Transport Canada Transports Canada

TERMS OF REFERENCE

Transport Canada Civil Aviation

Unmanned Air Vehicle (UAV) Systems
Program Design Working Group

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RDIMS No. 5705889(E)
SGDDI N° 5705631(F)

Canada

TERMS OF REFERENCE

UNMANNED AIR VEHICLE (UAV) SYSTEMS PROGRAM DESIGN WORKING GROUP

BACKGROUND

In December 2006, the General Aviation branch convened a joint government and industry Unmanned Air Vehicle (UAV) Working Group to review existing legislation and make recommendations for a regulatory framework for UAV operations. Transport Canada decided that the UAV Working Group would not be assigned by the Canadian Aviation Regulation Advisory Council (CARAC). However, it was understood that the recommendations by the UAV Working Group to amend existing regulations and develop new regulations would be subject to full consultation through CARAC.

The Final Report of the UAV Working Group, dated September 2007, made recommendations regarding new terms and definitions, aircraft registration and marking, flight crew and maintainer licensing, maintenance, airworthiness and continuing airworthiness, operational flight rules and operational approval. Amendments to the *Canadian Aviation Regulations* (CARs) were proposed, in addition to recommendations for new regulations and standards. The Final Report also charted a 5-year strategic Work Plan to safely integrate unmanned air vehicles into Canadian domestic airspace. In December 2007, the Final Report was presented to the Civil Aviation Regulatory Committee (CARC) and the Work Plan was approved in principle.

The first key activity outlined in the Work Plan was the creation of a new Working Group to review the Special Flight Operations Certificate (SFOC) process. In June 2008, the SFOC Working Group completed their work. This resulted in an amended *Staff Instruction for the Review and Processing of an Application for a Special Flight Operations Certificate for the Operation of an Unmanned Air Vehicle System.* This Staff Instruction was published on Transport Canada's website in December 2008.

In March 2009, Transport Canada created a UAV Steering Committee to bring together government agencies and UAV associations. The second meeting of the Steering Committee was held in July 2009, whereby a motion was passed to form a new working group to proceed with implementing the remaining recommendations contained in the UAV Working Group 2007 Final Report. The Steering Committee has now been dissolved.

PURPOSE

The purpose of this new Unmanned Air Vehicle (UAV) Systems Program Design Working Group is to make recommendations for amendments to existing regulations and standards and to introduce new regulations and standards for the safe integration of routine UAV operations in Canadian airspace. The UAV Working Group 2007 Final Report will serve as a starting point to develop these recommendations. The recommendations developed will require justifications since they will ultimately serve as the basis for Transport Canada to develop the Notices of Proposed Amendments (NPAs) that will be presented to the CARAC Technical Committee. In

addition, recommendations will be made for any non-regulatory instruments that will be required to promote the safe integration of routine UAV operations in Canadian airspace.

SCOPE

With the following exceptions, the UAV Systems Program Design Working Group will examine all issues required for safe integration. The following list of items will not initially be included in the scope, however, in future if it becomes necessary to include these items as part of the Working Group's mandate, approval to work on these issues must first be sought from the Technical Committee.

- SFOC Staff Instruction amendments;
- UAVs operating inside buildings or underground;
- UAVs with passengers on board;
- Disposable UAVs;
- Spectrum management regulations (i.e. responsibility of Industry Canada);
- Reporting UAV occurrences (i.e. responsibility of the Transportation Safety Board); and
- Search and rescue for downed UAVs (i.e. responsibility of 1 Cdn Air Div).

Consideration will be given to a single UAV being controlled from one control station, multiple aircraft controlled from one control station as well as multiple stations sharing control of a single aircraft (i.e. UAV handed off to the next station).

The assumptions made in the UAV Working Group 2007 Final Report will guide the work of the UAV Systems Program Design Working Group:

a. UAVs will integrate into the existing airspace structure in a safe manner;
b. UAVs will not create any greater hazards than manned aircraft;
c. UAVS will have access to all classes of airspace, providing the appropriate equipment requirements and other qualifying requirements have been met;
d. The air vehicle, payloads, communications architecture and command and control (control station) are all part of the total UAS;
e. All UAS will have a pilot-in-command who always has responsibility for the aircraft;
f. UAVs will comply with ATC instructions, clearances and procedures;
g. Each manufacturer will produce Instructions for Continued Airworthiness (ICAs) in accordance with a Transport Canada approved/accepted standard; and
h. UAV operations will be conducted without amendments to the "airspace use" regulations and practices, including air traffic management. Changes may, however, be necessary in future.

Where the UAV Systems Program Design Working Group determines that a deviation from the assumptions are justified, approval must be sought from the main Working Group.

The UAV Working Group recommended that both the UAV industry and Transport Canada would best be served by focusing initial regulatory efforts on small UAV systems, since it is expected that these systems will constitute the majority of the short-term emerging market. Therefore, the sequence of the work assigned to the UAV Systems Program Design Working Group will be conducted in accordance with section 19 (Regulatory Framework Summary) of the

UAV Working Group 2007 Final Report. This will result in four distinct phases of work. Since the work will extend over a period of time and over a number of issues, the UAV Systems Program Design Working Group will be a Standing Working Group in accordance with section 5.4.1 of the *CARAC Management Charter and Procedures*.

The UAV Systems Program Design Working Group will be divided into a main Working Group and three subgroups.

To break the work of the main working group and its subgroups into manageable phases, the Working Group will consider classes of recommendations based on:

1. within or beyond visual range operations, with a clear definition of this concept as a deliverable;

2. maximum weight of the aircraft (provisionally below 35 Kg, between 35 Kg and 150 Kg, and above 150 Kg) with rationale for these weight classes as a deliverable. Consideration will be given to any differences in requirements resulting from operational type, differing weight, kinetic energy and frangibility characteristics of the aircraft; and

3. type of operation of the unmanned air vehicle system.

The subgroups will be responsible for making recommendations to the main Working Group in accordance with their assigned tasks. The subgroups will provide an interim report to the main Working Group after each phase of work is completed. The four phases will be individually finalized without ending the mandate of the UAV Systems Program Design Working Group. The main Working Group will be responsible for reviewing and consolidating the recommendations created by the subgroups and will present the results to the Technical Committee. The main Working Group will also be responsible for making recommendations regarding UAV-specific liability insurance regulations.

Three Subgroups

Three subgroups will be created according to the following subject areas: People, Product and Operations and Access to Airspace.

Subgroup 1 - People (i.e. CARs Part IV)

- Pilot and System Operator Training
- Pilot and System Operator Competencies and Licensing
- Pilot and System Operator Medical Requirements
- Pilot and System Operator Recency Requirements
- UAV System Maintainer Competencies and Licensing

Subgroup 2 – Product (i.e. CARs Part II, V)

- Aircraft Registration and Marking
- Flight Authorities
- Aircraft and system products including: engines, airframes, command, control and communications systems, control stations, launch and recovery systems, flight termination systems, transportation of cargo (including dangerous goods) and sense and avoid systems
- Airworthiness Design Standard (aircraft under 150 Kg)
- Type certification (aircraft over 150 Kg)
- Maintenance and manufacturing
- Continuing airworthiness

Subgroup 3 – Operations and Access to Airspace (i.e. CARs Part I, III, VI, VII, VIII)

- Terminology and definitions
- Aerodrome requirements
- Operating and Flight Rules
- Aircraft requirements (i.e. air and ground components including aircraft lighting, operational limitations, control link and control station security requirements, collision avoidance requirements)
- Operating Certificates (Private, Commercial, State)
- Safety Management Systems (SMS)

Four Phases

Phase 1
In Phase1, all categories (e.g. fixed wing, rotary wing, glider, airship, alternate shapes) of UAV systems (i.e. a system consists of the aircraft, control station, command, control and communication links and any other elements required for flight) will be addressed where the UAV maximum take-off weight (MTOW) does not exceed 35 Kg and the UAV is operated within visual range and under visual flight rules (VFR), day or night.

Phase 2
In phase 2, all categories of UAV systems will be addressed where the UAV MTOW does not exceed 35 Kg and the UAV is operated beyond visual range and under VFR or instrument flight rules (IFR), day or night.

Phase 3
In Phase 3, all categories of UAV systems will be addressed where the UAV MTOW exceeds 35 Kg up to 150 Kg, and the UAV is operated in any combination of operational situations (i.e. visual range, VFR, beyond visual range, IFR, day or night).

Phase 4
In Phase 4, all categories of UAV systems will be addressed where the UAV MTOW exceeds 150 Kg, and the UAV is operated in any combination of operational situations.

APPROACH

Documentation Review

A documentation review will be conducted at the outset of the UAV Systems Program Design Working Group activities, and after that at appropriate intervals, as new information becomes available. This review may include, but not be limited to: UAV-related outputs from Canadian or foreign Working and Standards groups (e.g. RTCA SC-203, ASTM International Committee F-38, EUROCAE WG-73, JARUS International Coordination Group), regulatory and advisory material from other civil aviation authorities (e.g. FAA, CASA Australia, CAA UK), Canadian or foreign military documents (e.g. DND Technical Airworthiness Manual) as well as available documents from other bodies developing UAV standards, such as NATO, EUROCONTROL and ICAO.

Deliverables - Subgroups

Phase 1 Deliverables

During Phase I, all subgroups will address the requirements associated with the operation of all categories of UAV systems where the UAV MTOW does not exceed 35 Kg and the UAV is operated within visual range and under VFR, day or night. Each subgroup will review the subject areas assigned to it and develop recommendations as appropriate. Subgroup 2 will consider aircraft marking and registration requirements for all sizes and categories of UAVs, thereby eliminating the need for the topic to be addressed in subsequent Phases.

All subgroups will consider micro size UAVs (i.e. dragonfly size) up to 35 Kg. It is anticipated that this may result in the need to make a recommendation to establish a minimum weight or size limit for applying regulations.

Phase 2 Deliverables

During Phase 2, all subgroups will address the requirements associated with the operation of all categories of UAV systems where the UAV MTOW does not exceed 35 Kg and the UAV is operated beyond visual range and under VFR or IFR, day or night. Each subgroup will review the subject areas assigned to it and develop recommendations as appropriate. Phase 2 work is an expansion of Phase 1 work by including beyond visual range and IFR operations. In addition, during Phase 2 work will commence on flight authorities, an airworthiness design standard, operating certificates and safety management systems. Therefore, Phase 2 work will need to devote additional attention to the development of recommendations addressing:

- Beyond visual range operations
- IFR operations (assumes UAV will comply with existing IFR rules)
- Flight Authorities[1]
- Airworthiness Design Standard[2]
- Operating Certificates[3]
- Safety Management Systems[4]

[1] The UAV Working Group 2007 Final Report proposed that a flight authority for a UAV with a MTOW that does not exceed 35 Kg would not be mandated by regulation until the UAV is operated beyond visual range. Subgroup 2 will therefore need to make recommendations on flight authority standards.

[2] Subgroup 2 will begin work in this Phase to develop or adopt an airworthiness design standard for UAV systems where the MTOW of the UAV does not exceed 150 Kg (categories of aircraft to be determined).

[3] Subgroup 3 will begin work in this Phase to make recommendations on new operating certificate standards associated with private, commercial and state UAV system operations. It is intended that the Unmanned Aircraft System Operating Certificate (UOC) will replace the SFOC.

[4] In keeping with the principles of Transport Canada's regulated program, UAV operators will need to develop and maintain an effective Safety Management System. Therefore, subgroup 3 will begin work in this Phase to make recommendations on SMS regulatory standards.

Phase 3 Deliverables

During Phase 3, all subgroups will address the requirements associated with the operation of all categories of UAV systems where the UAV MTOW exceeds 35 Kg up to 150 Kg. Each subgroup will review the subject areas assigned to it and develop recommendations as appropriate. Phase 3 work will be an expansion of Phase 2 work, taking into account larger air vehicles.

Phase 4 Deliverables

During Phase 4, all subgroups will address the requirements associated with the operation of all categories of UAV systems where the UAV MTOW exceeds 150 Kg. Each subgroup will review the subject areas assigned to it and develop recommendations as appropriate. Phase 4 work assumes that type certification standards will be in place that are compliant with international standards (e.g. FAA, ICAO).

Deliverables - Main Working Group

The main Working Group will:

- After each phase of work is completed, review and consolidate the recommendations from the interim reports submitted by the subgroups and present them to the Technical Committee.
- Make recommendations to the Technical Committee regarding UAV-specific insurance requirements.
- Identify immediate needs for staff instructions, guidance material, policy documents, advisory circulars or exemptions and make recommendations to the Director, Standards
- Give consideration to the current polices and regulatory requirements of FAA, ICAO and EASA to ensure harmonization has been achieved to the extent practical.

Constraints on Deliverables

It is recognized that certain constraints after Phase 1 could delay or change the course of the deliverables of the UAV System Program Design Working Group. For example,

- Required new technologies, such as sense and avoid, are key issues that must be addressed to achieve the goal of safe, routine use of the airspace by UAVs. The availability of reliable detect sense and avoid technology is likely to be a significant number of years away, therefore, some of the work in Phase 2, which is dependent on the availability of sense and avoid technology, may be delayed.
- Change to existing airspace management / air navigation procedures – e.g. introduction of Automatic Dependent Surveillance- Broadcast (ADS-B) will certainly influence the integration of UAVs. It is difficult to estimate the full impact or time frames associated with these types of changes.
- The majority of the UAV Working Group 2007 Final Report recommendations were focused on the domestic use of UAVs, as regulations had not yet been established by ICAO and other regulatory agencies. Since the intent is to conform to ICAO standards, and to have similar regulations governing UAV flights to allow transparent cross-border operations with the United States, some of the subgroup work may be delayed, eliminated or otherwise affected.

WORKING GROUP MEMBERSHIP

This Standing Working Group has been designated as the "The Unmanned Air Vehicle (UAV) Systems Program Design Working Group".

Membership in the UAV Systems Program Design Working Group will be selected by the Technical Committee in accordance with the *CARAC Charter*. Membership will consist of representatives from the government and the aviation community, including but not limited to professional associations, UAV system developers, UAV operators, UAV sector associations and academia. While the *CARAC Charter* generally calls for a Working Group to be limited to not more than 10 individuals, it is recognized that the UAV Systems Program Design Working Group composition may need to be larger in order to ensure that the most technically correct solutions to the issues under study are obtained. Membership will be limited, however, to individuals having specialized technical knowledge and who intend to participate actively in Working Group discussions. It is anticipated that there may be an overlap of main and subgroup membership as well as an overlap between subgroups.

Transport Canada will lead the main Working Group. Since the UAV Systems Program Design Working Group term will extend longer than one year, the appointment of the main Working Group Leader shall not be less than one year and no longer than two years. This appointment may be renewed however, as recommended and accepted by CARC, at least every two years. The subgroups will not be led by Transport Canada although subgroup membership may include Transport Canada subject matter experts.

REPORTING

The subgroups will regularly report to the main Working Group. Subgroups will strive toward reaching consensus. On issues where there is no consensus in the subgroup, all views must be properly recorded so as to allow the main Working Group to make recommendations to the Technical Committee on those issues. The subgroup interim reports will include specific recommendations, the rationale upon which those recommendations are based and, where required, details of any dissenting points of view when consensus is not reached.

The main Working Group Chair shall report to the Technical Committee and is responsible for submitting reports to the Technical Committee Chair regarding progress made, decisions reached, updates on schedules and issues which remain unresolved. The main Working Group Leader shall also keep the CARAC Secretariat suitably appraised of the progress of the Working Group so that it may publish relevant information to the CARAC members as required.

TIMING

Establishment of the UAV Systems Program Design Working Group is expected after the June 2010 CARAC Technical Committee meeting. The Working Group will commence work once the Terms of Reference are approved and the members are defined. It is anticipated that the subgroups will present interim reports to the main Working Group according to the following timeframes:

Phase 1	Phase 2	Phase 3	Phase 4
One Year after WG established	Two Years after completion of Phase 1	One year after completion of Phase 2	Two Years after completion of Phase 3

It is anticipated that the subgroups will present a Phase 1 report to the main Working Group by the end of 2011. Based on meeting that timeframe, completion of the subgroups' Phase 4 work would occur by the end of 2016.

BUDGET

Costs incurred by organizations outside Transport Canada will be borne by those organizations.

ADMINISTRATIVE

Transport Canada Civil Aviation will be responsible for providing meeting facilities and secretarial support to the main Working Group.

Accepted by:

_____ _____

UAV Systems Program Design Working Group Leader Date

Approval:

_____ _____

Date

Don Sherritt
Director, Standards
Executive Director, CARAC Technical Committee
Civil Aviation

APPENDIX A

Transport Canada Reference Documents

It is intended that the following reference materials be used in conjunction with this UAV Systems Program Design Working Group.

- *Canadian Aviation Regulations*
  http://www.tc.gc.ca/civilaviation/regserv/affairs/cars/menu.htm
- UAV Working Group Final Report, September 2007
  http://www.tc.gc.ca/civilaviation/general/recavi/uavworkinggroup.htm
- SFOC Review Working Group Final Report, June 2008 (copies will be made available)
- Staff Instruction for The Review and Processing of an Application for a Special Flight Operations Certificate for the Operation of an Unmanned Air Vehicle (UAV) System
  http://www.tc.gc.ca/civilaviation/managementservices/referencecentre/documents/600/623-001.htm
- *CARAC Management Charter and Procedures*- 4th Edition – April 2008
  http://www.tc.gc.ca/civilaviation/RegServ/Affairs/carac/Charter/menu.htm

Industry Reference Documents

It is intended that the following reference materials be consulted in conjunction with this UAV Systems Program Design Working Group. This is not an exhaustive list.

- Small Unmanned Aircraft System Aviation Rulemaking Committee – FAA, April 1, 2009 - Comprehensive set of Recommendations for sUAS Regulatory Development
- CAP 722 – Unmanned Aircraft Systems Operations in UK Airspace – Guidance – CAA UK, Directorate of Airspace Policy – April 6, 2010
- Civil Aviation Safety Regulations – Part 101 – Unmanned Aircraft and Rocket Operations – CASA Australia
- NATO Standardization Agreement (STANAG) 4586 - USAR - UAV Systems Airworthiness Requirements.
- The Canadian Department of National Defence - Technical Airworthiness Manual

APPENDIX B

List of Acronyms

- ADS-B Automatic Dependent Surveillance-Broadcast
- ASTM American Society for Testing and Materials
- CAA Civil Aviation Authority
- CARAC Canadian Aviation Regulation Advisory Council
- CARC Civil Aviation Regulatory Committee
- CARs Canadian Aviation Regulations
- CASA Civil Aviation Safety Authority
- DND Department of National Defence
- EASA European Aviation Safety Agency
- EUROCAE European Organisation for Civil Aviation Equipment
- FAA Federal Aviation Administration
- ICAO International Civil Aviation Organization
- IFR Instrument Flight Rules
- JARUS Joint Authorities for Rulemaking on Unmanned Systems
- MTOW Maximum Take-off Weight
- NATO North Atlantic Treaty Organization
- NPAs Notices of Proposed Amendments
- RTCA Radio Technical Commission for Aeronautics
- SC Special Committee
- SFOC Special Flight Operations Certificate
- SMS Safety Management Systems
- STANAG Standardization Agreement (NATO)
- UAV Unmanned Air Vehicle
- UOC Unmanned Aircraft System Operating Certificate
- VFR Visual Flight Rules
- WG Working Group

APPENDIX C

Main Working Group Membership

Chair: Transport Canada – Ron Carter
Co-Chair: Unmanned Systems Canada – Wayne Crowe

Members: Alphabetical order by organizational name

• Accuas Inc.	Darryl Jacobs
• AeroVations Associates	Gerry Marsters
• Air Canada Pilots Association (ACPA)	Brad Kenyon
• Air Line Pilots Association, Int'l (ALPA)	Réal Levasseur TBD: (Tech Advisor)
• Canadian Air Traffic Controllers Association (CATCA)	Greg Myles
• Canadian Centre for Unmanned Vehicle Systems (CCUVS)	Dewar Donnithorne-Tait
• Canadian Federation of AME Associations (CFAMEA)	Ben McCarty
• Canadian Owners and Pilots Association (COPA)	Kevin Psutka Frank Hofmann (Tech Advisor)
• Department of National Defence (DND)	Major Art Jordan Major Mark Wuennenberg (Tech Advisor)
• Fugro Airborne Surveys Corp.	Richard Partner
• Helicopter Association of Canada (HAC)	Fred Jones
• ING Engineering	Ian Glenn Robb Nesbitt (Tech Advisor)
• InnUVative Systems Inc.	Mike Meakin
• L-3 MAS Canada	Jeremy Cartlidge
• MacDonald Dettwiler and Associates (MDA)	Andrew Carryer
• Model Aeronautics Association of Canada (MAAC)	Richard Lyle Barlow
• MS. Aero Inc.	Mac Sinclair
• National Research Council of Canada (NRC)	Stewart Baillie Kris Ellis (Tech Advisor)
• NAV CANADA	Brian Guimond Kelly Mcllwaine (Tech Advisor) Claude Fortier (Tech Advisor)
• Ontario Provincial Police (OPP)	Marc Sharpe
• Skylink Aviation Inc.	Alexander (Butch) Waldrum
• Transport Canada	Karen Tarr Bob Bancroft Terry Chilibeck
• Universal Wing Technologies Inc.	Declan Sweeney

- University of Waterloo Student — Doug Glussich
- Xiphos Technologies Inc. — Eric Edwards

Subgroup 1 – People (CARs Part IV)

Chair: Transport Canada - Terry Chilibeck

Members:

- ALPA — Réal Levasseur
- CCUVS — Dewar Donnithorne-Tait; Sterling Cripps (Tech Advisor)
- CFAMEA — Ben McCarty
- COPA — Frank Hofmann
- DND — Major Art Jordan
- L-3 MAS Canada — Jeremy Cartlidge
- OPP — Marc Sharpe
- Skylink Aviation Inc. — Butch Waldrum
- Transport Canada — Jason Meunier
- University of Waterloo Student — Doug Glussich

Subgroup 2 – Product (CARs Part II, V)

Chair: NRC – Stewart Baillie

Members:

- Accuas Inc. — Darryl Jacobs
- AeroVations Associates — Gerry Marsters
- DND — TBD
- ING Engineering — Ian Glenn
- InnUVative Systems Inc. — Mike Meakin
- MDA — Andrew Carryer
- NAV CANADA — Brian Guimond
- Transport Canada — Stephen Hallissey; TBD: A/C Certification; TBD: M&M
- Unmanned Systems Canada — Wayne Crowe

Subgroup 3 – Operations and Access to Airspace (CARs Part I, III, VI, VII, VIII)

Chair: Transport Canada – Karen Tarr

Members:

- DND — Mark Wuennenberg
- Fugro Airborne Surveys Corp. — Richard Partner
- ING Engineering — Robb Nesbitt
- MAAC — Richard Lyle Barlow
- MS. Aero Inc. — Mac Sinclair

• NAV CANADA	Kelly Mcllwaine Claude Fortier (Tech Adv)
• NRC	Kris Ellis
• Transport Canada	Al Piche Pete Firlotte
• Universal Wing Technologies Inc.	Declan Sweeney
• Xiphos Technologies Inc.	Eric Edwards

Observers:

• ACPA	Brad Kenyon
• ALPA	TBD
• COPA	Kevin Psutka
• HAC	Fred Jones
• NAV CANADA	Andrew McKenzie
• Transport Action & APSG	Gerry Einarsson