It is a HUGE safety issue with Transport Canada. We had a situation this summer where an operator of a drone chose to get photos of a fire after helicopters were finished (so he thought). Fires are regulated with a Notam (notice to airman) and no flying of any aircraft is permitted other than our own. These aircraft are regulated and if are going to use them for commercial operations, we are going to have to ensure that ALL aspects are complied with. See attached web link. There is room for them, what it is we are not sure, US experimenting with some idea's but people have to realize that they are regulated!! Stay tuned, thx dave

<http://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-uav-2265.htm>

From: Naylor, Jennifer A FLNR:EX
Sent: October-09-14 11:40 AM
To: Benson, Michael FLNR:EX

Cc: Marek, Dave FLNR:EX; Meier, Ian R FLNR:EX; Young, Bruce R FLNR:EX

Subject: Drones in the Field

Mike,

We briefly talked about the use of drones and whether anyone in our branch was exploring their use in our branch. I was wondering if you were following the forum thread on the @work site referenced below. There are references to Washington State testing them for Wildfire. I know there are linkages to both our program areas - GIS would be the technical lead for the data collected, but aviation is the group responsible for thermal imaging. My assumption is that your group would also be responsible to lead any research or field questions or inquires related to drones?

<https://gww.gov.bc.ca/forum/technology/2014/1002/drones-field>

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice:
250.286.9367 📠 Cell: 250.203-3221

Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (*FORWMBP.WMBGEO@gov.bc.ca*)

For GIS Support for the 2014 Fireseason please email WMBGEO or call the PWCC GIC Coordinator at: 250-312-3050 (desk) or 778-679-5355 (cell)

Wilson, John MTIC:EX

From: Meier, Ian R FLNR:EX
Sent: Thursday, October 9, 2014 5:53 PM
To: Marek, Dave FLNR:EX
Subject: Re: Drones in the Field

Well said Dave...

Ian Meier,
Director
Wildfire Management Branch
250 847 - 6640 (office)
250 643 - 0078 (cell)

On Oct 9, 2014, at 15:35, "Marek, Dave FLNR:EX" <dave.marek@gov.bc.ca> wrote:

Thx Jen, I will reply for Mike. UAV's, drones etc etc, have been on our radar for a few years now. Ideas of their uses have been coming at our shop for about as long. It is a HUGE safety issue with Transport Canada. We had a situation this summer where an operator of a drone chose to get photos of a fire after helicopters were finished (so he thought). Fires are regulated with a Notam (notice to airman) and no flying of any aircraft is permitted other than our own. These aircraft are regulated and if are going to use them for commercial operations, we are going to have to ensure that ALL aspects are complied with. See attached web link. There is room for them, what it is we are not sure, US experimenting with some idea's but people have to realize that they are regulated!! Stay tuned, thx dave
<http://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-uav-2265.htm>

From: Naylor, Jennifer A FLNR:EX
Sent: October-09-14 11:40 AM
To: Benson, Michael FLNR:EX
Cc: Marek, Dave FLNR:EX; Meier, Ian R FLNR:EX; Young, Bruce R FLNR:EX
Subject: Drones in the Field

Mike,

We briefly talked about the use of drones and whether anyone in our branch was exploring their use in our branch. I was wondering if you were following the forum thread on the @work site referenced below. There are references to Washington State testing them for Wildfire. I know there are linkages to both our program areas - GIS would be the technical lead for the data collected, but aviation is the group responsible for thermal imaging. My assumption is that your group would also be responsible to lead any research or field questions or inquires related to drones?

<https://gww.gov.bc.ca/forum/technology/2014/1002/drones-field>

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch |

☎ Voice: 250.286.9367 📠 Cell: 250.203-3221

Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO

(FORWMBP.WMBGEO@gov.bc.ca)

For GIS Support for the 2014 Fireseason please email WMBGEO or call the PWCC GIC Coordinator at: 250-312-3050 (desk) or 778-679-5355 (cell)

Wilson, John MTIC:EX

From: Young, Bruce R FLNR:EX
Sent: Monday, July 7, 2014 1:16 PM
To: Marek, Dave FLNR:EX; Benson, Michael FLNR:EX
Subject: FW: FPInnovations - UAV demo
Attachments: UAS demo invitation Hinton July17.pdf

We should discuss to see if there is someone who can attend this on behalf of the Program.

From: Ray Ault [<mailto:Ray.Ault@fpinnovations.ca>]
Sent: Monday, June 30, 2014 3:18 PM
To: Young, Bruce R FLNR:EX
Cc: Chad Gardeski; Mark Ryans; Benson, Michael FLNR:EX
Subject: FPInnovations - UAV demo

Bruce,

Hope all is well, it is a while since we have talked. You had asked some questions related to the future of UAV at a December 2012 presentation and I thought you might be interested in current developments.

Attached is an invite to a UAV / UAS demo in Hinton on July 17th. This project is coordinated by our Forest Operations Division and the wildfire operations research program interest is specific to detecting hold over fires in harvest debris piles.

Please let me know if an observer from Wildfire Management Branch would be interested in attending. Given it is short notice, if someone from BC is unable to attend I will endeavor to keep Mike Benson in the loop as to how the project proceeds and we will be presenting the summers results at the October 21 advisory meeting in Edmonton. Mike usually attends this meeting for BC.

Have a safe summer, Ray



Ray Ault
Program Leader, Wildfire Operations Research
1176 Switzer Dr, Hinton (AB) T7V 1V3
☎ 780 817 1840 📠 780-865-8266
✉ ray.ault@fpinnovations.ca

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Unmanned Aerial Systems for Forestry in Alberta: Kickoff Workshop and Field Demo

Thursday July 17th, 2014

Hinton Training Centre

1176 Switzer Drive

Hinton, AB

For registration, please contact:

Chad Gardeski

Extension Specialist

780-817-1440

chad.gardeski@fpinnovations.ca

Agenda

Unmanned Aerial Systems (UAS) for forestry in Alberta: Kickoff Workshop and Field Demo
Thursday July 17th, 2014
Hinton Training Centre (room 134) and Cache Percotte Forest

FPIInnovations recently received a grant from Alberta Enterprise and Advanced Education to evaluate forestry applications of UAS in Alberta with the cooperation of Millar Western, Weyerhaeuser, West Fraser and Alberta Environment and Sustainable Resource Development (ESRD). Over the next two years, this project will test at least seven applications of specific interest to the Alberta forest industry with the aim of potentially replacing costly aircraft and ground methods. This workshop will kick off the project by giving cooperators the opportunity to see the technology in action and discuss early results.

Welcome presentation (Mark Ryans, FPIInnovations)	10:00
FPIInnovations program on UAS and Alberta initiative (Denis Cormier, FPIInnovations)	10:15
Early results from Hinton trials (Udaya Vepakomma, FPIInnovations)	10:45
Local solution oriented UAS services (Ellen Christopherson, Elevated Robotic Services Inc.)	11:15
Open discussion on project agenda	11:45
Lunch (provided at the HTC dining room)	12:00
Gathering for UAV demonstration	13:00
UAV demonstration at Cache Percotte Forest (various technologies will be demonstrated by FPIInnovations and Elevated Robotic Services)	13:15 to 15:00

FPIInnovations



Alberta

Innovation and
Advanced Education



Elevated
Robotic Services



National Resources
Canada

Ressources naturelles
Canada



OUR NAME IS INNOVATION

Wilson, John MTIC:EX

From: Newton, Steve JAG:EX
Sent: Tuesday, April 21, 2015 12:18 PM
To: Marek, Dave FLNR:EX; Morrison, Andrew JAG:EX
Subject: RE: Newt UAV Question

Andrew, meet Dave. He is the Superintendent of Aviation Management for WMB.
Dave, meet Andrew. He is our Provincial SAR Specialist.

s.13,s.17

Newt...

Steve Newton

Regional Manager, Central Region

EMERGENCY MANAGEMENT BC

1255-D Dalhousie Drive
Kamloops, BC V2C 5Z5 CANADA
www.embc.gov.bc.ca

*Ph. 250.371.5268 Fax 250.371.5246
24 Hour Emergency Reporting 1.800.663.3456*

From: Marek, Dave FLNR:EX
Sent: Tuesday, April 21, 2015 12:11
To: Newton, Steve JAG:EX
Subject: RE: Newt UAV Question

Hey there, we had a presentation from a local company in regards to what service they may provide, what hoops and loops they have to jump through etc but we did not fly one. s.13,s.17
s.13,s.17

From: Newton, Steve JAG:EX
Sent: Tuesday, April 21, 2015 9:47 AM
To: Marek, Dave FLNR:EX
Subject: Newt UAV Question

Dave,

I understand that WMB was playing around with a UAV a week or two back here in Kamloops. Someone from our shop would like to talk to someone from your shop about that experience. Who would be the main contact?

Thanks...

Newt...

Wilson, John MTIC:EX

From: Patrick Crawford s.22
Sent: Sunday, September 22, 2013 6:10 PM
To: Marek, Dave FLNR:EX
Subject: Re: UAV Research Project at UBC

Hey Dave,

I am sure we can arrange a presentation, also happy to answer any questions via e-mail/conference call. We are both based in Vancouver at the moment, so it would take some preparation to get to Kamloops to present, but it can be arranged.

FYI I have been back and forth with FP Innovations, as Dr. Coops research is often closely related with their work. I have talked to FP about UAV work/research, and they are currently looking for an expert to join their ranks to begin investigating UAV use. They have expressed interest in working with Colin and I in the future, as we do have the right expertise for the proposed operations/research. Dr. Coops is working on bringing FP onto this project as a sponsor/contributor, so they will certainly be involved and in the loop on this research as well. His plan was to go to FP with the proposal after receiving a letter of support from your office to demonstrate that the project is all set-up and ready to move, just so things can move along quickly.

Cheers,

Patrick

On Fri, Sep 20, 2013 at 7:50 AM, Marek, Dave FLNR:EX <dave.marek@gov.bc.ca> wrote:

Thx guys, do you have something you can present, normally we would go through FP Innovations for this type of work.....will see what i can do!! dave

From: Patrick Crawford [mailto:s.22]
Sent: Thursday, September 19, 2013 4:42 PM

To: Marek, Dave FLNR:EX
Cc: Colin O'Neill
Subject: Re: UAV Research Project at UBC

Hey Dave,

We'd like to submit the NSERC grant proposal in about 5 weeks. So, would be great to figure out basic details and how this could all work by then. For this proposal we only need a fairly basic letter of support (with some description and allowing us access to fires and people come the new year), but not much beyond that. Definitely have some time, hope things calm down for you quick! Look forward to speaking soon.

Cheers,

Patrick

On Thu, Sep 19, 2013 at 8:11 AM, Marek, Dave FLNR:EX <dave.marek@gov.bc.ca> wrote:

Hey guys, thx for the update. How much time do I have to respond. Up to my eye balls right now and little help with a time line would be greatly appreciated. Thx dave

-----Original Message-----

From: Patrick Crawford [mailto:^{s.22}]
Sent: Wednesday, September 18, 2013 5:59 PM
To: Marek, Dave FLNR:EX
Cc: Colin O'Neill
Subject: UAV Research Project at UBC

Hi Dave,

I hope you're having a great week! Colin O'Neill and myself met with you in Kamloops back in June to discuss the possible use of UAVs in your operations.

Just to refresh, I'm an engineering student at UBC and have built UAVs into my academic research and activities (I am also a pilot). I have been working hard to get others around the university excited about the possibilities of UAV technology. I am especially interested in building understanding of how UAV technology can be applied to work such as yours. Ultimately, our goal is to create a commercial operation to offer comprehensive UAV services. But, as we all know, the technology must be proven out to understand exactly how these platforms can be utilized in work such as wildfire management. Included in this would be understanding operational capabilities, all safety aspects, data analysis, operational standards, and integration into current techniques.

We have made significant, positive movement with our efforts to build momentum. We are currently in an incredibly exciting position. Dr.

Nicholas Coops, world leading researcher, Canada Research Chair of Remote Sensing and a professor in the Faculty of Forestry here at UBC and ourselves (Spire Aerobotics, our start-up company) are currently applying for a combined NSERC grant to receive funding to answer specific questions related to the use of UAVs in wildfire scenarios.

The funds will help allow us to have a UAV platform on hand, have graduate students working on the research and building/utilizing software to do data analysis and presentation.

s.13,s.21

Naturally, I am looking to you to build a strong connection to work together with you. I think it's an incredibly exciting position for all of us. We are specifically looking for the opportunity to do test flights over controlled burns in the spring and hopefully be able to prove out the technology to be in the position to work project fires come next fire season.

I am ultimately looking for a letter of support to offer access to fires and knowledge sharing as we move

forward with this research.

This will be an important relationship as we apply for the NSERC grant.

I am very excited about exploring the use of UAVs in wildfire management and I think we're in the perfect position to explore these possibilities together. I think there will be a variety of large benefits to you as UAVs become integrated into operations, and I'm excited for us to be at the forefront of this innovation. I look forward to speaking with you soon!

Cheers,

Patrick

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Patrick J. Crawford
s.22

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--

Patrick J. Crawford
s.22

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Wilson, John MTIC:EX

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s.13,s.21

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Cheers,

Patrick

Wilson, John MTIC:EX

From: WMBGEO WMB P FLNR:EX
Sent: Thursday, April 9, 2015 3:36 PM
To: Marek, Dave FLNR:EX
Subject: RE: UAV's

Sounds good appreciate being kept I the loop. ☺

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice:
250.286.9367 📠 Cell: 250.203-3221

Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Marek, Dave FLNR:EX
Sent: Thursday, April 9, 2015 2:58 PM
To: WMBGEO WMB P FLNR:EX
Subject: RE: UAV's

I will call you at some point, briefing note etc, may not be today, soon though, dave

From: WMBGEO WMB P FLNR:EX
Sent: Thursday, April 9, 2015 2:56 PM
To: Marek, Dave FLNR:EX
Cc: WMBGEO WMB P FLNR:EX
Subject: RE: UAV's

Hey Dave,

Happy to discuss. We too regularly receive interest regarding UAV's and we have discussed this in the past. I think these inquiries are only going to increase and it would be in our best interest to have a standard response email to ensure there is consistent messaging and a common understanding. I think Kevin's Information Group could probably help with this.

s.13,s.17

Regards,

Jen

Jennifer Naylor

Geospatial Specialist and Coordinator | WMB Geospatial Services | Wildfire Management Branch | 📞Voice:
250.286.9367 📠 Cell: 250.203-3221

Jennifer.Naylor@gov.bc.ca

For Wildfire Management Branch Geospatial support email: WMBGEO (FORWMBP.WMBGEO@gov.bc.ca)

From: Marek, Dave FLNR:EX

Sent: Wednesday, April 8, 2015 1:18 PM

To: Naylor, Jennifer A FLNR:EX

Subject: UAV's

Hey there rock star!!!! Where do you want to go with UAV's re mapping/scanning etc etc. Getting some interest and we should probably try to control things before they try to control us. Thoughts, we can chat on the phone if you would like!!! Cheers Dave

David Marek

Superintendent of Aviation Management

Provincial Wildfire Coordination Center

Wildfire Management Branch

Ministry of Forests, Lands and Natural Resource Operations

Kamloops, British Columbia, Canada

250-312-3008 (o)

778-257-0683 ©