



CIVIL AVIATION AUTHORITY OF FIJI

# STANDARDS DOCUMENT

Operation Of Aircraft

Part IV – International Operations –

Remotely Piloted Aircraft Systems

First Edition

**SD-IO-RPAS**

Published by:

Civil Aviation Authority of Fiji  
Private Mail Bag, NAP 0354  
Nadi International Airport  
Fiji

[www.caaf.org.fj](http://www.caaf.org.fj)

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### Part IV – International Operations – Remotely Piloted Aircraft System

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Private Mail Bag, NAP 0354

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## PREFACE

### General

Fiji's National Aviation Law consists of a three tier regulatory system, comprising Acts, Regulations and Standards Documents; the purpose of which is to ensure, where deemed appropriate, compliance and conformance with ICAO Standards and Recommended Practices (SARPS).

The three tier regulatory system represents Fiji's Primary Legislation System and Specific Operating Regulations to meet Critical Elements CE1 and CE2 of ICAO's Eight Critical Element of a safety oversight system.

Standards Documents (SD) are issued by the Civil Aviation Authority of Fiji under the provision of Section 14 (3) (b) of the Civil Aviation Authority Act 1979 (CAP 174A)

Where appropriate, the SD also contains technical guidance (Critical Element CE5) on standards, practices, and procedures that are acceptable to the Authority.

Notwithstanding the above, and where specifically indicated in this Standards Document that such a provision is available, consideration may be given to other methods of compliance that may be presented to the Authority provided they have compensating factors that can demonstrate a level of safety equivalent to or better than those prescribed herein. Accordingly, the Authority will consider each case based on its own merits holistically in the context of and relevancy of the alternative methods to the individual applicant.

When new standards, practices, or procedures are determined to be acceptable, they will be added to this document.

### Purpose

This Standards Document – **Operation of Aircraft – Part IV- International Operations – Remotely Piloted Aircraft Systems** is issued by the Civil Aviation Authority of Fiji pursuant to Section **14 (3) (b) of the Civil Aviation Authority of Fiji Act 1979**. This Document is intended for use by CAAF, applicants for, and holders of, an **Air Operator** Certificate and for their staff.

### Change Notice

This Standards Document has been developed pursuant to the Authority's obligation to provide oversight on operators and their personnel, as well as the operator's obligation to comply with standards notified by the Authority and is the means by which such notification is given.

.....  
**THERESA LEVESTAM**  
**CHIEF EXECUTIVE**

## RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date entered	Entered by
1			
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CORRIGENDA			
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## ABBREVIATIONS

*(used in this SD)*

ACAS	Airborne collision avoidance system
ADS-B	Automatic dependent surveillance — broadcast
AGL	Above ground level
AIP	Aeronautical information publication
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
BVLOS	Beyond visual line-of-sight
CDL	Configuration deviation list
CNS	Communication, navigation and surveillance
COMAT	Operator material
CPDLC	Controller-pilot data link communications
DAA	Detect and avoid
EDTO	Extended diversion time operations
ELT	Emergency locator transmitter
ERP	Emergency response plan
EUROCAE	European Organisation for Civil Aviation Equipment
FDAP	Flight data analysis programme
FDR	Flight data recorder
FRMS	Fatigue risk management system
GPWS	Ground proximity warning system
HUD	Head-up display
IFR	Instrument flight rules
IMC	Instrument meteorological conditions
MCM	Maintenance control manual
MEL	Minimum equipment list
MMEL	Master minimum equipment list
MCTOM	Maximum certified take-off mass

NM	Nautical mile
NOTOC	Notice to Captain
PBN	Performance-based navigation
QoSD	Quality of service delivered
QoSE	Quality of service experienced
QoSR	Quality of service required

RCP	Required communication performance
RFFS	Rescue and firefighting service
ROC	RPAS operator certificate
RPA	Remotely piloted aircraft
RPA-RS	Remotely piloted aircraft-recorder system
RPAS	Remotely piloted aircraft system(s)
RPAS-RS	Remotely piloted aircraft system-recorder system
RPL	Remote pilot licence
RPS	Remote pilot station(s)
RPS-RS	Remote pilot station-recorder system
RVR	Runway visual range
RVSM	Reduced vertical separation minimum
SLA	Service level agreement
SMS	Safety management system
SSR	Secondary surveillance radar
UAS	Unmanned aircraft system
VLOS	Visual line-of-sight

## PUBLICATIONS

*(referred to in this SD)*

### ICAO Publications

#### Convention and Related Acts

*Convention on International Civil Aviation (Doc 7300)*

*Protocol Relating to an Amendment to the Convention on International Civil Aviation (Article 83 bis) (Doc 9318)*

#### Annexes to the Convention on International Civil Aviation

*Annex 1 — Personnel Licensing*

*Annex 2 — Rules of the Air*

*Annex 4 — Aeronautical Charts*

*Annex 5 — Units of Measurement to be Used in Air and Ground Operations*

*Annex 6 — Operation of Aircraft*

*Part I — International Commercial Air Transport — Aeroplanes*

*Part II — International General Aviation — Aeroplanes*

*Part III — International Operations — Helicopters*

*Annex 7 — Aircraft Nationality and Registration Marks*

*Annex 8 — Airworthiness of Aircraft*

*Annex 9 — Facilitation*

*Annex 10 — Aeronautical Telecommunications*

*Volume II — Communication Procedures including those with PANS status*

*Volume III — Communication Systems (Part I — Digital Data Communication Systems; Part II — Voice Communication Systems)*

*Volume IV — Surveillance and Collision Avoidance Systems*

*Volume VI — Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link*

*Annex 11 — Air Traffic Services*

*Annex 12 — Search and Rescue*

*Annex 13 — Aircraft Accident and Incident Investigation*

*Annex 14 — Aerodromes*

*Volume I — Aerodrome Design and Operations*

*Volume II — Heliports 10*

*Annex 15 — Aeronautical Information Services*

Annex 16 — *Environmental Protection*  
Volume I — *Aircraft Noise*  
Volume II — *Aircraft Engine Emissions*  
Volume III — *Aeroplane CO<sub>2</sub> Emissions*  
Volume IV — *Carbon Offsetting and Reduction Scheme for International Aviation (CORSA)*

Annex 18 — *The Safe Transport of Dangerous Goods by Air*

Annex 19 — *Safety Management*

#### Procedures for Air Navigation Services

*Aerodromes* (Doc 9981)

*AIM — Aeronautical Information Management* (Doc 10066)

*ATM — Air Traffic Management* (Doc 4444)

*OPS — Aircraft Operations* (Doc 8168)  
Volume I — *Flight Procedures*  
Volume II — *Construction of Visual and Instrument Flight Procedures*  
Volume III — *Aircraft Operating Procedures*

*TRG — Training* (Doc 9868)

*Regional Supplementary Procedures* (Doc 7030)

#### Manuals

*Aeronautical Surveillance Manual* (Doc 9924)

*Aeroplane Performance Manual* (Doc 10064)

*Airworthiness Manual* (Doc 9760)

*Aviation Security Manual* (Doc 8973-Restricted)

*Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods* (Doc 9481)

*Flight Planning and Fuel Management (FPFM) Manual* (Doc 9976)

*Guidance for Safe Operations Involving Aeroplane Cargo Compartments* (Doc 10102)

*Helicopter Code of Performance Development Manual* (Doc 10110)

*Human Factors Training Manual* (Doc 9683)

*Manual for the Oversight of Fatigue Management Approaches* (Doc 9966)

*Manual of Aircraft Ground De-icing/Anti-icing Operations* (Doc 9640)

*Manual of All-Weather Operations* (Doc 9365)

*Manual of Criteria for the Qualification of Flight Simulation Training Devices (Doc 9625)*

*Manual of Evidence-based Training (Doc 9995)*

*Manual of Procedures for Establishment and Management of a State's Personnel Licensing System (Doc 9379)*

*Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335)*

*Manual on a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574)*

*Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011)*

*Manual on Flight Data Analysis Programmes (FDAP) (Doc 10000)*

*Manual on Flight Operations Officers/Flight Dispatchers Competency-based Training and Assessment (Doc 10106)*

*Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery (Doc 10054)*

*Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019)*

*Manual on the implementation of Article 83 bis of the Convention on International Civil Aviation (Doc 10059)*

*Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869) (previously titled the Manual on Required Communication Performance (RCP))*

*Performance-based Navigation (PBN) Manual (Doc 9613)*

*Performance-based Navigation (PBN) Operational Approval Manual (Doc 9997)*

*Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587)*

*Guidance on the Preparation of an Operations Manual (Doc 10153)*

*Safety Management Manual (Doc 9859)*

*Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284)*

#### Circulars

*Guidance Material on SST Aircraft Operations (Cir 126)*

*Guidance on the Implementation of Article 83 bis of the Convention on International Civil Aviation (Cir 295)*

#### Other Publications

European Organisation for Civil Aviation Equipment (EUROCAE) Documents ED-76, ED-77, ED-112A and ED-155

International Maritime Organization, *International Regulations for Preventing Collisions at Sea*

RTCA Inc., RTCA DO-200A and RTCA DO-201A

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## FOREWORD

### Overview

An aircraft is defined as “any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface”. An aircraft which is intended to be operated with no pilot on board is classified as unmanned. An unmanned aircraft which is piloted from a remote pilot station is a remotely piloted aircraft (RPA)<sup>1</sup>.

Therefore, RPA are one type of unmanned aircraft. All unmanned aircraft, whether remotely piloted, fully automated or combinations thereof, are subject to the provisions of Article 8 of the Convention on International Civil Aviation (Chicago Convention, Doc 7300), signed at Chicago on 7 December 1944 and amended by the ICAO Assembly.

### Introduction

Standards and Recommended Practices for the *Operation of Aircraft — International Commercial Air Transport* were first adopted by the Council on 10 December 1948 pursuant to the provisions of Article 37 of the Convention on International Civil Aviation (Chicago, 1944) and designated as Annex 6 to the Convention. They became effective on 15 July 1949. On 2 December 1968, Standards and Recommended Practices for the *Operation of Aircraft — International General Aviation — Aeroplanes* was added and, on 14 March 1986, Standards and Recommended Practices for the *Operation of Aircraft, International Operations — Helicopters* was also added. The documents containing these Standards and Recommended Practices are now designated as Annex 6, Parts I, II and III respectively, to the Convention. All three parts, however, are specifically applicable to aircraft operations where the flight crew and, in most cases passengers, are on board the aircraft. The operation of aircraft which are remotely piloted is not addressed.

Annex 6, Part IV was created as a means of providing Standards and Recommended Practices for the operation of a remotely piloted aircraft system (RPAS). This first edition introduces provisions required for international RPAS operations and details the information that is required for a State to issue an RPAS operator certificate (ROC). These requirements were developed by the RPAS Panel on behalf of the Air Navigation Commission and adopted by the Council on [date]. They became effective on 22 July 2024 and applicable on 26 November 2026. Additional Standards and Recommended Practices covering other aspects of RPAS operations will be developed as topics mature. In the interim, for those aspects that are not yet addressed in Part IV, but for which Standards and Recommended Practices already exist in Parts I, II or III, it is intended that RPAS be operated in a manner that is consistent with those provisions, as appropriate.

In developing this material, the RPASP was guided by the following principles:

*Presentation and conformity with Annex 6, Parts I, II and III.* Part IV is equivalent in scope and it conforms, as closely as possible, to the other Parts of Annex 6.

*Level of safety,* the provisions provide the basis to ensure that RPAS will be operated in such a manner as to minimize hazards to persons, property and other aircraft.

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<sup>1</sup> Annex 7, 2.2.

## Categories of operation

The operation of unmanned aircraft (UA) should be regulated in a manner that is proportionate to the risk of the particular operation. Considering the broad range of operations and types of UA, it is appropriate that categories for operations and an associated regulatory regime covering the whole range of possible operations be established by States. Such a categorization scheme is outlined below:

- a) **Open** (low risk). For this category, provided that operations are conducted within defined limitations (e.g. visual line-of-sight (VLOS) only, specified distances from aerodromes and persons, maximum height above ground level (AGL), etc.), flights can take place without the need for an authorization from the appropriate authority.
- b) **Specific** (medium risk/regulated lower risk). This category of operation would require an operational authorization from an appropriate authority prior to the flight(s) taking place; appropriate limitations/restrictions would be applied based on the type of operation, complexity of the UAS and the specific qualifications and experience of operating personnel. Approval for the operation would be based on analysis of a safety risk assessment and any mitigations employed to reduce any risks to an acceptable level. This category encompasses operations where the risk to persons being overflown is greater than what would be permitted in category a), or involves sharing the airspace with other manned or unmanned aircraft, but is at a level below that where the full application of manned aviation principles would be warranted.
- c) **Certified** (certified airworthiness approach). This category utilizes the same method used for regulating manned aviation, because the aviation risks, and hence the aviation safety requirements, associated with the operation have increased to an equivalent level. Operator certification, remote flight crew licensing and RPA certification will be required due to the higher associated risk. Operations in this category are primarily considered to be flown beyond visual line-of-sight (BVLOS), however portions of the flight (i.e., launch and recovery) may operate within VLOS.

The SARPs within Part IV to Annex 6 contain the requirements to regulate international operations in the *Certified* category.

Table A shows the origin of subsequent amendments together with a list of the principal subjects involved and the dates on which the Annex and the amendments were adopted by the Council, when they became effective and when they became applicable.

## Applicability

The Standards and Recommended Practices in Annex 6, Part IV, are applicable to the operation of RPAS certificated in accordance with Annex 8 by operators authorized to conduct international RPAS operations.

In accordance with Article 31 of the Convention on International Civil Aviation, every aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued, or rendered valid, by the State in which it is registered. Furthermore, for the conduct of international operations, Annex 2, Appendix 4 requires that in order to operate RPAS certificated in accordance with Annex 8, operators have an RPAS operator certificate issued in accordance with the provisions of Annex 6, Part IV and that remote pilots be licensed, or have their licences rendered valid, in accordance with the provisions of Annex 1.

The provisions contained herein do not apply to *Open* and *Specific* category operations.

While the application of the provisions of Annex 6, Part IV is clearly defined, States are encouraged to apply the SARPs contained herein for domestic RPAS operations, as appropriate.

Operators of remotely piloted aircraft systems for which applicable airworthiness international Standards are not contained in Annex 8, such as those in the *Open* or *Specific* categories, may conduct cross-border operations, in accordance with the national regulations of each State involved. “Cross-border” operations are those where an RPA crosses the sovereign or territorial borders of two or more States, or when the RPA and the RPS are in different States. It also includes RPA

operations within the sovereign or territorial borders of a State different from the State of Registry; however, it does not include operations where either the RPA or the RPS are over or on the high seas.

Annex 6, Part IV SARPs were largely developed based on operations under instrument flight rules (IFR). States are encouraged to apply the SARPs provided herein for domestic RPAS operations, as appropriate. Unlike Annex 6, Parts I, II and III, which are specific to either aeroplanes or helicopters, Part IV applies to both aeroplane and helicopter categories that can be remotely piloted. In cases where a particular aircraft can, by design, be flown with a pilot on board or be remotely piloted, Part IV applies when the aircraft is being remotely piloted.

Annex 6, Part IV is applicable to the conduct of any international RPAS operation without distinction between commercial air transport and general aviation, including aerial work.

Unless otherwise stated, these provisions are applicable to both remotely piloted aeroplanes and remotely piloted helicopters without distinction between commercial air transport and general aviation, including aerial work. Where the Standards apply to both remotely piloted aeroplanes and remotely piloted helicopters, the Standards refer to RPA. Where they apply to one or the other, a clear distinction is made between remotely piloted aeroplane and remotely piloted helicopter.

## Actions by Contracting States

*Notification of differences.* The attention of Contracting States is drawn to the obligation imposed by Article 38 of the Convention on International Civil Aviation by which Contracting States are required to notify the Organisation of any differences between their national regulations and practices and the International Standards contained in Annex 6 Part IV and any amendments thereto. Contracting States are invited to extend such notification to any differences from the Recommended Practices contained in Annex 6 Part IV, and any amendments thereto, when the notification of such differences is important for the safety of air navigation. Further, Contracting States are invited to keep the Organisation currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. A specific request for notification of differences will be sent to Contracting States immediately after the adoption of each amendment to Annex 6 Part IV.

Attention of States is also drawn to the provisions of Annex 15 related to the publication of differences between their national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Information Service, in addition to the obligation of States under Article 38 of the Convention on International Civil Aviation.

*Promulgation of information.* The establishment, withdrawal of and changes to facilities, services and procedures affecting RPAS operations provided in accordance with the Standards and Recommended Practices specified in Annex 6 Part IV should be notified and take effect in accordance with the provisions of Annex 15.

*Use of the text of the Annex in national regulations.* The Council, on 13 April 1948, adopted a resolution inviting the attention of Contracting States to the desirability of using in their own national regulations, as far as is practicable, the precise language of those ICAO Standards that are of a regulatory character and also of indicating departures from the Standards, including any additional national regulations that are important for the safety or regularity of air navigation. Wherever possible, the provisions of Annex 6 Part IV have been written in such a way as would facilitate incorporation, without major textual changes, into national legislation.

## Status of Annex components

An Annex is made up of the following component parts, not all of which, however, are necessarily found in every Annex; they have the status indicated:

1. — *Material comprising the Annex proper:*

- a) *Standards and Recommended Practices* adopted by the Council under the provisions of the Convention on International Civil Aviation. They are defined as follows:

*Standard:* Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38.

*Recommended Practice:* Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention on International Civil Aviation.

- b) *Appendices* comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council.
- c) *Definitions* of terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted dictionary meanings. A definition does not have independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.
- d) *Tables and Figures* which add to or illustrate a Standard or Recommended Practice, and which are referred to therein, form part of the associated Standard or Recommended Practice and have the same status.

2. — Material approved by the Council for publication in association with the Standards and Recommended Practices:

- a) *Forewords* comprising historical and explanatory material based on the action of the Council and including an explanation of the obligations of States with regard to the application of the Standards and Recommended Practices ensuing from the Convention and the Resolution of Adoption;
- b) *Introductions* comprising explanatory material introduced at the beginning of parts, chapters or sections of the Annex to assist in the understanding of the application of the text;
- c) *Notes* included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommended Practices in question, but not constituting part of the Standards or Recommended Practices;
- d) *Attachments* comprising material supplementary to the Standards and Recommended Practices, or included as a guide to their application.

## Selection of language

Annex 6 Part IV has been adopted in six languages — English, Arabic, Chinese, French, Russian and Spanish. Each Contracting State is requested to select one of those texts for the purpose of national implementation and for other effects provided for in the Convention, either through direct use or through translation into its own national language, and to notify the Organisation accordingly.

## Editorial practices

The following practice has been adhered to in order to indicate at a glance the status of each statement: *Standards* have been printed in light face roman; *Recommended Practices* have been printed in light face italics, the status being indicated by the prefix **Recommendation**; *Notes* have been printed in light face italics, the status being indicated by the prefix *Note*.

The following editorial practice has been followed in the writing of specifications: for Standards the operative verb “shall” is used, and for Recommended Practices the operative verb “should” is used.

The units of measurement used in this document are in accordance with the International System of Units (SI) as specified in Annex 5 to the Convention on International Civil Aviation. Where Annex 5 permits the use of non-SI alternative units, these are shown in parentheses following the basic units. Where two sets of units are quoted it must not be assumed that the pairs of values are equal and interchangeable. It may, however, be inferred that an equivalent level of safety is achieved when either set of units is used exclusively.

Any reference to a portion of this document, which is identified by a number, includes all subdivisions of that portion.

**Table A. Amendments to Annex 6, Part IV**

<i>Amendment</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted Effective Applicable</i>
1st Edition	Eighteenth meeting of the RPAS Panel	Provisions for international operations of remotely piloted aircraft systems (RPAS) in controlled airspace and at aerodromes.	18 March 2024 22 July 2024 26 November 2026

## CHAPTER 1. DEFINITIONS

When the following terms are used in the Standards and Recommended Practices for international operations of RPAS, they have the following meanings:

**Accident.** An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

- a) a person is fatally or seriously injured as a result of:
  - being in the aircraft, or
  - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
  - direct exposure to jet blast,

*except* when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

- b) the aircraft sustains damage or structural failure which:
  - adversely affects the structural strength, performance or flight characteristics of the aircraft, and
  - would normally require major repair or replacement of the affected component,

*except* for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

- c) the aircraft is missing or is completely inaccessible.

*Note 1. — For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified, by ICAO, as a fatal injury.*

*Note 2. — An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.*

*Note 3.— The type of unmanned aircraft system to be investigated is addressed in 5.1 of Annex 13— Aircraft Accident and Incident Investigation.*

*Note 4.— Guidance for the determination of aircraft damage can be found in Attachment E of Annex 13.*

**Aerial work.** An aircraft operation in which an aircraft is used for specialised services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement, etc.

**Aerodrome.** A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

**Aerodrome operating minima.** The limits of usability of an aerodrome for:

- a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;
- b) landing in 2D instrument approach operations, expressed in terms of visibility and/or runway visual range minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions; and
- c) landing in 3D instrument approach operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the type and/or category of the operation.

**Aeroplane.** A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

**Aircraft.** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

**Aircraft operating manual.** A manual, acceptable to the State of the Operator, containing normal, abnormal and emergency procedures, checklists, limitations, performance information, details of the aircraft systems and other material relevant to the operation of the aircraft.

*Note 1. — The aircraft operating manual is part of the operations manual.*

*Note 2. — For RPAS, this includes information related to the whole system, including the RPS.*

**Alternate aerodrome.** An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use. Alternate aerodromes include the following:

**Take-off alternate.** An alternate aerodrome at which an aircraft would be able to land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

**En-route alternate.** An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en-route.

**Destination alternate.** An alternate aerodrome at which an aircraft would be able to land should it become either impossible or inadvisable to land at the aerodrome of intended landing.

*Note. — The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.*

**Automatic landing system.** The airborne system which provides automatic control of the aeroplane during the approach and landing.

**C2 Link.** The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

**C2 Link communications service provider (C2CSP).** An entity which provides a portion of, or all of, the C2 Link service for operation of an RPAS.

*Note. — An RPAS operator may also be its own C2CSP.*

**C2 Link interruption.** Any temporary situation where the C2 Link is unavailable, discontinuous, introduces too much delay, or has inadequate integrity; but where the lost C2 Link decision time has not been exceeded.

**COMAT.** Operator material carried on an operator's aircraft for the operator's own purposes.

**Configuration deviation list (CDL).** A list established by the organization responsible for the type design with the approval of the State of Design which identifies any external parts of an aircraft type which may be missing at the commencement of a flight, and which contains, where necessary, any information on associated operating limitations and performance correction.

**Continuing airworthiness.** The set of processes by which an aircraft, remote pilot station, engine, propeller or part complies with the applicable airworthiness requirements and remains in a condition for safe operation throughout its operating life.

**Continuing airworthiness records.** Records which are related to the continuing airworthiness status of an aircraft, remote pilot station, engine, propeller or associated part.

**Dangerous goods.** Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those Instructions.

*Note. — The provisions of Annex 18 govern the international transport of dangerous goods by air including their classification.*

**Defined point after take-off (DPATO).** The point, within the take-off and initial climb phase, before which the helicopter's ability to continue the flight safely, with one engine inoperative, is not assured and a forced landing may be required.

*Note. — For RPAS, defined points apply to remotely piloted helicopters operating in performance Class 2 only.*

**Defined point before landing (DPBL).** The point, within the approach and landing phase, after which the helicopter's ability to continue the flight safely, with one engine inoperative, is not assured and a forced landing may be required.

*Note. — For RPAS, defined points apply to remotely piloted helicopters operating in performance Class 2 only.*

**Detect and avoid.** The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action.

**Duty.** Any task that flight or cabin crew members are required by the operator to perform, including, for example, flight duty, administrative work, training, positioning and standby when it is likely to induce fatigue.

*Note. — For RPAS this includes remote flight crew members.*

**Duty period.** A period which starts when a flight or cabin crew member is required by an operator to report for or to commence a duty and ends when that person is free from all duties.

*Note. — For RPAS this includes remote flight crew members and other remote crew members.*

**Fatigue.** A physiological state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, circadian phase, and/or workload (mental and/or physical activity) that can impair a person's alertness and ability to perform safety-related operational duties.

**Fatigue risk management system (FRMS).** A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.

**Flight data analysis.** A process of analysing recorded flight data in order to improve the safety of flight operations.

**Flight duty period.** A period which commences when a flight or cabin crew member is required to report for duty that includes a flight or a series of flights and which finishes when the aircraft finally comes to rest and the engines are shut down at the end of the last flight on which he/she is a crew member.

*Note. — For RPAS this includes remote flight crew members.*

**Flight manual.** A manual, associated with the certificate of airworthiness, containing limitations within which the aircraft is to be considered airworthy, and instructions and information necessary to the flight crew members for the safe operation of the aircraft.

*Note. — For RPAS, this includes information related to the whole system, including the RPS and remote flight crew members.*

**Flight operations officer/flight dispatcher.** A person designated by the operator to engage in the control and supervision of flight operations, whether licensed or not, suitably competent in accordance with Annex 1, who supports, briefs and/or assists the remote pilot-in-command in the safe conduct of the flight.

**Flight plan.** Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

**Flight safety documents system.** A set of interrelated documentation established by the operator, compiling and organising information necessary for flight and ground operations, and comprising, as a minimum, the operations manual and the operator's maintenance control manual.

**Flight simulation training device.** Any one of the following three types of apparatus in which flight conditions are simulated on the ground:

A *flight simulator*, which provides an accurate representation of the flight deck of a particular aircraft type to the extent that the mechanical, electrical, electronic, etc. aircraft systems control functions, the normal environment of flight crew members, and the performance and flight characteristics of that type of aircraft are realistically simulated;

A *flight procedures trainer*, which provides a realistic flight deck environment, and which simulates instrument responses, simple control functions of mechanical, electrical, electronic, etc. aircraft systems, and the performance and flight characteristics of aircraft of a particular class;

A *basic instrument flight trainer*, which is equipped with appropriate instruments, and which simulates the flight deck environment of an aircraft in flight in instrument flight conditions.

*Note.* — For RPAS, the RPS is equivalent to the “flight deck,” and may not be specific to the type of RPA being used.

**Flight termination system.** A system intended to terminate flight and minimize the possibility of injury or damage to persons, property or other aircraft.

**Flight time – remotely piloted aircraft systems.** The total time from the moment a C2 Link is established between the remote pilot station (RPS) and the remotely piloted aircraft (RPA) for the purpose of taking off or from the moment the remote pilot receives control following a handover until the moment the remote pilot completes handover or the C2 Link between the RPS and RPA is terminated at the end of the flight.

**Ground handling.** Services necessary for an aircraft’s arrival at, and departure from, an airport, other than air traffic services.

**Handover.** The act of passing piloting control from one remote pilot station to another.

**Helicopter.** A heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

*Note.* — Some States use the term “rotorcraft” as an alternative to “helicopter”.

**Helideck.** A heliport located on a floating or fixed offshore structure.

**Heliport.** An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.

*Note 1.* — Throughout this Part, when the term “heliport” is used, it is intended that the term also applies to aerodromes primarily meant for the use of aeroplanes.

*Note 2.* — Helicopters may be operated to and from areas other than heliports.

**Human performance.** Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

**Incident.** An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

*Note.* — *The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in Attachment C of Annex 13 – Aircraft Accident and Incident Investigation.*

**Isolated aerodrome.** A destination aerodrome for which there is no destination alternate aerodrome suitable for a given aeroplane type.

**Lost C2 Link decision time.** The maximum length of time permitted before declaring a lost C2 Link state during which the C2 Link performance is not sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner appropriate to the airspace and operational conditions.

**Lost C2 Link state.** The state of the RPAS in which the C2 Link performance has degraded, as a result of a C2 Link interruption that is longer than the lost C2 Link decision time, to a point where it is not sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner.

**Maintenance.** The performance of tasks on an aircraft, remote pilot station, engine, propeller or associated part required to ensure the continuing airworthiness of an aircraft, remote pilot station, engine, propeller or associated part including any one or combination of overhaul, inspection, replacement, defect rectification, and embodiment of a modification or repair.

**Master minimum equipment list (MMEL).** A list established for a particular aircraft type by the organization responsible for the type design with the approval of the State of Design containing items, one or more of which is permitted to be unserviceable at the commencement of a flight. The MMEL may be associated with special operating conditions, limitations or procedures.

**Minimum equipment list (MEL).** A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type.

*Note.* — *For RPAS this includes inoperative equipment of the RPAS, not only the RPA.*

**Movement area.** That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s).

**NOTAM.** A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

**Operational control.** The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.

**Operations in performance Class 1.** Operations with performance such that, in the event of a critical engine failure, performance is available to enable the helicopter to safely continue the flight to an appropriate landing area, unless the failure occurs prior to reaching the take-off decision point (TDP) or after passing the landing decision point (LDP), in which cases the helicopter must be able to land within the rejected take-off or landing area.

*Note.* — *For RPAS, this refers to remotely piloted helicopters only.*

**Operations in performance Class 2.** Operations with performance such that, in the event of critical engine failure, performance is available to enable the helicopter to safely continue the flight to an

appropriate landing area, except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which cases a forced landing may be required.

*Note.* — For RPAS, this refers to remotely piloted helicopters only.

**Operations in performance Class 3.** Operations with performance such that, in the event of an engine failure at any time during the flight, a forced landing will be required.

*Note.* — For RPAS, this refers to remotely piloted helicopters only.

**Operations manual.** A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties.

**Operations specifications.** The authorizations, including specific approvals, conditions and limitations associated with the air operator certificate and subject to the conditions in the operations manual.

*Note.* — For RPAS these specifications are associated with the RPAS operator certificate.

**Operator.** The person, organization or enterprise engaged in or offering to engage in an aircraft operation.

*Note.* — In the context of remotely piloted aircraft, an aircraft operation refers to the operation of an RPAS.

**Operator's maintenance control manual.** A document which describes the operator's procedures necessary to ensure that all scheduled and unscheduled maintenance is performed on the operator's aircraft on time and in a controlled and satisfactory manner.

*Note.* — For RPAS this includes all parts and components of the RPAS, not only the RPA.

**Point of no return.** The last possible geographic point at which an aircraft can proceed to the destination aerodrome as well as to an available en-route alternate aerodrome for a given flight.

**Psychoactive substances.** Alcohol, opioids, cannabinoids, sedatives and hypnotics, cocaine, other psychostimulants, hallucinogens, and volatile solvents, whereas coffee and tobacco are excluded.

**Remote co-pilot.** A licensed remote pilot serving in any piloting capacity other than as remote pilot-in-command but excluding a remote pilot who is in the remote pilot station for the sole purpose of receiving flight instruction.

**Remote crew member.** A person assigned by an operator with duties connected to the operation of a remotely piloted aircraft system during a flight duty period.

**Remote flight crew member.** A licensed flight crew member charged with duties essential to the operation of a remotely piloted aircraft system during a flight duty period.

**Remote pilot.** A person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.

**Remote pilot-in-command.** The remote pilot designated by the operator as being in command and charged with the safe conduct of a flight.

**Remote pilot station (RPS).** The component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft.

**Remotely piloted aircraft (RPA).** An unmanned aircraft which is piloted from a remote pilot station.

**Remotely piloted aircraft system (RPAS).** A remotely piloted aircraft, its associated remote pilot station(s), the required C2 Link(s) and any other components as specified in the type design.

**Rest period.** A continuous and defined period of time, subsequent to and/or prior to duty, during which flight or cabin crew members are free of all duties.

*Note.* — For RPAS, this applies to remote flight crew members and other remote crew members.

**RPA observer.** A trained and competent person designated by the operator who, by visual observation of the remotely piloted aircraft, assists the remote pilot in the safe conduct of the flight.

**RPAS operator certificate (ROC).** A certificate authorizing an operator to carry out specified RPAS operations.

**RPAS-recorder system (RPAS-RS).** The recorder system installed in the remotely piloted aircraft system for the purpose of complementing accident/incident investigation. RPAS recorder systems consists of the following:

*An RPA-recorder system (RPA-RS).* Any type of recorder system installed in the remotely piloted aircraft for the purpose of complementing accident/incident investigation.

*An RPS-recorder system (RPS-RS).* Any type of recorder system installed in the RPS for the purpose of complementing accident/incident investigation.

**Runway visual range (RVR).** The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

**Safety.** The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.

**Safety management system (SMS).** A systematic approach to managing safety, including the necessary organisational structures, accountability, responsibilities, policies and procedures.

**Safety oversight.** A function performed by a State to ensure that individuals and organizations performing an aviation activity comply with safety-related national laws and regulations.

**Serious incident.** An incident involving circumstances indicating that there was a high probability of an accident and associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down.

*Note 1.* — The difference between an accident and a serious incident lies only in the result.

*Note 2.— Examples of serious incidents can be found in Attachment C of Annex 13.*

**Service level agreement (SLA).** The agreement between the C2CSP and the RPAS operator covering the safety, performance, service area and security of the C2 Link provision as required for the RPAS operator's intended operations.

**Specific approval.** A specific approval is an approval which is documented in the Operations Specifications for commercial air transport operations or in the list of specific approvals for non-commercial operations.

*Note. — The terms authorization, specific approval, approval and acceptance are further described in Attachment D.*

**State of Registry.** The State on whose register the aircraft is entered.

*Note 1. — In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587).*

*Note 2. — For RPAS, this refers to the State on whose register the RPA is entered.*

**State of the Aerodrome.** The State in whose territory the aerodrome is located.

*Note. — For RPAS, the aerodrome includes an airport, heliport or landing location over which the State has jurisdiction.*

**State of the Operator.** The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

**State of the RPS service provider.** The State where the RPS service provider has its primary place of business.

**Surveillance.** The State activities through which the State proactively verifies through inspections and audits that aviation licence, certificate, authorization or approval holders continue to meet the established requirements and function at the level of competency and safety required by the State.

**Switchover.** The act of transferring the active data link path between the RPS and the RPA from one of the links or networks that constitutes the C2 Link to another link or network that constitutes the C2 Link.

**Synthetic vision system (SVS).** A system to display data-derived synthetic images of the external scene from the perspective of the flight deck.

**Visual line-of-sight (VLOS) operation.** An operation in which the remote pilot or RPA observer maintains direct unaided visual contact with the remotely piloted aircraft.



## CHAPTER 2. APPLICABILITY

The Standards and Recommended Practices contained in Annex 6, Part IV, shall be applicable to the operation of RPAS certificated in accordance with Annex 8 by operators authorized to conduct international RPAS operations.

*Note 1.— The SARPs contained herein are consistent with the existing requirements found in Annex 6, Parts I, II and III, where relevant.*

*Note 2.— These SARPs will enable States to authorize RPAS operations consistent with Article 8 – Pilotless Aircraft, of the Convention on International Civil Aviation (Chicago, 1944).*

*Note 3. — These SARPs do not currently support operations of RPA carrying persons on board.*

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## CHAPTER 3. GENERAL AND OPERATOR RESPONSIBILITIES

*Note 1.— Although the Convention on International Civil Aviation allocates to the State of Registry certain functions which that State is entitled to discharge, or obligated to discharge, as the case may be, the Assembly recognized, in Resolution A23-13 that the State of Registry may be unable to fulfil its responsibilities adequately in instances where aircraft are leased, chartered or interchanged — in particular without crew — by the operator of another State and that the Convention may not adequately specify the rights and obligations of the State of the Operator in such instances until such time as Article 83 bis of the Convention enters into force. Accordingly, the Council of ICAO urged that if, in the above-mentioned instances, the State of Registry finds itself unable to discharge adequately the functions allocated to it by the Convention, it delegates to the State of the Operator, subject to acceptance by the latter State, those functions of the State of Registry that can more adequately be discharged by the State of the Operator. It was understood that, pending entry into force of Article 83 bis of the Convention, the foregoing action would only be a matter of practical convenience and would not affect either the provisions of the Chicago Convention prescribing the duties of the State of Registry or any third State. However, as Article 83 bis of the Convention entered into force on 20 June 1997, such transfer agreements will have effect in respect of Contracting States which have ratified the related Protocol (Doc 9318) upon fulfilment of the conditions established in Article 83 bis. It should be noted that, as of 3 November 2022, remote pilot licences shall be issued by the Licensing Authority of the State of the Operator, in accordance with Annex 1 (Amendment 175 refers). Accordingly, a transfer of functions and duties under Article 83 bis is not pertinent for licences of remote pilots, since the State of the Operator is the responsible authority.*

*Note 2. — In the case of international operations effected jointly with several RPAS not all of which are registered in the same Contracting State, nothing in this Part prevents the States concerned entering into an agreement for the joint exercise of the functions placed upon the State of Registry by the provisions of the relevant Annexes.*

### 3.1 COMPLIANCE WITH LAWS, REGULATIONS AND PROCEDURES

3.1.1 The operator shall ensure that all those involved in the RPAS operation know that they must comply with the laws, regulations and procedures of those States in which:

- a) the RPA is being operated; and
- b) the RPS are located.

*Note. — For operations over the high seas, the Standards contained in Annex 2 to the Convention on International Civil Aviation apply, without exception.*

3.1.2 The operator shall ensure that all remote pilots are familiar with the laws, regulations and procedures, pertinent to the performance of their duties, prescribed for the areas to be traversed, the aerodromes to be used and the air navigation facilities relating thereto. The operator shall ensure that other members of the remote flight crew are familiar with such of these laws, regulations and procedures as are pertinent to the performance of their respective duties in the operation of the RPAS.

*Note. — Information for remote pilots and RPAS operations personnel on flight procedure parameters and operational procedures is contained in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019), PANS-OPS (Doc 8168), Volumes I and III. Criteria for the construction of instrument flight procedures are contained in PANS-OPS (Doc 8168), Volume II. Obstacle clearance criteria and procedures used in certain States may differ from PANS-OPS (Doc 8168), and knowledge of these differences is important for safety reasons.*

3.1.3 The operator or a designated representative shall have responsibility for operational control.

3.1.4 Responsibility for operational control shall be delegated only to the remote pilot-in-command and to a flight operations officer/flight dispatcher if the operator's approved method of control and supervision of flight operations requires the use of flight operations officer/flight dispatcher personnel.

*Note. — Guidance on the operational control organization and the role of the flight operations officer/flight dispatcher is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335). Detailed guidance on the authorization, duties and responsibilities of the flight operations officer/flight dispatcher is contained in the Guidance on the Preparation of an Operations Manual (Doc 10153). The requirements for age, skill, knowledge and experience for licensed flight operations officers/flight dispatchers are contained in Annex 1.*

3.1.5 If an emergency situation which endangers the safety of the RPA or persons becomes known first to the flight operations officer/flight dispatcher, action by that person in accordance with 4.7.2 shall include, where necessary, notification to the appropriate authorities of the nature of the situation without delay, and requests for assistance if required.

3.1.6 If an emergency situation which endangers the safety of the RPA or persons necessitates the taking of action which involves a violation of local regulations or procedures, the remote pilot-in-command shall notify the appropriate authority without delay. If required by the State in which the incident occurs, the remote pilot-in-command shall submit a report on any such violation to the appropriate authority of such State; in that event, the remote pilot-in-command shall also submit a copy of it to the State of the Operator and to the State of the RPS service provider, if different. Such reports shall be submitted as soon as possible and normally within ten days.

3.1.7 Operators shall ensure that remote pilots-in-command have available at the RPS all the essential information concerning the search and rescue services in the area over which the RPA will be flown.

*Note. — This information may be made available to the remote pilot by means of the operations manual or such other means as is considered appropriate.*

3.1.8 Operators shall ensure that remote flight crew members demonstrate the ability to speak and understand the language used for radiotelephony communications as specified in Annex 1.

## **3.2 COMPLIANCE BY A FOREIGN OPERATOR WITH LAWS, REGULATIONS AND PROCEDURES OF A STATE**

3.2.1 When a State identifies a case of non-compliance or suspected non-compliance of a foreign operator with laws, regulations and procedures applicable within that State's territory, or a similar

serious safety issue with that operator, that State shall immediately notify the operator and, if the issue warrants it, the State of the Operator. Where the State of the Operator and the State of Registry are different, such notification shall also be made to the State of Registry, if the issue falls within the responsibilities of that State and warrants a notification.

3.2.2 In the case of notification to States as specified in 3.2.1, if the issue and its resolution warrant it, the State(s) in which the operation is conducted shall engage in consultations with the State of the Operator and the State of Registry, as applicable, concerning the safety standards maintained by the operator.

*Note 1. — RPAS operations may be conducted in more than one State concurrently, as the RPA may be operating in one State while the RPS is in another State.*

*Note 2.— The Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335) provides guidance on the surveillance of operations by foreign operators. The manual also contains guidance on the consultations and related activities, as specified in 3.2.2, including the ICAO model clause on aviation safety, which, if included in a bilateral or multilateral agreement, provides for consultations among States, when safety issues are identified by any of the parties to a bilateral or multilateral agreement on air services.*

### 3.3 SAFETY MANAGEMENT

3.3.1 The operator shall implement a safety management system (SMS) that incorporates the framework and principles defined in Annex 19, Chapter 4 and Appendix 2, and in this Chapter.

*Note. — Annex 19 includes safety management provisions for RPAS operators. Further guidance is contained in the Safety Management Manual (Doc 9859).*

3.3.2 **Recommendation.** — *The operator of an RPAS should establish and maintain a flight data analysis programme (FDAP) as part of its safety management system, which includes the flight data, including C2 Link data, required to be recorded at the RPS, the RPA and any other data designated by the State of the Operator.*

*Note. — The operator may contract the operation of an FDAP to another party while retaining overall responsibility for the maintenance of such a programme.*

3.3.3 Where an FDAP is established, it shall contain adequate safeguards to protect the source(s) of the data in accordance with Appendix 3 to Annex 19.

*Note. — Guidance on the establishment of an FDAP is included in the Manual on Flight Data Analysis Programmes (FDAP) (Doc 10000).*

3.3.4 States shall not allow the use of audio or images of persons by an RPA recorder system (RPA-RS) or an RPS recorder systems (RPS-RS) for purposes other than the investigation of an accident or incident as per Annex 13, except where the recordings or transcripts are:

- a) related to a safety-related event identified in the context of a safety management system; are restricted to the relevant portions of a de-identified transcript of the recording; and are subject to the protections accorded by Annex 19;

b) sought for use in criminal proceedings not related to an event involving an accident or incident investigation; and are subject to the protections accorded by Annex 19; or

c) used for inspections of recorder systems as provided in Section 6 of Appendix 8.

*Note. — Provisions on the protection of safety data, safety information and related sources are contained in Appendix 3 to Annex 19. When an investigation under Annex 13 is instituted, investigation records are subject to the protections accorded by Annex 13.*

3.3.5 States shall not allow the use of recordings made by RPA-RS and RPS-RS and that are not addressed by 3.3.4, as well as transcripts of such recordings, for purposes other than the investigation of an accident or incident as per Annex 13, except where the recordings or transcripts are subject to the protections accorded by Annex 19 and are:

a) used by the operator for airworthiness or maintenance purposes;

b) used by the operator in the operation of a flight data analysis programme required in this Annex;

c) sought for use in proceedings not related to an event involving an accident or incident investigation;

d) de-identified; or

e) disclosed under secure procedures.

*Note. — Provisions on the protection of safety data, safety information and related sources are contained in Appendix 3 to Annex 19.*

3.3.6 The operator shall establish a flight safety documents system, for the use and guidance of operational personnel, as part of its safety management system.

## 3.4 USE OF PSYCHOACTIVE SUBSTANCES

*Note. — Provisions concerning the use of psychoactive substances are contained in Annex 1, 1.2.7 and Annex 2, 2.5.*

## 3.5 REGISTRATION

3.5.1 RPA used for international operations shall be registered in accordance with the provisions in Annex 7.

### 3.5.2 RPS Identification

3.5.2.1 The operator shall include within the operations manual the following details for all RPS that it operates:

a) the individual or legal entity holding ownership of each RPS;

- b) the RPS manufacturer and manufacturer's designation for the RPS;
- c) the serial number of each RPS;
- d) indication of the type, model and variant of each RPA an RPS is capable of controlling; and
- e) other relevant data as required by applicable legislation.

### 3.6 SAFETY-CRITICAL SERVICES

3.6.1 The operator shall verify that the provider of safety-critical services has organizational structure, documented procedures, resources and personnel sufficient to ensure the safe provision of services.

3.6.2 Safety-critical services shall include, but are not limited to:

- a) provision of geographical data and airspace limitations;
- b) collection and forwarding of occurrence data;
- c) the training of remote pilots;
- d) communication services supporting the C2 Link;
- e) provision of services through RPS located anywhere in the world; and
- f) provision of services related to flight planning and management including related safety risk assessments.

#### 3.6.3 Safe operation of the C2 Link

3.6.3.1 The State of the Operator shall be responsible for the oversight of the C2 Link service provision, whether any of the C2 Link components are under the control of the RPAS operator or a C2 Link communications service provider (C2CSP).

*Note. — Such oversight of the C2 Link service provision may be conducted as part of the State of the Operator's oversight of the RPAS Operator safety management system.*

3.6.3.2 When the operator exercises direct control over the entire C2 Link(s), the operator shall be responsible for the safe operation of all C2 Link components. Such responsibilities shall be detailed in a service level agreement (SLA) internal to the operator.

3.6.3.3 When a portion of, or all of, the C2 Link(s) is under the operational control of a C2CSP, the operator shall establish an SLA with the C2CSP prior to commencing operations.

3.6.3.4 The SLA shall be approved by the State of the Operator.

3.6.3.5 The SLA shall contain at least:

- a) legal identification of the party(ies);

- b) scope of the provided service, including hours of service and service area;
- c) performance requirements of the C2 Link provision, including the QoSR which is commensurate with the C2 Link specification required, under normal conditions, for the operator's intended operations;
- d) security measures and management, including security requirements for the C2 Link provision;
- e) procedures for planned outages and contingencies, including reporting requirements;
- f) safety management responsibilities and processes related to safety risk management and safety assurance, including safety risk assessment and mitigation, safety performance monitoring and measurement, safety reporting, and safety analysis;
- g) arrangements to facilitate oversight of the C2 Link service provision by the State of the Operator; and
- h) the C2CSP emergency response plan (ERP) including how they would address service losses and how they would be restored.

3.6.3.6 In exercising its oversight function of the C2 Link service provision in accordance with 3.6.3.1, the State of the Operator shall:

- a) verify that the C2 Link service is to be provided by an authorized C2CSP;

*Note. — Such an authorization or approval would normally be issued by the State in which the C2CSP is located. Further guidance is provided in the Manual on C2 Links for Remotely Piloted Aircraft Systems (forthcoming).*

- b) ensure that the operator has established and documented monitoring processes to ensure that the C2 Link service provision meets the established requirements, including C2 Link quality of service required (QoSR) and security;
- c) ensure that the operator has established and documented monitoring processes to raise findings, and to request and monitor corrective actions related to the C2 Link service provision;
- d) ensure that the operator takes appropriate measures, when necessary, to resolve C2 Link service provision findings identified in application of the continuous monitoring processes; and
- e) approve, in accordance with its national regulations, the use of a C2CSP which has been authorized as per 3.6.3.6 a) above.

3.6.3.7 The C2CSP shall establish and document processes to perform C2CSP monitoring of the QoS as part of their routine operations, with the objective of ensuring that the C2 Link service provision meets the applicable requirements, including the C2 Link QoSR specified in the SLA.

3.6.3.8 The operator shall be responsible for monitoring that the C2 Link service provision QoS meets the QoSR, including its security, and shall:

- a) document any observed anomalies; and
- b) report any observed anomalies to the C2CSP, in accordance with the SLA.

3.6.3.9 The operator shall notify the State of the Operator of:

- a) all C2 Link provision degradations with regards to the SLA that occur during operations; and
- b) degradations that cannot be resolved by direct interaction between the operator and the C2CSP, when the C2CSP is not the operator.

### 3.6.4 Safe operation of the RPS

3.6.4.1 The operator shall be responsible for the safe operation of all RPS involved in the operation.

3.6.4.2 Each RPS used shall be installed at the intended operational location by personnel who have the required level of expertise and competence for the task, as determined by the type certificate holder.

3.6.4.3 During installation of the RPS, the installer shall verify that it meets applicable airworthiness and operational requirements and that it provides proper connection with the specified RPA type(s).

3.6.4.4 When one or more of the RPS involved in the operation are under the control of a service provider, this service provider shall be under the safety oversight of the State of the Operator in conjunction with the State of the RPS service provider, if different.

*Note 1. — Competency of the remote flight crew is addressed in 9.4.6.*

*Note 2.— Guidance on the oversight of the RPS service provider can be found in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019).*

3.6.4.5 When one or more of the RPS involved in the operation are under the control of a service provider, this service provider shall only allocate tasks to:

- a) remote flight crews which are properly trained and competent;
- b) remote pilots holding a valid remote pilot licence (RPL) issued or rendered valid by the State of the Operator, complemented by appropriate ratings; and
- c) remote flight crews which are medically fit.

3.6.4.5.1 The safety, security and performance of the RPS service provided shall be acceptable to the State of the Operator and to the State of the RPS service provider.

3.6.4.5.2 If the RPS is operated by an RPS service provider, the safety and security aspects of the RPS shall be addressed in an SLA between the RPAS operator and the RPS service provider.

3.6.4.5.3 Any SLA with an RPS service provider shall include the continuing airworthiness records addressed in paragraph 8.4.

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## CHAPTER 4. FLIGHT OPERATIONS

### 4.1 OPERATING FACILITIES

4.1.1 The operator shall ensure that a flight will not be commenced unless it has been ascertained by every reasonable means available that the ground and/or water facilities including communication facilities and navigation aids available and directly required for the safe operation of the RPAS are adequate for the type of operation under which the flight is to be conducted and are adequately operated for this purpose.

*Note. — “Reasonable means” in this Standard is intended to denote the use of information available to the operator either through official information published by the aeronautical information services or readily obtainable from other sources.*

4.1.2 The operator shall ensure that any inadequacy of facilities observed in the course of operations is reported to the authority responsible for the facilities, without undue delay.

4.1.3 The operator shall, as part of its safety management system, assess the level of rescue and firefighting service (RFFS) protection available at any aerodrome intended to be specified in the operational flight plan in order to ensure that an acceptable level of protection is available for the RPA intended to be used.

*Note. — Annex 19 includes safety management provisions for air operators. Further guidance is contained in the Safety Management Manual (Doc 9859).*

4.1.4 Information related to the level of RFFS protection that is deemed acceptable by the operator shall be contained in the operations manual.

*Note 1. — Attachment I contains guidance on assessing an acceptable level of RFFS protection at aerodromes.*

*Note 2. — It is not intended that the Attachment I guidance referred to in the Note above limit or regulate the operation of an aerodrome. The assessment performed by the operator does not in any way affect the RFFS requirements of Annex 14, Volume I, for aerodromes.*

### 4.2 OPERATIONAL CERTIFICATION AND SUPERVISION

#### 4.2.1 RPAS operator certificate (ROC)

4.2.1.1 The operator shall not engage in international RPAS operations unless in possession of a valid RPAS operator certificate (ROC) issued by the State of the Operator.

4.2.1.2 **Recommendation.** — *Each State should extend the requirement to hold a valid operator certificate for domestic RPAS operations accounting for the nature and complexity of RPAS operations and considering airspace usage and mitigations appropriate to the risk to third parties.*

4.2.1.3 The ROC shall authorize the operator to conduct RPAS operations in accordance with the operations specifications.

*Note.* — Provisions for the content of the RPAS operator certificate and its associated operations specifications are contained in 4.2.1.7 and 4.2.1.8.

4.2.1.4 The issue of an ROC by the State of the Operator shall be dependent upon the operator demonstrating an adequate organization, a method of identifying, assessing, and mitigating the risks associated with flight operations, training, ground handling and maintenance requirements, consistent with the nature and extent of the operations specified.

*Note.* — Attachment D contains guidance on the issuance of an RPAS operator certificate.

4.2.1.5 **Recommendation.** — For operators that also hold an Air Operator Certificate (AOC), based on Annex 6 Part I or Part III, the State of the Operator should define an integrated surveillance schedule to include all applicable audit items. In order to avoid duplication of audits, credit may be granted for specific audit items already completed during the AOC surveillance planning cycle, subject to four conditions:

- a) the specific audit item should be the same for all certificates under consideration;
- b) *there should be satisfactory evidence on record that such specific audit items were carried out and that all corrective actions have been implemented to the satisfaction of the State of the Operator;*
- c) *the State of the Operator should be satisfied that there is no evidence that standards have deteriorated in respect of those specific audit items being granted a credit;*
- d) *the interval between two audits for the specific item being granted a credit should not exceed the applicable surveillance planning cycle.*

4.2.1.6 The continued validity of an ROC shall be subject to the operator:

- a) maintaining the requirements of 4.2.1.4 under the supervision of the State of the Operator, and
- b) granting access to any facilities, documents, records and equipment as required for the State of the Operator to perform oversight.

4.2.1.7 The ROC shall contain at least the following information and follow the layout of Appendix 6:

- a) the State of the Operator and the issuing authority;
- b) the ROC number and its expiration date;
- c) the operator name, trading name (if different) and address of the principal place of business;
- d) the date of issue and the name, signature and title of the authority representative; and
- e) the location, in a controlled document, where the contact details of operational management can be found. With regards to the controlled document:

- 1) an electronic copy shall be carried on the RPA; and

2) an electronic or paper copy shall be easily accessible at each RPS.

4.2.1.8 The operations specifications associated with the ROC shall follow the layout of and contain at least the information listed in Appendix 6.

*Note. — Attachment D, paragraph 3.2.2, contains additional information that may be listed in the operations specifications associated with the RPAS operator certificate.*

4.2.1.9 The format (e.g. paper or electronic) of the ROC document shall be acceptable to all States in which the RPA is to be operated.

4.2.1.10 **Recommendation.** — *The State of the Operator should grant operators that are approved to conduct operations under an AOC and an ROC, a single ‘merged’ certificate listing the privileges in the operations specification attached to that single certificate.*

*Note 1.— The merged certificate may encompass the privileges of an AOC based on Annex 6, Part I or Part III and the privileges of an ROC based on this Part IV.*

*Note 2.— As there are no provisions in Annex 6, Parts I or III for credit to be given towards the granting of an AOC, the holder of an ROC would need to complete all requirements of Annex 6, Parts I or III in order to obtain an AOC.*

4.2.1.11 The operator shall ensure that the accountable executive identified consistent with Annex 19, Appendix 2, has the authority to ensure that all activities can be financed and carried out in accordance with the ROC.

*Note. — The accountable executive is responsible for the implementation and maintenance of an effective safety management system (Annex 19, Appendix 2, Standard 1.2).*

4.2.1.12 The operator shall nominate a person or group of persons whose management responsibilities include ensuring that the operator remains in compliance with the ROC, laws, regulations and procedures of those States in which operations are conducted.

*Note — Areas for which a person or persons are nominated typically include: RPAS operations, continuing airworthiness, crew training, and safety management.*

4.2.1.13 The application for an ROC shall be made to the State of the Operator.

4.2.1.14 The State of the Operator shall establish a system for both the certification and the continued surveillance of the operator in accordance with Appendix 5 to this Annex and Appendix 1 to Annex 19 to ensure that the required standards of operations established in 4.2 are maintained.

4.2.1.15 The State of the Operator shall ensure that the operator’s actions are in compliance with the approvals and limitations established by the State of Registry.

*Note 1.— Initial certification and the continued surveillance of the operator may be based on the process described in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335), for commercial air transport operators, with possible adaptations to cover specific features of RPAS operations (e.g. handover between RPS).*

*Note 2.— Guidance concerning the transfer of responsibilities by the State of Registry to the State of the Operator in accordance with Article 83 bis is contained in the Manual on the Implementation of Article 83 bis of the Convention on International Civil Aviation (Doc 10059).*

#### **4.2.2 Contracted services**

- 4.2.2.1 When the operator contracts any safety or security related services in support of its operations to a third party that is not certified (in accordance with this Section) by a State to carry out such an activity, the contracted third party shall comply with all of the RPAS operator's procedures, including those for safety and security management, as approved by the State of the Operator.
- 4.2.2.2 The operator shall ensure that the authorities of the State where the contracted services are provided are given access to the premises, facilities, equipment and documents of the contracted organization to the extent required for determining continued compliance with the applicable Standards specified in this Annex and Annex 19.
- 4.2.2.3 The operator shall ensure that contracted service providers grant access to the premises, facilities, equipment and documents of the contracted organization, to the authorities of the State where the contracted services are provided, to the extent required for determining continued compliance with the applicable Standards specified in this Annex and Annex 19.

#### **4.2.3 Surveillance of operations conducted by a foreign operator**

- 4.2.3.1 Contracting States shall recognize as valid an ROC issued by another Contracting State, provided that the requirements under which the certificate was issued are at least equal to the applicable Standards specified in this Annex and Annex 19.
- 4.2.3.2 States shall establish a programme with procedures for the surveillance of RPAS operations in their territory conducted by a foreign operator and for taking appropriate action when necessary to preserve safety.
- 4.2.3.3 The operator shall meet and maintain the requirements established by the States in which the operations are conducted.

*Note. — Guidance on the surveillance of operations by foreign operators may be found in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335).*

- 4.2.3.4 If the operator intends to have an operating base from which operational control is exercised in a State other than the State of the Operator, the operator shall notify the State in which the operating base will be located.

*Note 1. — An operating base is normally the location where personnel involved in the operation of the RPAS work and the records associated with the operation are located.*

*Note 2. — Additional approvals or authorizations may be required from the State in which the operating base will be located.*

## 4.2.4 Operations manual

4.2.4.1 The operator shall provide, for the use and guidance of operations personnel concerned, an operations manual in accordance with Appendix 2. The operations manual shall be amended or revised as is necessary to ensure that the information contained therein is kept up to date. All such amendments or revisions shall be issued to all personnel that are required to use this manual.

4.2.4.2 The State of the Operator shall establish a requirement for the operator to provide a copy of the operations manual together with all amendments and/or revisions, for review and acceptance and, where required, approval. The operator shall incorporate in the operations manual such mandatory material as the State of the Operator may require.

*Note 1.— Requirements for the organization and content of an operations manual are provided in Appendix 2*

*Note 2.— Specific items in the operations manual require the approval of the State of the Operator in accordance with the Standards in 4.2.8, 6.1.3, 9.3.1 and 13.1.2.*

## 4.2.5 Operating instructions — general

4.2.5.1 The operator shall ensure that all operations personnel are properly instructed in their particular duties and responsibilities and the relationship of such duties to the operation as a whole.

4.2.5.2 An RPA shall not be taxied on the movement area of an aerodrome unless the person at the controls:

- a) has been duly authorized by the operator or a designated agent;
- b) is fully competent to taxi the RPA;
- c) is qualified to use the radiotelephone; and
- d) has received instruction from a competent person in respect of aerodrome layout, routes, signs, marking, lights, air traffic control (ATC) instructions, phraseology and procedures, and is able to conform to the operational standards required for safe movement at the aerodrome.

4.2.5.3 **Recommendation.**— *The operator should issue operating instructions and provide information on RPA climb performance with all engines operating to enable the remote pilot-in-command to determine the climb gradient that can be achieved during the departure phase for the existing take-off conditions and intended take-off technique. This information should be included in the operations manual.*

Note. — Performance requirements are addressed in 5.2.

## 4.2.6 In-flight simulation of abnormal and emergency situations

4.2.6.1 The operator shall ensure that when cargo is being carried, no emergency or abnormal situations are simulated.

4.2.6.2 The operator shall ensure that in-flight training of simulated emergency and abnormal situations is only conducted following careful consideration and mitigation of the risks to third parties.

#### 4.2.7 Checklists

The checklists provided in accordance with 6.1.3 shall be used by remote flight crews prior to, during and after all phases of operations, and in emergencies, to ensure compliance with the operating procedures contained in the flight manual or other documents associated with the certificate of airworthiness and otherwise in the operations manual. The design and utilisation of checklists shall observe Human Factors principles.

*Note.* — *Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).*

#### 4.2.8 Minimum flight altitudes

4.2.8.1 The operator shall be permitted to establish minimum flight altitudes for those routes flown for which minimum flight altitudes have been established by the State being overflown or the responsible State, provided that they shall not be less than those established by that State.

4.2.8.2 The operator shall specify the method by which it is intended to determine minimum flight altitudes for operations conducted over routes for which minimum flight altitudes have not been established by the State being overflown or the responsible State, and shall include this method in the operations manual. The minimum flight altitudes determined in accordance with the above method shall not be lower than specified in Annex 2.

4.2.8.3 **Recommendation.** — *The method for establishing the minimum flight altitudes should be approved by the State of the Operator.*

4.2.8.4 **Recommendation.**— *The State of the Operator should approve such method only after careful consideration of the probable effects of the following factors on the safety of the operation in question:*

- a) the accuracy and reliability with which the position of the RPA can be determined;
- b) the inaccuracies in the indications of the altimeters used;
- c) the characteristics of the terrain (e.g. sudden changes in the elevation);
- d) the probability of encountering unfavourable meteorological conditions (e.g. severe turbulence and descending air currents);
- e) possible inaccuracies in aeronautical charts; and
- f) airspace restrictions.

#### 4.2.9 Aerodrome operating minima

- 4.2.9.1 The State of the Operator shall require that the operator establish aerodrome operating minima for each aerodrome to be used in operations and shall approve the method of determination of such minima. Such minima shall not be lower than any that may be established for such aerodromes by the State of the Aerodrome, except when specifically approved by that State for RPAS operations.

Note. — This Standard does not require the State of the Aerodrome to establish aerodrome operating minima.

- 4.2.9.2 The State of the Operator shall require that in establishing the aerodrome operating minima, which will apply to any RPAS operation, the operator shall take full account of:

- a) the type, performance and handling characteristics of the RPA and any conditions or limitations stated in the flight manual;
- b) the composition of the remote flight crew, their competence and experience;
- c) the dimensions and characteristics of the runways, heliports or landing location, which may be selected for use;
- d) the adequacy and performance of the approach and automatic landing capabilities of the RPAS;
- e) the equipment available to the remote pilot-in-command for the purpose of navigation and/or control of the flight path during the approach to landing and the missed approach;
- f) the obstacles in the approach and missed approach areas and the obstacle clearance altitude/height for the instrument approach procedures;
- g) the means used to determine and report meteorological conditions;
- h) the obstacles in the climb-out areas and necessary clearance margins;
- i) the conditions prescribed in the operations specifications; and
- j) any minima that may be promulgated by the State of the Aerodrome.

*Note.* — *Guidance on the establishment of aerodrome operating minima is contained in the Manual of All-Weather Operations (Doc 9365).*

4.2.9.3 The State of the Operator shall issue a specific approval for operations that involve the use of an automatic landing capability, irrespective of the prevailing weather conditions.

4.2.9.3.1 For landing in low visibility, if the design of the RPAS enables this to be conducted visually, the State of the Operator shall issue a specific approval for instrument approach operations in low visibility which shall only be conducted when RVR information is provided.

*Note.* — *In this case, “visually” can refer to a VLOS operation or any synthetic/camera based solution which enables the remote pilot to monitor and correct the RPA’s track along the ground.*

4.2.9.4 The State of the Operator shall issue a specific approval for operations that involve the use of an automatic take-off capability, irrespective of the prevailing weather conditions.

4.2.9.4.1 For take-off in low visibility, if the design of the RPAS enables this to be conducted visually, the State of the Operator shall issue a specific approval for the minimum take-off RVR.

*Note 1.* — *In this case, ‘visually’ can refer to a VLOS operation or any synthetic/camera based solution which enables the remote pilot to monitor and correct the RPA’s track along the ground.*

*Note 2.*— *In general, visibility for take-off is defined in terms of RVR. An equivalent horizontal visibility may also be used.*

4.2.9.5 The operating minima for 3D instrument approach RPAS operations using instrument approach procedures where the landing is conducted visually, shall be determined by establishing a decision altitude (DA) or decision height (DH) and the minimum visibility or RVR.

*Note.* — *In this case, “visually” can refer to a VLOS operation or any synthetic/camera based solution which enables the remote pilot to monitor and correct the RPA’s track when below the DA or DH.*

#### **4.2.10 Threshold crossing height for automatic landing or 3D instrument approach operations**

The operator shall establish operational procedures designed to ensure that an RPA being used to conduct automatic landings or 3D instrument approach operations crosses the threshold by a safe margin, with the RPA in the landing configuration and attitude.

#### **4.2.11 Fuel and oil records**

*Note.*— *For the remainder of this Part of this Annex, the term “fuel” is intended to include all sources of energy, to include (but not limited to) petroleum based, solar, battery or any future source that provides energy to the RPA.*

4.2.11.1 The operator shall maintain fuel records to enable the State of the Operator to ascertain that, for each flight, the requirements of 4.3.6 and 4.3.7.1 have been complied with.

4.2.11.2 If an engine relies on oil for lubrication, the operator shall maintain oil records to enable the State of the Operator to ascertain that trends for oil consumption are such that an RPA has sufficient oil to complete each flight.

4.2.11.3 Fuel and oil records shall be retained by the operator for a period of three months following the conclusion of the flight.

#### 4.2.11 Remote crew

4.2.12.1 **Remote pilot-in-command.** For each flight, the operator shall designate a remote pilot to act as remote pilot-in command.

4.2.12.2 The operator shall only designate one remote pilot to act as remote pilot-in-command for an RPA, at any given time.

4.2.12.3 The operator shall only permit the remote pilot-in-command to control one RPA, at any given time.

4.2.12.4 The operator may designate more than one remote pilot-in-command for an RPA over the course of an RPAS flight.

4.2.12.5 **Recommendation.** — *The remote pilot-in-command responsibilities should be transferred to the remote pilot-in-command taking control of the RPA when conducting an RPS handover.*

*Note 1. — There may be multiple changes of the individual designated as remote pilot-in-command during the flight of an RPA.*

*Note 2. — Provisions regarding handovers and the transfer of control between remote pilots at a single RPS are available under 4.4.12 and 4.4.13 of this Part.*

4.2.12.6 **Recommendation.** — *In the event that the remote pilot-in-command is incapacitated during the flight, the operator should designate a substitute remote pilot to act as remote pilot-in-command.*

#### 4.2.13 Passengers

*Reserved for future use.*

### 4.3 FLIGHT PREPARATION

4.3.1 A flight shall not be commenced until flight preparation forms have been completed certifying that the remote pilot-in-command is satisfied that:

- a) the RPA is airworthy and the appropriate certificates (i.e. airworthiness, registration) are on board the RPA;
- b) the instruments and equipment installed in the RPAS are appropriate, taking into account the expected flight conditions and airspace requirements;

- c) the RPS(s) used for the flight is (are) serviceable and compatible with the RPA used;
- d) a C2 Link(s) is (are) expected to be available for the duration of the flight and meets the performance criteria;
- e) the C2 Link QoS for each phase of flight is described in flight documents and is provided to the remote pilot by the operator.

*Note.— The service level agreement between the RPAS operator and the C2CSP describes the C2 Link QoS for each phase of the flight. Information related to C2 Link QoS is found in 3.6.3.*

- f) a maintenance release as prescribed in 8.8 has been issued in respect of the RPA;
- g) the mass of the RPA and centre of gravity location are such that the flight can be conducted safely, taking into account the flight conditions expected;
- h) any load carried is properly distributed and safely secured;
- i) the RPA operating limitations, contained in the flight manual, or its equivalent, will not be exceeded;
- j) the Standards of 4.3.3 relating to operational flight planning have been complied with; and
- k) a special authorization, as required by Article 8 of the *Convention on International Civil Aviation*, has been obtained in accordance with Annex 2, Appendix 4.

*Note 1.— These responsibilities established under 4.3.1. above apply to the first remote pilot-in-command responsible for the flight of the RPA.*

*Note 2.— Refer to section 6.25 of this Part for requirements related to what documents need to be carried on board the RPA and in the RPS.*

- 4.3.2 Completed flight preparation forms shall be kept by the operator for a period of three months following the conclusion of the flight.

### 4.3.3 Operational flight planning

*Note.— Separate from the operational flight planning processes detailed in this section, the requirements for flight plans to be provided to ATS units, are contained in Annex 2 and PANS-ATM (Doc 4444).*

- 4.3.3.1 An operational flight plan shall be completed for every intended flight. The operational flight plan shall be approved and signed by the first remote pilot-in-command responsible for the flight of the RPA and, where applicable, signed by the flight operations officer/flight dispatcher, and a copy shall be filed with the operator or a designated agent, or, if these procedures are not

possible, it shall be left with the aerodrome authority or on record in a suitable place at the point of departure.

Note.— The duties of a flight operations officer/flight dispatcher are contained in 4.7.

4.3.3.2 Whenever there is a change of the remote pilot-in-command, the remote pilot-in-command taking control of the RPA shall approve the operational flight plan before accepting command for the subsequent segments of the flight.

Note.— *Procedures for changing the remote pilot-in-command can be found in 4.4.12 and 4.4.13.*

4.3.3.3 The operations manual must describe the content and use of the operational flight plan.

4.3.3.4 The approval(s) of the operational flight plan shall be recorded in a manner acceptable to the State of the Operator and retained for a period of three months following the conclusion of the flight.

4.3.3.5 The operator shall specify flight planning procedures to provide for the safe conduct of the flight based on considerations of RPAS performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes, including alternate aerodromes, concerned.

4.3.3.6 Flight planning procedures, including considerations for inflight emergency situations, shall be included in the operations manual.

4.3.3.7 The operator shall ensure that the remote pilot is provided with information regarding factors that could affect the quality of the C2 Link for each segment of the operation, and appropriate mitigations to minimize the impact of a degraded C2 Link.

4.3.3.8 **Recommendation.**— *Operational flight planning should include specific needs for RPAS such as the number of remote pilots and crew duty time planning for long endurance missions. The future availability of RPS may also need to be considered. Such requirements may not be available at the time of departure but may be necessary for operation in a later phase of the flight.*

4.3.3.9 The operator shall establish procedures in the operations manual to ensure a seamless operation throughout the duration of the flight including the different phases of the flight such as take-off, climb, en-route, approach, and landing carried out by remote pilots responsible for each phase of flight.

#### 4.3.4 Alternate aerodromes

4.3.4.1 For an aerodrome to be selected as an alternate the available information shall indicate that, at the estimated time of use, the C2 Link required to effect a landing will be available.

4.3.4.2 *Take-off alternate aerodrome*

4.3.4.2.1A take-off alternate aerodrome shall be selected and specified in the flight plan if either the meteorological conditions at the aerodrome of departure are below the operator's established

aerodrome landing minima for that operation or if it would not be possible to return to the aerodrome of departure for other reasons.

4.3.4.2.2 The take-off alternate aerodrome shall be located at a distance and within a flight time from the aerodrome of departure that is readily attainable with regard to the RPA's calculated performance and endurance.

4.3.4.2.3 For an aerodrome to be selected as a take-off alternate the available information shall indicate that, at the estimated time of use, the conditions will be at or above the operator's established aerodrome operating minima for that operation.

#### 4.3.4.3 *Destination alternate aerodromes*

4.3.4.3.1 For a flight to be conducted in accordance with instrument flight rules, at least one destination alternate aerodrome shall be selected and specified in the operational and ATS flight plans, unless:

a) the duration of the flight from the departure aerodrome, or from the point of in-flight re-planning, to the destination aerodrome is such that, taking into account all meteorological conditions and operational information relevant to the flight, at the estimated time of use, a reasonable certainty exists that:

1) the approach and landing may be made without reliance on an instrument approach procedure; and

2) for remotely piloted aeroplanes, separate runways are usable at the estimated time of use of the destination aerodrome with at least one runway having an operational instrument approach procedure; or

b) the aerodrome is isolated. Operations into isolated aerodromes do not require the selection of a destination alternate aerodrome(s) and shall be planned in accordance with 4.3.6.4 d) 4);

1) for each flight into an isolated aerodrome a point of no return shall be determined; and

2) a flight to be conducted to an isolated aerodrome shall not be continued past the point of no return unless a current assessment of meteorological conditions, traffic and other operational conditions indicate that a safe landing can be made at the estimated time of use.

*Note 1. — Separate runways are two or more runways at the same aerodrome configured such that if one runway is closed, operations to the other runway(s) can be conducted.*

*Note 2.— Guidance on planning operations to isolated aerodromes is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.4.3.2 Two destination alternate aerodromes shall be selected and specified in the operational and ATS flight plans when, for the destination aerodrome:

a) meteorological conditions at the estimated time of use will be below the operator's established aerodrome operating minima for that operation; or

- b) meteorological information is not available.

4.3.4.3.3 When an offshore alternate heliport is specified, it shall be specified subject to the following:

- a) if the departure point is onshore, the offshore alternate heliport shall be used only after a point of no return. Prior to a point of no return, onshore alternate heliports shall be used;
- b) mechanical reliability of critical control systems and critical components shall be considered and taken into account when determining the suitability of the alternate heliport(s);
- c) one engine inoperative performance capability shall be attainable prior to arrival at the alternate heliport;
- d) to the extent possible, helideck availability shall be guaranteed; and
- e) weather information must be reliable and accurate.

*Note.— The landing technique specified in the flight manual following control system failure may preclude the nomination of certain helidecks as alternate heliports.*

4.3.4.4 Notwithstanding the provisions in 4.3.4.1 and 4.3.4.2, the State of the Operator may, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained, approve operational variations to alternate aerodrome selection criteria. The specific safety risk assessment shall include at least the:

- a) capabilities of the operator;
- b) overall capability of the RPAS;
- c) available aerodrome technologies, capabilities and infrastructure;
- d) quality and reliability of meteorological information;
- e) identified hazards and safety risks associated with each alternate aerodrome variation; and
- f) specific mitigation measures.

*Note. — Guidance on performing a safety risk assessment and on determining variations, including examples of variations, is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976) and the Safety Management Manual (Doc 9859).*

### 4.3.5 Meteorological conditions

4.3.5.1 A flight to be conducted in accordance with instrument flight rules shall not:

- a) take off from the departure aerodrome unless the meteorological conditions, at the time of use, are at or above the operator's established aerodrome operating minima for that operation; and
- b) take off or continue beyond the point of in-flight re-planning unless at the aerodrome of intended landing or at each alternate aerodrome to be selected in compliance with 4.3.4, current meteorological reports or a combination of current reports and forecasts indicate that the meteorological conditions will be, at the estimated time of use, at or above the operator's established aerodrome operating minima for that operation.

4.3.5.2 To ensure that an adequate margin of safety is observed in determining whether or not an approach and landing can be safely carried out at each alternate aerodrome, the operator shall specify appropriate incremental values for height of cloud base and visibility, acceptable to the State of the Operator, to be added to the operator's established aerodrome operating minima.

*Note.— Guidance on the selection of these incremental values is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.5.3 The State of the Operator shall approve a margin of time established by the operator for the estimated time of use of an aerodrome.

*Note.— Guidance on establishing an appropriate margin of time for the estimated time of use of an aerodrome is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.5.4 A flight to be operated in known or expected icing conditions shall not be commenced unless the RPA is certificated and equipped to cope with such conditions.

4.3.5.5 A flight to be planned or expected to operate in suspected or known ground icing conditions shall not take off unless the RPA has been inspected for icing and, if necessary, has been given appropriate de-icing/anti-icing treatment. Accumulation of ice or other naturally occurring contaminants shall be removed so that the RPA is kept in an airworthy condition prior to take-off.

*Note.— Guidance material is given in the Manual of Aircraft Ground De-icing/Anti-icing Operations (Doc 9640).*

### 4.3.6 Fuel requirements

4.3.6.1 An RPA shall have available a sufficient amount of usable fuel to complete the planned flight safely and to allow for deviations from the planned operation.

4.3.6.2 If fuel is planned to be generated or supplied during flight (e.g. air refuelling or charging of batteries via solar energy), the RPA shall maintain sufficient capability at any given time to continue to a safe landing, including the necessary reserves and contingency fuel.

4.3.6.3 The amount of usable fuel available shall, as a minimum, be based on:

- a) fuel consumption data:
  - 1) provided by the RPAS manufacturer; or
  - 2) if available, current RPA-specific data derived from a fuel consumption monitoring system; and

*Note.— Where no specific fuel consumption data exist for the precise conditions of the flight, the RPA may be operated in accordance with estimated fuel consumption data.*

- b) the operating conditions for the planned flight including:
  - 1) anticipated RPA mass;
  - 2) NOTAM;
  - 3) current meteorological reports or a combination of current reports and forecasts;
  - 4) air traffic services procedures, restrictions and anticipated delays; and
  - 5) the effects of deferred maintenance items and/or configuration deviations.
- c) the efficiency and capacity of fuel storage devices (e.g. batteries) for the planned operating conditions considering degradation of those fuel storage devices as appropriate.

4.3.6.4 The pre-flight calculation of usable fuel required shall include:

- a) *Taxi fuel*, which shall be the amount of fuel expected to be consumed before take-off taking into account local conditions at the point of departure and auxiliary power unit (APU) fuel consumption;
- b) *Trip fuel*, which shall be the amount of fuel required to enable the RPA to fly from take-off until landing at the destination aerodrome taking into account the operating conditions of 4.3.6.3 b);

*Note.— The trip fuel at the beginning of the flight may be reduced for some types of RPA or types of operation (e.g. solar powered RPA or in-flight refuelling).*

- c) *contingency fuel*, which shall be the amount of fuel required to compensate for unforeseen factors;

*Note.— Unforeseen factors are those which could have an influence on the fuel consumption to the destination aerodrome, such as deviations of an individual RPA from the expected fuel consumption data, deviations from forecast meteorological conditions, extended delays and deviations from planned routings and/or cruising levels.*

- d) *destination alternate fuel*, which shall be:
  - 1) where a destination alternate is required, the amount of fuel required to enable the RPA to:
    - i. perform a missed approach at the destination aerodrome;
    - ii. climb to the expected cruising altitude;
    - iii. fly the expected routing;
    - iv. descend to the point where the expected approach is initiated; and

- v. conduct the approach and landing at the destination alternate aerodrome; or
- 2) where two destination alternate aerodromes are required, the amount of fuel, as calculated in 4.3.6.4 d) 1), required to enable the RPA to proceed to the destination alternate aerodrome which requires the greater amount of alternate fuel; or
  - 3) where a flight is operated without a destination alternate aerodrome, the amount of fuel required to enable the RPA to fly 15 minutes at holding speed at 450 m (1 500 ft.) above destination elevation in standard conditions; or
  - 4) where the intended destination is an isolated aerodrome:
    - i. for a non-turbine-engined RPA, the amount of fuel required to fly for 45 minutes plus 15 per cent of the flight time planned to be spent at cruising level, including final reserve fuel, or two hours, whichever is less; or
    - ii. for a turbine-engine RPA, the amount of fuel required to fly for two hours at normal cruise consumption above the destination, including final reserve fuel;
- e) *final reserve fuel*, which shall be the amount of fuel calculated using the estimated mass on arrival at the destination alternate aerodrome, or the intended destination aerodrome when no destination alternate aerodrome is required:
- 1) for a non-turbine-engined RPA, the amount of fuel required to fly for 45 minutes, under speed and altitude conditions specified by the State of the Operator; or
  - 2) for a turbine-engined RPA, the amount of fuel required to fly for 30 minutes at holding speed at 450 m (1 500 ft.) above aerodrome elevation in standard conditions;
- f) *additional fuel*, which shall be the supplementary amount of fuel required if the minimum fuel calculated in accordance with 4.3.6.4 b), c), d) and e) is not sufficient to:
- 1) allow the RPA to descend as necessary and proceed to an alternate aerodrome in the event of engine failure based on the assumption that such a failure occurs at the most critical point along the route;
    - i. fly for 15 minutes at holding speed at 450 m (1 500 ft.) above aerodrome elevation in standard conditions; and
    - ii. make an approach and landing;
  - 2) meet additional requirements not covered above;

*Note.— Fuel planning for a failure that occurs at the most critical point along a route (4.3.6.4 f) 1) may place the RPA in a fuel emergency situation based on 4.3.7.2.*

- g) *discretionary fuel*, which shall be the extra amount of fuel to be carried at the discretion of the remote pilot-in-command.

4.3.6.5 **Recommendation.** — *Operators should determine one final reserve fuel value for each RPA type and variant in their fleet rounded up to an easily recalled figure.*

4.3.6.6 A flight shall not commence unless the usable fuel on board meets the requirements in 4.3.6.4 a), b), c), d), e) and f) if required and shall not continue from the point of in-flight re-planning unless the usable fuel on board meets the requirements in 4.3.6.4 b), c), d), e) and f) if required.

4.3.6.7 Notwithstanding the provisions in 4.3.6.4 a), b), c), d) and f), the State of the Operator may, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained, approve variations to the pre-flight fuel calculation of taxi fuel, trip fuel, contingency fuel, destination alternate fuel, and additional fuel. The specific safety risk assessment shall include at least the:

- a) flight fuel calculations;
- b) capabilities of the operator to include:
  - 1) a data-driven method that includes a fuel consumption monitoring programme;  
and/or
  - 2) the advanced use of alternate aerodromes; and
- c) specific mitigation measures.

*Note.— Guidance on the specific safety risk assessment, fuel consumption monitoring programmes and the advanced use of alternate aerodromes is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.6.8 The use of fuel after flight commencement for purposes other than originally intended during pre-flight planning shall require a re-analysis and, if applicable, adjustment of the planned operation.

*Note.— Guidance on procedures for in-flight fuel management including re-analysis, adjustment and/or re-planning considerations when a flight begins to consume contingency fuel before take-off is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

### 4.3.7 In-flight fuel management

4.3.7.1 The operator shall establish policies and procedures, approved by the State of the Operator, to ensure that in-flight fuel checks and fuel management are performed.

4.3.7.2 The remote pilot-in-command shall continually ensure that the amount of usable fuel remaining on board is not less than the fuel required to proceed to a destination where a safe landing can be made with the planned final reserve fuel remaining upon landing.

*Note.— The protection of final reserve fuel is intended to ensure a safe landing at any destination when unforeseen occurrences may not permit safe completion of an operation as originally planned. Guidance on flight planning including the circumstances that may require re-analysis, adjustment and/or re-planning of the planned operation before take-off or en-route, is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.7.2.1 The remote pilot-in-command shall request delay information from ATC when unanticipated circumstances may result in landing at the destination with less than the final reserve fuel plus any fuel required to proceed to a destination alternate or the fuel required to operate to a destination which is isolated.

4.3.7.2.2 The remote pilot-in-command shall advise ATC of a minimum fuel state by declaring MINIMUM FUEL when, having committed to land at a specific destination, the pilot calculates that any change to the existing clearance to that destination may result in landing with less than the planned final reserve fuel.

*Note 1.— The declaration of MINIMUM FUEL informs ATC that all planned destination options have been reduced to a specific aerodrome of intended landing and any change to the existing clearance may result in landing with less than the planned final reserve fuel. This is not an emergency situation but an indication that an emergency situation is possible should any additional delay occur.*

*Note 2.— Guidance on declaring minimum fuel is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

4.3.7.2.3 The remote pilot-in-command shall declare a situation of fuel emergency by broadcasting MAYDAY, MAYDAY, MAYDAY FUEL when the calculated usable fuel estimated to be available upon landing at the nearest destination where a safe landing can be made is less than the planned final reserve fuel.

*Note 1.— The planned final reserve fuel refers to the value calculated in 4.3.6.4 e) and is the minimum amount of fuel required upon landing at any aerodrome.*

*Note 2.— The words “MAYDAY FUEL” describe the nature of the distress conditions as required in Annex 10, Volume II, 5.3.2.1.1, b) 3.*

*Note 3.— Guidance on procedures for in-flight fuel management is contained in the Flight Planning and Fuel Management (FPFM) Manual (Doc 9976).*

#### **4.3.8 Refuelling with passengers on board**

*Reserved for future use.*

#### **4.3.9 Oxygen supply**

*Reserved for future use.*

#### **4.3.10 Time capability of cargo compartment fire suppression system**

**Recommendation.** — *All flights should be planned so that the diversion time to an aerodrome where a safe landing could be made does not exceed the cargo compartment fire suppression time capability of the RPA, when one is identified in the relevant RPA documentation, reduced by an operational safety margin specified by the State of the Operator.*

*Note 1.* — *Cargo compartment fire suppression time capabilities will be identified in the relevant RPA documentation when they are to be considered for the operation.*

*Note 2.* — *Fifteen minutes is an operational safety margin commonly retained for that purpose.*

## 4.4 IN-FLIGHT PROCEDURES

### 4.4.1 Aerodrome operating minima

4.4.1.1 A flight shall not be continued towards the aerodrome of intended landing, unless the latest available information indicates that at the expected time of arrival, a landing can be effected at that aerodrome or at least one destination alternate aerodrome, in compliance with the operating minima established in accordance with 4.2.9.1.

4.4.1.2 An instrument approach shall not be continued below 300 m (1 000 ft.) above the aerodrome elevation or into the final approach segment unless the reported visibility or controlling RVR is at or above the aerodrome operating minima.

*Note.* — *Criteria for the final approach segment is contained in PANS-OPS (Doc 8168), Volume II.*

4.4.1.3 For approaches to aerodromes where the final part of the landing is to be conducted visually, if, after entering the final approach segment or after descending below 300 m (1 000 ft.) above the aerodrome elevation, the reported visibility or controlling RVR falls below the specified minimum, the approach may be continued to DA/H or MDA/H. In any case, an RPA shall not continue its approach-to-land at any aerodrome beyond a point at which the limits of the operating minima specified for that aerodrome would be infringed.

*Note 1.* — *In this case, ‘visually’ can refer to a VLOS operation or any synthetic/camera-based solution which enables the remote pilot to monitor and correct the RPA’s track when below the DA or DH.*

*Note 2.* — *Controlling RVR means the reported values of one or more RVR reporting locations (touchdown, mid-point and stop-end) used to determine whether operating minima are or are not met. Where RVR is used, the controlling RVR is the touchdown RVR, unless otherwise specified by State criteria.*

### 4.4.2 Meteorological observations

*Note.* — *The procedures for making meteorological observations and for recording and reporting them are contained in Annex 3, the PANS-ATM (Doc 4444) and the appropriate*

*Regional Supplementary Procedures (Doc 7030). For an RPA in flight such observations could be obtained from on board sensors.*

- 4.4.2.1 The remote pilot-in-command shall report the runway braking action via a special air-report (AIREP) when the runway braking action encountered is not as good as reported.

*Note. — The procedures for making special air-reports regarding runway braking action are contained in the PANS-ATM (Doc 4444), Chapter 4 and Appendix 1.*

#### **4.4.3 Hazardous flight conditions**

**Recommendation.**— *Hazardous flight conditions encountered, other than those associated with meteorological conditions, should be reported to the appropriate aeronautical station as soon as possible. The reports so rendered should give such details as may be pertinent to the safety of other aircraft.*

#### **4.4.4 Remote flight crew members at duty stations**

- 4.4.4.1 *Take-off and landing.* All remote flight crew members required for take-off and landing shall be at their duty stations.

- 4.4.4.2 *En-route.* All remote flight crew members required to be at their stations shall remain at their stations except when their absence is necessary for the performance of duties in connection with the operation of the RPA or for physiological needs.

#### **4.4.5 Use of oxygen**

*Reserved for future use.*

#### **4.4.6 Safeguarding of cabin crew and passengers**

*Reserved for future use.*

#### **4.4.7 In-flight operational instructions**

Operational instructions involving a change in the ATS flight plan shall be coordinated with the appropriate ATS unit before transmission to the remote pilot, when practicable.

*Note.— When the above coordination has not been possible, operational instructions do not relieve a remote pilot of the responsibility for obtaining an appropriate clearance from an ATS unit, if applicable, before making a change in flight plan.*

#### **4.4.8 Instrument flight procedures**

4.4.8.1 One or more instrument approach procedures designed to support instrument approach operations shall be approved and promulgated by the State in which the aerodrome is located to serve each instrument runway or aerodrome utilized for instrument flight operations.

4.4.8.2 All RPAS operated in accordance with instrument flight rules shall comply with the instrument flight procedures approved by the State in which the aerodrome is located, or by the State which is responsible for the heliport when located outside the territory of any State.

*Note.— Information for remote pilots on flight procedure parameters and operational procedures is contained in PANS-OPS (Doc 8168), Volume I. Criteria for the construction of instrument flight procedures for the guidance of procedure specialists are provided in PANS-OPS (Doc 8168), Volume II. Obstacle clearance criteria and procedures used in certain States may differ from PANS-OPS, and knowledge of these differences is important for safety reasons (see Chapter 3, 3.1.1).*

#### **4.4.9 RPA operating procedures for noise abatement**

4.4.9.1 **Recommendation.**— *RPA operating procedures for noise abatement should comply with the provisions of PANS-OPS (Doc 8168), Volume III.*

4.4.9.2 **Recommendation.**— *Noise abatement procedures specified by an operator for any one RPA type should be the same for all aerodromes.*

*Note.— A single procedure may not satisfy the requirements at some aerodromes.*

#### **4.4.10 RPAS operating procedures for rates of climb and descent**

**Recommendation.**— *Unless otherwise specified in an air traffic control instruction, to avoid unnecessary airborne collision avoidance system (ACAS II) resolution advisories in aircraft at or approaching adjacent altitudes or flight levels, operators should specify procedures to ensure that a rate of climb or descent of less than 8 m/s or 1 500 ft./min (depending on the instrumentation available) is achieved throughout the last 300 m (1 000 ft.) of climb or descent to the assigned altitude or flight level, when made aware of another aircraft at or approaching an adjacent altitude or flight level.*

*Note.— Material concerning the development of these procedures is contained in PANS-OPS (Doc 8168), Volume III, Section 4, Chapter 3.*

#### **4.4.11 RPAS operating procedures for landing performance**

For remotely piloted aeroplanes, an approach to land shall not be continued below 300 m (1 000 ft.) above aerodrome elevation unless the remote pilot-in-command is satisfied that, with the runway surface condition information available, the RPA performance information indicates that a safe landing can be made.

*Note 1.— The procedures used by aerodromes to assess and report runway surface conditions are contained in the PANS-Aerodromes (Doc 9981) and those for using runway surface condition information on board aircraft are in the Aeroplane Performance Manual (Doc 10064).*

*Note 2.— Guidance on development of RPA performance information is contained in the Aeroplane Performance Manual (Doc 10064).*

#### 4.4.12 Handovers

4.4.12.1 All RPS involved in the handover shall be under the operational control of the operator.

4.4.12.2 The operator shall develop procedures for the handover of control of an RPA from one RPS to another that ensure:

- a) the availability of the gaining RPS;
- b) the remote pilot initiating the handover retains responsibility for the RPA until handover is complete and the remote pilot in the gaining RPS has confirmed that control has been established;
- c) the remote pilot taking control of the RPA is notified of or briefed on the current ATC clearance and the current radio communication frequency and/or data link authority;
- d) the gaining RPS control settings are correctly aligned to the configuration of the RPA;
- e) the gaining RPS type is specified in the certificate of airworthiness of the RPA involved in the handover;
- f) the RPA is within C2 Link coverage of both the transferring and gaining RPS;
- g) communications between the transferring and gaining RPS involved in the handover are available and as near real-time as possible;
- h) the transferring RPS can retain or regain control of the RPA in the event that the handover to the gaining RPS is unsuccessful;
- i) notices to the remote pilot-in-command regarding the carriage of dangerous goods, including the NOTOC, are transferred to the remote pilot-in-command taking control of the RPA; and
- j) the journey log book is transferred and that the RPA technical log is accessible to the gaining RPS prior to conducting the handover, to allow the remote pilot taking control of the RPA to be made aware of the current status of the RPAS to include any faults/system failures;
- k) that the remote pilot-in-command is provided with following information prior to conducting the handover:

- 1) location of the RPA and surrounding traffic;
- 2) current meteorological conditions;
- 3) destination weather forecast or conditions;
- 4) C2 Link status and configuration;
- 5) changes or limitations to the intended flight or RPA performance; and
- 6) ATM-related limitations or outages (e.g. communications, navigation, surveillance equipment).

4.4.12.3 There shall be only one RPS actively controlling an RPA at any one time.

4.4.12.4 **Recommendation.** — *The RPS intended to gain control of an RPA may monitor the activities of the controlling RPS to obtain situational awareness or to facilitate communications between the remote pilots, but should only send commands to the RPA once control has been transferred.*

4.4.12.5 The remote flight crew members involved in the handover shall be qualified for the:

- a)
  - a) RPS they are operating;
  - b) RPA being transferred; and
  - c) portion or phase of the flight which they are conducting.

*Note.— An electronic method for an operator to verify the qualification of the remote flight crew members involved in handovers may be used.*

4.4.12.6 Handovers conducted when the RPA is on the ground for maintenance or other purposes, shall only be conducted if the:

- a) RPA is secured so as to prevent inadvertent ground movements or take-off; and
- b) C2 Link is approved for use on the ground where the RPA and the RPS are located.

*Note.— To facilitate maintenance or taxiing operations, qualified personnel other than remote pilots may be authorized by the operator to conduct handovers, in accordance with 4.2.5.2.*

#### 4.4.13 Transfer of control between remote pilots at a single RPS

4.4.13.1 The operator shall develop procedures for the transfer of control of an RPA between remote pilots as one remote pilot relieves the other at the same RPS. These procedures shall include the following minimum information to be provided to the remote pilot taking control of the RPA:

- a) current status of the RPAS, to include any faults/system failures;

- b) location of the RPA and surrounding traffic;
- c) current ATC clearance, ATC unit, and communication frequency or channel and if using data link communications, the current data link authority;
- d) current meteorological conditions;
- e) destination weather forecast or conditions;
- f) status of fuel and other RPA consumables;

- g) C2 Link status and configuration;
- h) changes or limitations to the intended flight or RPA performance;
- i) ATM-related limitations or outages (e.g. communications, navigation, surveillance equipment); and
- j) notices to the remote pilot-in-command regarding the carriage of dangerous goods, including the NOTOC, as applicable.

4.4.13.2 If flight operations will necessitate transfer of remote pilot-in-command responsibility during flight, the operator shall establish transfer procedures that ensure the safe continuity of the operation.

## 4.5 RPAS SPECIFIC OPERATING RULES

*Note.— See Annex 2, Appendix 4, for general operating rules applicable to RPAS.*

### 4.5.1 Establishment, assurance and termination of the C2 Link

4.5.1.1 When managed through the C2 Link, taxiing or ground movement shall not be initiated or shall be aborted if the Quality of Service Experienced (QoSE) does not provide the required performance for the remote pilot to safely control the RPA.

4.5.1.2 Take-off shall not be initiated or, if safe to do so, shall be aborted if the QoSE does not provide the required performance for the remote pilot to safely control the RPA.

4.5.1.3 A switchover to another C2 Link or network shall be conducted in accordance with the procedures defined in the operations manual. Such procedures shall include confirming the QoSE of the accepting C2 Link or network.

4.5.1.4 The remote pilot shall initiate the condition of a lost C2 Link state if, while in flight, the QoSE has been determined by the remote pilot to be insufficient to actively manage the flight in a safe and timely manner.

### 4.5.2 Visual line-of-sight

For portions of the flight requiring visual line-of-sight (VLOS) procedures, including night-time operations, the remote pilot or an RPA observer shall maintain direct unaided visual contact with the RPA.

### 4.5.3 Take-off and landing

*Note 1. — RPAS may be operated from aerodromes, to include both airports and heliports, open to public use or other locations fulfilling the operational requirements and that meet the system configuration, design and performance requirements.*

*Note 2. — This section also applies to launch and recovery operations.*

4.5.3.1 For operations at locations other than aerodromes open to public use, the operator or remote pilot, prior to conducting operations at that location, shall take into account the following:

- a) take-off and landing area and the condition thereof, to include protections for persons and property;
- b) meteorological conditions appropriate to the intended flight;
- c) location and height of all obstacles that could hinder take-off or landing;
- d) performance and capability related to obstacle clearance, departure or arrival procedures (if applicable) and any flight restrictions;
- e) communications with the appropriate ATS unit, if required;
- f) service provision ensuring required C2 Link performance (transaction time, availability, continuity and integrity);
- g) compliance with ATC clearances and instructions in controlled airspace or remaining well clear from other air traffic in uncontrolled airspace; and
- g) availability of ground infrastructure, services and equipment required for take-off/launch, landing/recovery and taxiing (if applicable).

#### **4.5.4 Launch and recovery equipment**

4.5.4.1 Where specific launch and recovery equipment is required, the positioning, set-up, and operation of the launch and recovery equipment shall be coordinated with the aerodrome operator and appropriate ATS unit(s) to ensure there is no adverse impact on safety.

4.5.4.2 The RPAS ground crew and/or the remote flight crew shall position, prepare, set up and check that the condition and operability of all required launch and recovery equipment is:

- a) in accordance with the instructions provided by the manufacturer;
- b) in a position coordinated with the aerodrome operator and appropriate ATS unit(s) if located at an aerodrome; and
- c) for operations at locations other than aerodromes open to public use, in a position to afford protection to persons and property.

4.5.4.3 The operator shall ensure that the required launch and recovery equipment is serviceable before each launch and compatible with each RPA being used.

4.5.4.4 During launch and recovery operations, only persons and vehicles authorized by the operator shall be permitted within the launch and recovery area of the RPA.

*Note.— Further guidance regarding the launch and recovery area can be found within Volume II of the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019).*

#### 4.5.1 Emergencies and contingencies

The RPAS operations manual shall contain procedures to mitigate at least the following:

- a) lost C2 Link, including the potential loss of air-ground communications;
- b) loss of essential systems or navigational data;
- c) unavailability of required services or equipment;
- d) unscheduled closure of airspace or aerodromes;
- e) emergency landing;
- f) RPS crew incapacitation; and
- h) inadvertent release of dangerous goods.

#### 4.5.2 Emergency landing, ditching locations, flight termination

*Note.— Depending on the configuration of the RPA, remote pilots may have limited ability to observe actual details on the ground in the vicinity of the RPA during an emergency. The remote pilot may rely to a much greater extent on preplanning emergency scenarios that may occur along the intended route of flight.*

4.5.2.1 When planning for, or selecting, emergency landing locations, remote pilots shall prioritize the safety of persons on the ground over RPA recovery.

4.5.2.2 During flight, remote pilots shall reassess the selected emergency landing areas so that risks to persons and property on the ground are minimized, considering the following:

- a) type of terrain and ground obstructions;
- b) population density and open air assemblies of persons;
- c) accessibility for recovery or fire suppression;
- d) proximity of aerodromes;
- e) possibility of landing on open water; and
- e) type and quantity of dangerous goods on board.

4.5.6.3 The operator shall establish procedures for the use of a flight termination system, if the RPA is so equipped.

#### 4.5.7 C2 Link contingency and emergency procedures

4.5.7.1 If any of the C2 Link components fail, actions shall be taken to minimize the time that the remote pilot is not actively managing the flight of the RPA.

4.5.7.2 The RPAS operations manual shall state the actions to be taken by the remote pilot to minimize the time that the RPAS is in a lost C2 Link state.

4.5.7.3 Contingency switchovers shall be performed in line with security measures and procedures that ensure that the accepting C2 Link or network is authenticated and authorized.

4.5.7.4 Contingency handovers shall be performed in line with security measures and procedures that ensure that the gaining RPS is authenticated and authorized to take control of the RPA.

4.5.7.5 A means or process for anticipating C2 Link interruptions or lost C2 Link states shall be provided to the remote pilot.

#### 4.5.8 Lost C2 Link

4.5.8.1 In the event of a lost C2 Link, an RPA shall be capable of following a pre-programmed and predictable flight profile.

4.5.8.2 Prior to flight, the operator shall ensure that if the RPAS enters a lost C2 Link state, the RPA will follow the procedures contained in Annex 2 or the relevant State Aeronautical Information Publication (AIP).

4.5.8.3 The operator shall establish crew procedures for C2 Link interruption and lost C2 Link operations.

*Note.— Additional procedures related to emergencies, voice communication failure and contingencies are described in the Procedures for Air Navigation Services — Air Traffic Management (Doc 4444), Chapter 15.*

4.5.8.4 When operating in airspace where SSR transponder carriage is required, the RPAS/RPA shall set the transponder to Mode A Code 7400 to indicate a lost C2 Link state.

4.5.8.5 When operating in airspace where ADS-B carriage is required or if ADS-B is part of the RPA detect and avoid (DAA) capability, the RPAS/RPA shall be capable of selecting the appropriate functionality to indicate a lost C2 Link state.

4.5.8.6 Remote pilots shall notify the ATC unit as soon as practicable upon the lost C2 Link procedures being activated for any flight operated as a controlled flight or any flight that may affect other aircraft operating in controlled airspace and, if applicable, upon the C2 Link being successfully restored.

## 4.6 DUTIES OF REMOTE PILOT-IN-COMMAND

*Note.* — 4.2.12 permits the use of multiple remote pilots-in-command during a flight.

4.6.1 The remote pilot-in-command is responsible for the operation and safety of the RPA from the moment the RPA is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down.

4.6.1.1 The remote pilot-in-command shall hold the duties of remote pilot-in-command during the period detailed in 4.6.1 above, or for flights involving the use of multiple remote pilots-in command, from the time that person has assumed the duties from the previous remote pilot-in-command until the duties have been accepted by another remote pilot-in-command, or the RPA has come to rest at the end of the flight, as appropriate.

4.6.2 The remote pilot-in-command shall ensure that the checklists specified in 4.2.7 are complied with in detail.

4.6.3 The remote pilot-in-command shall be responsible for notifying the nearest appropriate authorities, by the quickest available means, of any accident involving the RPAS resulting in serious injury or death of any person or substantial damage to the aeroplane or property.

*Note.*— *The appropriate authorities could include the civil aviation authority and the accident investigation authority in the State of Occurrence and in the State where the RPS is located, if different. Further details on the notification of accidents are contained in Annex 13, Chapter 4 – Notification and associated guidance material.*

4.6.3.1 **Recommendation.**— *In the event that the remote pilot-in-command is unable to comply with 4.6.3, the operator should notify the nearest appropriate authorities.*

4.6.4 The remote pilot-in-command, or a person designated by the operator, shall be responsible for reporting all known or suspected defects in the RPAS to the operator at the earliest practicable time.

4.6.5 The remote pilot-in-command shall be responsible for the journey log book or the general declaration containing the information listed in 11.4.2.

*Note.*— *By virtue of Resolution A10-36 of the Tenth Session of the Assembly (Caracas, June–July 1956) “the General Declaration, [described in Annex 9] when prepared so as to contain all the information required by Article 34 [of the Convention on International Civil Aviation] with respect to the journey log book, may be considered by Contracting States to be an acceptable form of journey log book”.*

## 4.7 DUTIES OF FLIGHT OPERATIONS OFFICER/FLIGHT DISPATCHER

4.7.1 Where required in the operations manual, a flight operations officer/flight dispatcher in conjunction with a method of control and supervision of flight operations in accordance with 4.2.1.4 shall:

- a) assist the remote pilot-in-command in flight preparation and provide the relevant information;

- b) assist the remote pilot-in-command in preparing the operational and ATS flight plans, sign when applicable and file the ATS flight plan with the appropriate ATS unit;
- c) furnish the remote pilot-in-command while in flight, by appropriate means, with information which may be necessary for the safe conduct of the flight; and
- d) notify the appropriate ATS unit when the position of the RPA cannot be determined by an aircraft tracking capability and/or attempts to establish communication with the remote pilot are unsuccessful.

4.7.2 In the event of an emergency, a flight operations officer/flight dispatcher shall:

- a) initiate such procedures as outlined in the operations manual while avoiding taking any action that would conflict with ATC procedures; and
- b) convey safety-related information to the remote pilot-in-command that may be necessary for the safe conduct of the flight, including information related to any amendments to the flight plan that become necessary in the course of the flight.

*Note.— It is equally important that the remote pilot-in-command also convey similar information to the flight operations officer/ flight dispatcher during the course of the flight, particularly in the context of emergency situations.*

#### **4.8 EXTENDED DIVERSION TIME OPERATIONS (EDTO)**

*Reserved for future use.*

#### **4.9 CARRY-ON BAGGAGE**

*Reserved for future use.*

#### **4.10 FATIGUE MANAGEMENT**

*Note.— Guidance on the development and implementation of fatigue management regulations is contained in the Manual for the Oversight of Fatigue Management Approaches (Doc 9966).*

4.10.1 The State of the Operator shall establish regulations for the purpose of managing fatigue. These regulations shall be based upon scientific principles, knowledge and operational experience with the aim of ensuring that remote flight crew members are performing at an adequate level of alertness. Accordingly, the State of the Operator shall establish:

- a) prescriptive regulations for duty periods, duty period limitations and rest period requirements; and
- b) where authorizing the operator to use a Fatigue Risk Management System (FRMS) to manage fatigue, FRMS regulations in accordance with Appendix 7.

4.10.2 The State of the Operator shall require that the operator, in compliance with 4.10.1 and for the purposes of managing its fatigue-related safety risks, establish either:

- a) duty periods, duty period limitations and rest period requirements that are within the prescriptive fatigue management regulations established by the State of the Operator; or
- b) an FRMS in compliance with 4.10.1 b) for all operations; or
- c) an FRMS in compliance with 4.10.5 for part of its operations and the requirements of 4.10.2 a) for the remainder of its operations.

*Note.— Complying with the prescriptive fatigue management regulations does not relieve the operator of the responsibility to manage its risks, including fatigue-related risks, using its safety management system (SMS) in accordance with the provisions of Annex 19.*

4.10.3 Where the operator adopts prescriptive fatigue management regulations for part or all of its operations, the State of the Operator:

- a) shall require evidence that the limitations are not exceeded and that non-duty period requirements are met;
- b) shall require that the operator familiarizes its personnel with the principles of fatigue management and its policies with regard to fatigue management;
- c) shall establish a process to allow variations from the prescriptive fatigue management regulations to address any additional risks associated with sudden, unforeseen operational circumstances; and
- d) may approve, in exceptional circumstances, variations to these regulations on the basis of a risk assessment provided by the operator. Approved variations shall provide a level of safety equivalent to, or better than, that achieved through the prescriptive fatigue management regulations.

4.10.4 Where an operator implements an FRMS to manage fatigue-related safety risks in the provision of part or all of its operations in accordance with 4.10.2 b), the State shall:

- a) require the operator to have processes to integrate FRMS functions with its other safety management functions; and
- b) approve an FRMS, according to a documented process, that provides a level of safety acceptable to the State.

*Note.— Provisions on the protection of safety information, which support the continued availability of information required by an FRMS, are contained in Annex 19.*

4.10.5 Where the operator implements an FRMS to manage fatigue-related safety risks, the operator shall, as a minimum: incorporate scientific principles and knowledge within the FRMS;

- a) identify fatigue-related safety hazards and the resulting risks on an ongoing basis;
- b) ensure that remedial actions, necessary to effectively mitigate the risks associated with the hazards, are implemented promptly;
- c) provide for continuous monitoring and regular assessment of the mitigation of fatigue risks achieved by such actions; and
- d) provide for continuous improvement to the overall performance of the FRMS.

Note. — Detailed requirements for an FRMS are in Appendix 7.

4.10.6 **Recommendation.** — *States should require that, where the operator has an FRMS, it is integrated with the operator's SMS.*

*Note.— The integration of FRMS and SMS is described in the Manual for the Oversight of Fatigue Management Approaches (Doc 9966).*

4.10.7 The operator shall maintain records for all its remote flight crew members of duty periods and rest periods for a period of time specified by the State of the Operator.

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## CHAPTER 5. RPAS PERFORMANCE OPERATING LIMITATIONS

### 5.1 GENERAL

5.1.1 RPA shall be operated in accordance with a comprehensive and detailed code of performance established by the State of Registry in compliance with the applicable Standards of this chapter.

*Note 1. — The code of performance reflects, for the conduct of operations, both the various phases of flight and the operational environment.*

*Note 2.— The Helicopter Code of Performance Development Manual (Doc 10110) provides guidance to assist States in establishing a code of performance for helicopters.*

5.1.2 Except as provided in 5.4 and 5.5 for single-engine RPA, RPA shall only be operated over such routes and diversions therefrom, that permit a safe forced landing to be executed in the event of a critical engine failure.

5.1.2.1 For remotely piloted helicopters, notwithstanding the provisions of 5.1.2, the State of the Operator may, based on the result of a risk assessment, allow for variations without a safe forced landing to be included in the code of performance established in accordance with the provisions of 5.1.1. The risk assessment shall take into consideration at least the following:

- a) the type and circumstances of the operation;
- b) the area/terrain over which the operation is being conducted and the population density;
- c) the probability of, and length of exposure to, a critical engine failure and the tolerability of such an event;
- d) the procedures and systems for monitoring and maintaining the reliability of the engine(s);
- e) the training and operational procedures to mitigate the consequences of the critical engine failure; and
- f) remotely piloted helicopter equipment.

*Note. — Guidance on conduct of the risk assessment to allow for variations to the need for a safe forced landing, including mitigation strategies to reduce the risk, is contained in the Helicopter Code of Performance Development Manual (Doc 10110).*

5.1.2.2 Where the State of the Operator permits operations over heavily populated areas with remotely piloted helicopters in performance Class 3, such operations shall be conducted in accordance with the provisions of 5.5.

5.1.3 **Recommendation.** — *For RPAS for which Parts VIII, IX and X of Annex 8 are not applicable because of the exemption provided for in Article 41 of the Convention, the State of Registry should ensure that the level of performance specified in 5.2 should be met as far as practicable.*

## 5.2 RPA CERTIFICATED IN ACCORDANCE WITH PARTS VIII AND IX OF ANNEX 8

5.2.1 The Standards contained in 5.2.2 to 5.2.10 inclusive are applicable to the RPA to which Parts VIII and IX of Annex 8 are applicable.

*Note.— The following Standards do not include quantitative specifications comparable to those found in national airworthiness codes. In accordance with 5.1.1, they are to be supplemented by national requirements prepared by Contracting States.*

5.2.2 The level of performance defined by the appropriate parts of the comprehensive and detailed national code referred to in 5.1.1 for RPA designated in 5.2.1 shall be at least substantially equivalent to the overall level embodied in the Standards of this chapter.

5.2.3 An RPA shall be operated in compliance with the terms of its certificate of airworthiness and within the approved operating limitations contained in its flight manual.

5.2.4 The State of Registry shall take such precautions as are reasonably possible to ensure that the general level of safety contemplated by these provisions is maintained under all expected operating conditions, including those not covered specifically by the provisions of this chapter.

5.2.5 A flight shall not be commenced unless the performance information provided in the flight manual, supplemented as necessary with other data acceptable to the State of the Operator, indicates that the Standards of 5.2.6 to 5.2.10 can be complied with for the flight to be undertaken.

5.2.6 In applying the Standards of this chapter, account shall be taken of all factors that significantly affect the performance of the RPA, including but not limited to the:

- a) mass of the RPA;
- b) operating procedures;
- c) pressure-altitude appropriate to the elevation of the aerodrome;
- d) for remotely piloted aeroplanes, runway slope;
- e) ambient temperature;
- f) wind;
- g) surface conditions of the runway, heliport or landing location at the expected time of use, i.e. presence of snow, slush, water, and/or ice for land RPA, water surface condition for sea RPA; and
- h) C2 Link specification and performance.

5.2.7 Such factors as addressed in 5.2.6 above shall be taken into account directly as operational parameters or indirectly by means of allowances or margins, which may be provided in the

scheduling of performance data or in the comprehensive and detailed code of performance in accordance with which the RPA is being operated.

*Note. — For remotely piloted aeroplanes, guidelines for using runway surface condition information in accordance with 4.4.11 are contained in the Aeroplane Performance Manual (Doc 10064).*

## 5.2.8 Mass limitations

5.2.8.1 The mass of the RPA at the start of take-off shall not exceed the mass at which 5.2.8.4 is complied with, or the mass at which 5.2.9 and 5.2.10 are complied with, allowing for expected reductions in mass as the flight proceeds, and for such fuel jettisoning as is envisaged in applying 5.2.10 and, in respect of alternate aerodromes, 5.2.8.3 and 5.2.11.

5.2.8.2 In no case shall the mass at the start of take-off exceed the maximum take-off mass specified in the flight manual for the pressure altitude appropriate to the elevation of the aerodrome, and if used as a parameter to determine the maximum take-off mass, any other local atmospheric condition.

5.2.8.3 In no case shall the estimated mass for the expected time of landing at the destination of intended landing and at any destination alternate aerodromes, exceed the maximum landing mass specified in the flight manual for the pressure altitude appropriate to the elevation of those aerodromes, and if used as a parameter to determine the maximum landing mass, any other local atmospheric condition.

5.2.8.4 In no case shall the mass at the start of take-off, or at the expected time of landing at the aerodrome and at any destination alternate aerodrome, exceed the relevant maximum masses at which compliance has been demonstrated with the applicable noise certification Standards in Annex 16, Volume I, unless otherwise authorized in exceptional circumstances for a certain destination or a runway where there is no noise disturbance problem, by the State of the Aerodrome in which the aerodrome is situated.

### 5.2.9 *Take-off phase*

5.2.9.1 *Remotely piloted aeroplanes.* The remotely piloted aeroplane shall be able, in the event of a critical engine failing, or for other reasons, at any point in the take-off, either to discontinue the take-off and stop within either the accelerate-stop distance available or the runway available, or to continue the take-off and clear all obstacles along the flight path by an adequate vertical or horizontal distance until the remotely piloted aeroplane is in a position to comply with 5.2.10.1. When determining the resulting take-off obstacle accountability area, the operating conditions, such as the crosswind component and navigation accuracy, must be taken into account.

5.2.9.1.1 For remotely piloted aeroplanes, in determining the length of the runway available, account shall be taken of the loss, if any, of runway length due to alignment of the remotely piloted aeroplane prior to take-off.

5.2.9.2 *Remotely piloted helicopter operations in performance Class 1.* The remotely piloted helicopter shall be able, in the event of the failure of the critical engine being recognized at or before the take-off decision point, to discontinue the take off and stop within the rejected take-off area available or, in the event of the failure of the critical engine being recognized at or after the

take-off decision point, to continue the take-off, clearing all obstacles along the flight path by an adequate margin until the remotely piloted helicopter is in a position to comply with 5.2.10.3.

5.2.9.3 *Remotely piloted helicopter operations in performance Class 2.* The remotely piloted helicopter shall be able, in the event of the failure of the critical engine at any time after reaching the defined point after take-off (DPATO), to continue the take-off, clearing all obstacles along the flight path by an adequate margin until the remotely piloted helicopter is in a position to comply with 5.2.10.3. Before the DPATO, failure of the critical engine may cause the remotely piloted helicopter to force-land; therefore the conditions stated in 5.1.2 shall apply.

5.2.9.4 *Remotely piloted helicopter operations in performance Class 3.* At any point of the flight path, failure of an engine will cause the remotely piloted helicopter to force-land; therefore, the conditions stated in 5.1.2 shall apply.

#### 5.2.10 *En-route phase*

5.2.10.1 *Remotely piloted aeroplanes — one engine inoperative.* In the case of a remotely piloted aeroplane having no less than two engines, the remotely piloted aeroplane shall be able, in the event of the critical engine becoming inoperative at any point along the route or planned diversions therefrom, to continue the flight to an aerodrome at which the Standard of 5.2.11.1 can be met, without flying below the minimum obstacle clearance altitude at any point.

5.2.10.2 *Remotely piloted aeroplanes — two engines inoperative.* In the case of a remotely piloted aeroplane having three or more engines, on any part of a route where the location of en-route alternate aerodromes and the total duration of the flight are such that the probability of a second engine becoming inoperative must be allowed for if the general level of safety implied by the Standards of this chapter is to be maintained, the remotely piloted aeroplane shall be able, in the event of any two engines becoming inoperative, to continue the flight to an en-route alternate aerodrome and land.

5.2.10.3 *Remotely piloted helicopters - operations in performance Classes 1 and 2.* The remotely piloted helicopter shall be able, in the event of the failure of the critical engine at any point in the en-route phase, to continue the flight to a site at which the conditions of 5.2.11.2 for operations in performance Class 1, or the conditions of 5.2.11.3 for operations in performance Class 2 can be met, without flying below the appropriate minimum flight altitude at any point.

5.2.10.4 *Remotely piloted helicopters - operations in performance Class 3.* The remotely piloted helicopter shall be able, with all engines operating, to continue along its intended route or planned diversions without flying at any point below the appropriate minimum flight altitude. At any point of the flight path, failure of an engine will cause the remotely piloted helicopter to force-land; therefore the conditions stated in 5.1.2 shall apply.

#### 5.2.11 *Approach and landing phase*

5.2.11.1 *Remotely piloted aeroplanes.* The remotely piloted aeroplane shall, at the aerodrome of intended landing and at any alternate aerodrome, after clearing all obstacles in the approach path by a safe margin, be able to land, with assurance that it can come to a stop or, for a sea remotely piloted aeroplane, to a satisfactorily low speed, within the landing distance available. Allowance shall be made for expected variations in the approach and landing techniques, if such allowance has not been made in the scheduling of performance data.

*Note.— Guidelines on appropriate margins for the “at time of landing” distance assessment is contained in the Aeroplane Performance Manual (Doc 10064).*

5.2.11.2 *Remotely piloted helicopters - operations in performance Class 1.* In the event of the failure of the critical engine being recognized at any point during the approach and landing phase, before the landing decision point, the remotely piloted helicopter shall, at the destination and at any alternate, after clearing all obstacles in the approach path, be able to land and stop within the landing distance available or to perform a balked landing and clear all obstacles in the flight path by an adequate margin equivalent to that specified in 5.2.9.2. In case of the failure occurring after the landing decision point, the remotely piloted helicopter shall be able to land and stop within the landing distance available.

5.2.11.3 *Remotely piloted helicopters - operations in performance Class 2.* In the event of the failure of the critical engine before the defined point before landing (DPBL), the remotely piloted helicopter shall, at the destination and at any alternate, after clearing all obstacles in the approach path, be able either to land and stop within the landing distance available or to perform a balked landing and clear all obstacles in the flight path by an adequate margin equivalent to that specified in 5.2.9.3. After the DPBL, failure of an engine may cause the remotely piloted helicopter to force-land; therefore, the conditions stated in 5.1.2 shall apply.

5.2.11.4 *Remotely piloted helicopters - operations in performance Class 3.* At any point of the flight path, failure of an engine will cause the remotely piloted helicopter to force-land; therefore, the conditions stated in 5.1.2 shall apply.

### 5.3 OBSTACLE DATA

5.3.1 The operator shall use available obstacle data to:

- a) for remotely piloted aeroplanes, develop procedures to comply with 5.2.10.1;  
or
- b) for remotely piloted helicopters, develop procedures to comply with the take-off, initial climb, approach and landing phases detailed in the code of performance established by the State of the Operator.

*Note.— See Annex 4 and Annex 15, Chapter 5 and Appendix 1 and the Procedures for Air Navigation Services — Aeronautical Information Management (PANS-AIM), Chapter 5 for methods of presentation of certain obstacle data.*

5.3.2 The operator shall take account of charting accuracy when assessing compliance with 5.2.9.

### 5.4 ADDITIONAL REQUIREMENTS FOR OPERATIONS OF APPROVED SINGLE-ENGINE REMOTELY PILOTED AEROPLANES OVER HEAVILY POPULATED AREAS

5.4.1 In approving operations by single-engine remotely piloted aeroplanes over heavily populated areas, the State of the Operator shall ensure that the airworthiness certification of the remotely

piloted aeroplane is appropriate and that the overall level of safety intended by the provisions of Annexes 6 and 8 is provided by:

- a) the reliability of the engine;
- b) the operator's maintenance procedures, operating practices, flight dispatch procedures and crew training programmes; and
- c) equipment and other requirements provided in accordance with Appendix 3.

5.4.2 All single-engine remotely piloted aeroplanes operated over heavily populated areas shall have an automatic engine trend monitoring system.

## 5.5 ADDITIONAL REQUIREMENTS FOR OPERATIONS OF REMOTELY PILOTED HELICOPTERS IN PERFORMANCE CLASS 3 OVER HEAVILY POPULATED AREAS

5.5.1 Remotely piloted helicopter operations in performance Class 3 shall be conducted only over a surface environment acceptable to the competent authority of the State over which the operations are performed.

5.5.2 In approving operations by remotely piloted helicopters operating in performance Class 3 over heavily populated areas, the State of the Operator shall ensure that the airworthiness certification of the remotely piloted helicopter is appropriate and that the overall level of safety intended by the provisions of Annexes 6 and 8 is provided by:

- a) the reliability of the engines;
- b) the operator's maintenance procedures, operating practices and crew training programmes; and
- c) equipment and other requirements provided in accordance with Appendix 3.

Note.— Guidance on additional requirements for operations of remotely piloted helicopters in performance Class 3 over *heavily populated areas* is contained in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019).

5.5.3 Operators of remotely piloted helicopters operating in performance Class 3 over heavily populated areas shall have a programme for engine trend monitoring and shall utilize the engine and helicopter manufacturers' recommended instruments, systems and operational/maintenance procedures to monitor the engines.

5.5.4 **Recommendation.**— *In order to minimize the occurrence of mechanical failures, remotely piloted helicopters operating over heavily populated areas in performance Class 3 should utilize vibration health monitoring for the tail-rotor drive system.*



## CHAPTER 6. RPAS INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

Note. — Specifications for the provision of RPAS communication and navigation equipment are contained in Chapter 7.

### 6.1 GENERAL

- 6.1.1 In addition to the minimum equipment necessary for the issuance of a certificate of airworthiness, the instruments, equipment, flight documents, information and data prescribed in the following paragraphs shall be installed or carried, as appropriate, in the RPA or RPS according to the RPAS used and to the circumstances under which the operation is to be conducted. The prescribed instruments and equipment, including their installation, shall be approved or accepted by the State of Registry.

Note. — Information regarding equipment required for operations in a given airspace can be found in the Regional Supplementary Procedures (Doc 7030) and Aeronautical Information Publications (AIPs).

- 6.1.2 The operator shall provide a minimum equipment list (MEL) in the operations manual, approved by the State of the Operator which will enable the remote pilot-in-command to determine whether a flight may be commenced or continued from any intermediate stop should any instrument, equipment or systems become inoperative. Where the State of the Operator is not the State of Registry, the State of the Operator shall ensure that the MEL does not affect the RPA's compliance with the airworthiness requirements applicable in the State of Registry.

Note. — Attachment E contains guidance on the minimum equipment list.

- 6.1.3 The operator shall provide operations staff and remote flight crew with an RPAS operating manual, for each RPA type operated, containing the normal, abnormal and emergency procedures relating to the operation of the RPA/RPS. The manual shall include details of the RPA/RPS systems and of the checklist to be used. The design of flight manuals shall observe human performance principles.

Note 1.— Appendix 2 contains requirements on the organization and content of an operations manual.

Note 2. — States may reference accepted and recognized industry codes of practice as the basis for the development of an operations manual.

Note 3.— Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

#### 6.1.4 RPAS operated under an Article 83 bis agreement

Reserved for future use.

Note.— Guidance concerning the transfer of responsibilities by the State of Registry to the State of the Operator in accordance with Article 83 bis is contained in the Manual on the implementation of Article 83 bis of the Convention on International Civil Aviation (Doc 10059).  
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## 6.2 ALL RPAS ON ALL FLIGHTS

An RPAS shall be equipped with the systems and instruments necessary to enable the remote pilot to control the flight path of the RPA, carry out any required procedural manoeuvres and observe the operating limitations of the RPA in the expected operating conditions.

## 6.3 C2 LINK

The C2 Link shall comply with the requirements defined in Annex 10, Volume VI.

## 6.4 REMOTE PILOT STATION

### 6.4.1 General

Note. — Configuration management aspects of RPAS are addressed in Annex 8, Part X.

6.4.1.1 The RPS shall be equipped with suitable controls and displays which will enable the remote pilot(s) to monitor and control the intended operation of the RPA on the ground and in the air.

6.4.1.2 The RPS shall enable the remote pilot(s) to carry out any required manoeuvres and deal with emergencies while observing the operating limitations in the expected operating conditions.

6.4.1.3 The RPS shall provide the means for the remote pilot(s) to communicate with ATS units and other airspace users as appropriate.

6.4.1.4 The RPS shall be equipped to provide the remote pilot with all the relevant information, alerts and warnings pertaining to the operation, in a timely and distinctive manner.

### 6.4.2 RPS work environment

6.4.2.1 The operator shall ensure that the RPS is located in an environment which:

- a) allows the remote pilot(s) to concentrate on their tasks; and
- b) minimizes distractions.

6.4.2.2 The operator shall ensure that the working environment for the remote flight crew takes into account the application of Human Factors principles.

Note 1.— Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

Note 2. — Considerations related to the working environment may include appropriate space, lighting, air conditioning, ergonomic furniture and required information or tools for the operation to be readily available.

6.4.2.3 The display(s) shall be so arranged as to permit the remote pilot(s) to see the indications readily from their station.

6.4.2.4 A means of measuring and displaying time in hours, minutes and seconds shall be available to the remote flight crew.

### 6.4.3 Manuals, charts and information

6.4.3.1 The remote pilot shall have the following manuals, charts and information, readily available at the RPS:

- a) the operations manual prescribed in 4.2.4 or those parts of it that pertain to flight operations;
- b) the flight manual for the RPAS, or other documents containing performance data required for the application of Chapter 5, and any other information necessary for the operation of the RPAS within the terms of its certificate of airworthiness, unless these data are available in the operations manual;
- c) current and suitable charts for the route of the proposed flight and all routes along which it is reasonable to expect that the flight may be diverted;
- d) procedures, as prescribed in Annex 2, for pilots-in-command of intercepted aircraft;
- e) visual signals for use by intercepting and intercepted aircraft, if relevant for the RPA being used, as contained in Annex 2;
- f) the appropriate licence for each remote flight crew member;
- g) the checklists to which 4.2.7 refers; and
- h) any information and procedures identified as relevant in the safety assessment performed by the operator including emergency and contingency procedures.

6.4.3.2 Each RPS shall have available a flight manual for each RPA type capable of being, and intended to be, operated from the RPS.

### 6.4.4 Contingency plans

6.4.4.1 The operator shall provide the remote flight crew with the capability to contact and coordinate with the appropriate ATS unit in the event of an evacuation of the RPS.

6.4.4.2 The remote flight crew shall contact and coordinate with the appropriate ATS unit in the event of an evacuation of the RPS.

6.4.4.3 The operator shall develop, promulgate and implement contingency plans to provide alternative RPS facilities when assigned RPS facilities are unavailable.

Note. — A widespread outage affecting assigned RPS facilities at a single location may necessitate the use of alternative RPS facilities at other locations.

6.4.4.4 Contingency plans shall include, as a minimum, the following:

- a) provisions for alternative facilities and services;
- b) detailed agreements among the parties concerned, before the occurrence of the event requiring contingency action, including the manner and timing of promulgating such arrangements; and
- c) details regarding alternative RPS facilities, infrastructure and remote pilots.

6.4.4.5 **Recommendation.** — Such plans should be developed in consultation with affected stakeholders.

Note. — The operator may consider enhancing contingency arrangements if an RPS facility is to be located in a geographical area susceptible to adverse natural phenomena (e.g. earthquakes or floods), to ensure that an alternate RPS facility is suitable for long-term operations at short notice in the event of the total destruction of the original RPS facility.

## 6.5 RPAS RECORDER SYSTEMS

Note 1.— RPAS recorder systems record data from any system on-board the RPA and the RPS (e.g. video from the RPA, audio, data, and C2 Link).

Note 2.— Detailed requirements on RPAS recorder systems are contained in Appendix 8.

Note 3.— European Organisation for Civil Aviation Equipment (EUROCAE) EUROCAE ED-112A, Minimum Operational Performance Specifications (MOPS) for Flight Recorders and EUROCAE ED-155, Minimum Operational Performance Specifications (MOPS) for Lightweight Flight Recording Systems, may provide information to aid in the design of a recorder used on an RPAS.

### 6.5.1 Applicability

6.5.1.1 For all RPA of a maximum certified take-off mass (MCTOM) of over 2 250 kg, and that are first issued with a certificate of airworthiness on or after [date of adoption of Annex 6, Part IV + 3 years] an RPA-RS on board the RPA shall record the data associated with the RPA functions defined in Appendix 8, Section 3.

6.5.1.2 **Recommendation.** — For all RPA of a MCTOM of 2 250 kg or less, the data associated with the RPA functions defined in Appendix 8 should be recorded on board the RPA.

6.5.1.3 All RPS controlling RPA operating under Annex 6, Part IV, and that are manufactured on or after [date of adoption of Annex 6, Part IV + 3 years] shall be equipped with an RPS-RS.

Note. — The functions to be recorded by the RPS-RS are described in Appendix 8, Section 4.

## 6.5.2 Duration

6.5.2.1 All RPA-RS shall be capable of retaining the information recorded from the moment the RPA is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, or the last 25 hours, whichever is longer.

6.5.2.2 The RPS-RS shall begin recording continuously from the commencement of the RPS checks prior to connecting to a specific RPA, either pre-flight or inflight, until connection with the specific RPA is terminated, either inflight or post-flight, and RPS post connection checks are completed.

6.5.2.3 In the case of multiple RPS controlling the flight of a specific RPA sequentially, each RPS shall record data for the duration stated in 6.5.2.2.

Note. — The intention is to capture all remote pilot activities that have an effect on the operation, from RPA pre-flight checks to completion of the flight.

## 6.5.3 Construction and installation

RPA-RS shall be constructed, located and installed so as to provide maximum practical protection for the recordings in order that the recorded information may be preserved, recovered and analysed. The recorder systems shall meet the prescribed crashworthiness and fire protection specifications.

## 6.5.4 Preservation of data

Note. — The operator's(s') responsibilities regarding the retention of RPA-RS and RPS-RS records are contained in 11.7.

6.5.4.1 In the case of an accident or incident occurring during a flight, the data recorded by the RPA-RS, when required by 6.5.1.1, and RPS-RS shall be preserved for investigation purposes.

6.5.4.2 RPA-RS crash protection. All RPA required to carry an RPA-RS in accordance with 6.5.1.1 shall be equipped with an RPA-RS protected with Flight Recorder Systems industry

crashworthiness and fire protection. The crashworthiness and fire protection shall be based on analysis of potential damages to the recording media.

6.5.4.3 RPS-RS protection. RPS-RS shall ensure the recorded data is safely maintained with respect to environmental conditions, security and emergencies that could affect the integrity of the RPS. Where the RPS is carried on board a vehicle, vessel or another aircraft, the RPS-RS shall include crashworthiness and fire protection.

6.5.4.4 The RPA-RS shall be deactivated whenever possible upon completion of the flight if an accident or incident has occurred or is suspected of having occurred and shall not be reactivated before the disposition of the recorders is determined in accordance with Annex 13.

6.5.4.5 The RPS-RS shall preserve the original recorded data related to the accident or incident of an RPA without affecting the continued operation of the RPS-RS. The original recorded data related to the accident or incident of an RPA shall be preserved and retained until the disposition of the recorders is determined in accordance with Annex 13.

Note. — The need for recovery of the recorded data from the RPA-RS and RPS-RS will be determined by the accident investigation authority in the State conducting the investigation with due regard to the seriousness of an occurrence and the circumstances, including the impact on the operation.

### 6.5.5 RPAS recorder system data recovery

6.5.5.1 An RPA meeting the applicability standards outlined in Chapter 2 and 6.5.1 of this Part shall be equipped with a means, approved by the State of the Operator, to recover the data from RPAS recorder systems (RPAS-RS), and make it available in a timely manner.

6.5.5.2 In approving the means to make the RPAS-RS data available in a timely manner, the State of the Operator shall take into account the following:

- a) the capabilities of the operator;
- b) overall capability of the RPAS as certified by the State of Design;
- c) the reliability of the means to recover the appropriate RPS-RS voice recorder channels;  
and
- d) specific mitigation measures.

Note. — Guidance on approving the means to make flight recorder data available in a timely manner is contained in the Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery (Doc 10054).

### 6.5.6 Continued serviceability

Operational checks and evaluations of recordings from the recording systems shall be conducted to ensure the continued serviceability of the recorders.

Note. — Procedures for the inspections of the recording systems are given in Appendix 8.

## 6.5.7 RPS recorder systems

### 6.5.7.1 *General*

6.5.7.1.1 All RPAS required to meet the operational requirements of this Part (defined in Chapter 2) and the applicability Standards outlined in 6.5.1.3 shall record voice communications and the aural environment at the RPS.

Note. — The information to be recorded is detailed in Appendix 8.

6.5.7.1.2 All RPS required to meet the operational requirements of this Part (defined in Chapter 2) and the applicability Standards outlined in 6.5.1.3 shall record the information displayed to the remote flight crew from electronic displays, as well as the operation of switches and selectors by the remote flight crew as defined in Appendix 8.

6.5.7.1.2.1 Remote flight crew-machine interface recording shall be able to be correlated to the recorded RPS audio.

6.5.7.1.3 All RPS shall record on an RPS-RS the data associated with the functions defined in Section 5 of Appendix 8.

### 6.5.7.2 *RPS-RS Documentation*

6.5.7.2.1 The operator shall retain the documentation necessary to convert the recorded flight data into flight parameters expressed in engineering units. This documentation shall be provided upon request to the accident investigation authorities.

6.5.7.2.2 **Recommendation.** — The documentation necessary to convert the recorded data into data usable by an accident investigation team should be provided in electronic format.

Note. — Industry specification for documentation concerning flight recorder parameters may be found in the ARINC 647A, Flight Recorder Electronic Documentation, or equivalent document.

6.5.7.2.3 The operator shall maintain a record of each RPS that has controlled an RPA during each flight.

### 6.5.7.3 *Data security*

Data shall be secured in a manner that prevents readout of the data without the use of special tools or techniques. Data encryption of the RPA-RS or RPS-RS shall not be used as it may affect data recovery if the memory or media is damaged. 72

## 6.5.8 Data link recorders

All RPS which utilize any of the data link communications applications listed in Appendix 8 and are required to be equipped with an RPS-RS, shall record the data link communications.

## **6.6 ALL RPAS ON FLIGHTS OVER WATER**

### **6.6.1 Sea RPA**

6.6.1.1 For all flights, sea RPA shall be equipped with equipment for making the sound signals prescribed in the International Regulations for Preventing Collisions at Sea, where applicable.

6.6.1.2 **Recommendation.** — A sea RPA should be equipped with:

- a) an anchor, unless it is intended to secure the sea RPA to a fixed berth; and
- b) a sea anchor (drogue), when necessary to assist in manoeuvring.

Note. — “Sea RPA” includes amphibians operated as sea RPA.

### **6.6.2 RPA not configured for sea operations**

Reserved for future use.

### **6.6.3 All RPA on long-range over-water flights**

Reserved for future use.

## **6.7 ALL RPA CARRYING LIVE ANIMALS OR PASSENGERS OVER DESIGNATED LAND AREAS**

Reserved for future use.

## **6.8 ALL RPA CARRYING LIVE ANIMALS OR PASSENGERS ON HIGH ALTITUDE FLIGHTS**

Reserved for future use.

## 6.9 ALL RPA IN ICING CONDITIONS

6.9.1 All RPA shall be equipped with suitable de-icing and/or anti-icing devices when operated in circumstances in which icing conditions are reported to exist or are expected to be encountered.

6.9.2 The RPA shall be equipped with an ice detection system, when required, in order to comply with 6.9.1. 73

## 6.10 ALL RPAS OPERATED IN ACCORDANCE WITH INSTRUMENT FLIGHT RULES

6.10.1 All RPAS when operated in accordance with the instrument flight rules shall be equipped with a means of detecting as a minimum the following information:

- a) magnetic heading;
- b) pressure altitude;
- c) airspeed;
- d) RPA attitude;
- e) outside air temperature;
- f) rate-of-climb and descent; and
- g) failures of an altitude, airspeed or attitude system.

Note. — 6.10.1 may be met by one or a combination of systems provided that the safeguards against total failure are retained.

6.10.2 For operations in accordance with instrument flight rules, the information in 6.10.1 shall be displayed at the RPS to the remote pilot(s).

Note. — 6.10.1 may be met by one or a combination of displays provided that the safeguards against total failure are retained.

6.10.3 RPAS shall be equipped with such additional instruments and equipment as may be prescribed by the appropriate authority.

Note. — Additional requirements regarding special authorizations for RPAS engaged in international air navigation are contained within Annex 2, Appendix 4.

## 6.11 RPS EMERGENCY POWER SUPPLY

6.11.1 The RPS shall be fitted with an emergency power supply, independent of the main electrical supply or generated power supply systems, which is capable of providing power for a duration

that is sufficient to implement contingency actions or transfer control of the RPA to an alternate RPS.

6.11.2 The emergency power supply shall be automatically operative after the total failure of the main electrical generating system and clear indication shall be given that the RPS is being operated on emergency power.

6.11.3 When operating on emergency power supply, the RPS shall provide the remote pilot with, as a minimum, the essential flight information required to conduct a safe recovery. 74

## **6.12 ALL RPA WHEN OPERATED AT NIGHT**

All RPA when operated at night shall be equipped with:

- a) all equipment as specified in 6.10;
- b) the lights required by Annex 2 for aircraft in flight or operating on the movement area of an aerodrome; and

Note. — Specifications for lights meeting the requirements of Annex 2 for navigation lights are contained in Appendix 1. The general characteristics of lights are specified in Annex 8.

- c) two landing lights.

## **6.13 PRESSURIZED RPA WHEN CARRYING ANIMALS OR PASSENGERS — WEATHER RADAR**

Reserved for future use.

## **6.14 ALL RPA OPERATED ABOVE 15 000 M (49 000 FT) — RADIATION INDICATOR**

Reserved for future use.

## **6.15 MACH NUMBER INDICATOR**

RPA with speed limitations expressed in terms of Mach number shall be equipped with a means of displaying Mach number in the RPS.

## **6.16 GROUND PROXIMITY WARNING SYSTEMS (GPWS)**

### **6.16.1 Applicability**

- 6.16.1.1 Unless the design of the RPAS already includes a capability to fully address the risk of ground collision, all RPA conducting IFR operations shall be equipped with a GPWS which has a forward-looking terrain avoidance function.
- 6.16.1.2 When a GPWS is installed in an RPA, the operator shall implement database management procedures that ensure the timely distribution and update of current terrain and obstacle data to the GPWS.
- 6.16.1.3 A GPWS shall provide, automatically, a timely and distinctive warning to the remote flight crew when the RPA is in potentially hazardous proximity to the earth's surface.
- 6.16.1.4 A GPWS shall provide, unless otherwise specified herein, warnings of the following circumstances:
- a) excessive descent rate;
  - b) excessive terrain closure rate;
  - c) excessive altitude loss after take-off or go-around;
  - d) unsafe terrain clearance while not in landing configuration:
    - 1) gear not locked down;
    - 2) flaps not in a landing position; and
  - e) excessive descent below the instrument glide path.

## 6.17 RPA CARRYING PASSENGERS — CABIN CREW SEATS

Reserved for future use.

## 6.18 EMERGENCY LOCATOR TRANSMITTER (ELT)

Only RPA configured to carry persons on board shall be equipped with an ELT.

## 6.19 LOCATION OF AN RPA IN DISTRESS

Note. — RPAS SARPs do not currently address RPA with persons on board. Consequently, provisions that apply to RPAS search and rescue services have not been developed.

## 6.20 DETECT AND AVOID CAPABILITY

Note. — The operational requirements specified herein for conflicting traffic are intended to meet the requirements of Annex 2 for avoidance of collisions, including proximity and right-of-way.

## 6.20.1 DAA operational requirements

6.20.1.1 The State of the Operator shall ensure that the operator has established and documented the operational limitations, procedures for the use of, and training requirements for, the DAA equipment.

6.20.1.2 Any RPAS operated in accordance with IFR shall have a DAA capability which enables the remote pilot to avoid conflicting traffic and other hazards.

Note. — Other hazards may refer to terrain, weather, wake turbulence, incompatible airspace activity and, when the aircraft is on the ground, surface vehicles and other obstructions on the movement area of an aerodrome.

6.20.1.3 A DAA airborne collision avoidance capability shall operate in accordance with the relevant provisions of Annex 10, Volume IV, Parts 1 and 2.

Note 1.— DAA capability does not necessarily require RPAS installed equipment. It may be supported by other forms of external equipment, (e.g. ground-based detect and avoid system) if necessary, to perform its function.

Note 2.— The loss of a DAA capability is addressed in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019).

Note 3.— DAA equipment SARPs in Annex 10 will initially only address the hazards of conflicting airborne traffic.

6.20.1.4 DAA shall provide the remote pilot with the capability of exercising vigilance for the purpose of detecting and avoiding potential collisions with other aircraft.

6.20.1.5 DAA shall provide the remote pilot with the capability of ensuring appropriate action is taken when different hazards are present at the same time whether DAA for these hazards is provided by one system or different systems.

6.20.1.6 The remote pilot shall be able to intervene in the management of automated hazard avoidance manoeuvres, except in the case of a C2 Link interruption.

Note. — Procedures for the operation of DAA are contained in PANS-OPS (Doc 8168), Volume III.

6.20.1.7 RPAS controls, displays and alerts shall enable the remote pilot to recognize when an action may be necessary to override an automated hazard avoidance manoeuvre.

## 6.20.2 Automated collision avoidance

- 6.20.2.1 The RPA shall be equipped with an automated system that performs appropriate collision avoidance manoeuvres, except when the collision avoidance responsibilities of the remote pilot can be adequately exercised using other means.
- 6.20.2.2 Notwithstanding the provisions in 6.20.2.1, the State of the Operator may approve RPAS operations without automated collision avoidance, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained. The specific safety risk assessment shall include at least the:
- a) integrity and performance of the C2 Link;
  - b) diversity of multiple C2 Links, if installed; and
  - c) reliability of other systems that are required to allow the remote pilot to exercise control of the RPA flight trajectory.

Note 1. — The presence of any single-point failures in one or more RPAS systems that could lead to frequent and/or long -duration loss of the remote pilot's ability to control the RPA flight trajectory will require an automated means to conduct manoeuvres to avoid conflicting traffic.

Note 2.— Guidance on safety risk assessments is contained in the Safety Management Manual (Doc 9859).

## 6.21 REQUIREMENTS FOR PRESSURE-ALTITUDE REPORTING TRANSPONDERS

- 6.21.1 All RPA shall be equipped with a Mode S transponder which operates in accordance with the relevant provisions of Annex 10, Volume IV.
- 6.21.2 All RPA shall be equipped with a data source that provides pressure-altitude information with a resolution of 7.62 m (25 ft.), or better.
- 6.21.3 The Mode S transponder shall be provided with the airborne/on-the-ground status of the RPA.

Note. — These provisions will improve the effectiveness of airborne collision avoidance systems as well as air traffic services that employ Mode S radar. In particular, tracking processes are significantly enhanced with a resolution of 7.62 m (25 ft.), or better.

## 6.22 MICROPHONES

All remote flight crew members required to be on duty at the RPS shall communicate through hands-free microphones whenever the situation is such that they must not be distracted by the overall environment within the RPS and at all times during:

- a) the departure and arrival phases of the flight; and

- b) periods when close monitoring of the flight is deemed to be essential.

Note. — Appendix 8, paragraph 5.2 refers to the recording of the operational environment of the RPS.

## 6.23 REMOTELY PILOTED AEROPLANES — FORWARD-LOOKING WIND SHEAR WARNING SYSTEM

- 6.23.1 **Recommendation.** — All remotely piloted aeroplanes should be equipped with a forward-looking wind shear warning system.
- 6.23.2 **Recommendation.** — A forward-looking wind shear warning system should be capable of providing the remote pilot with a timely aural and visual warning of wind shear ahead of the remotely piloted aeroplane, and the information required to permit the remote pilot to safely commence and continue a missed approach or go-around or to execute an escape manoeuvre if necessary. The system should also provide an indication to the remote pilot when the limits specified for the certification of automatic landing equipment are being approached, when such equipment is in use.

## 6.24 DOCUMENTS HELD BY THE OPERATOR

### 6.24.1 General

The following documents, manuals and information specific to the operator, shall be available, in the authentic form, at the location of the operator's operational management location or other location specified by the State of the Operator:

- a) the ROC;
- b) operations specifications relevant to the RPA and RPS models, associated with the ROC;
- c) special authorizations obtained from States different from the State of the Operator, as required by Appendix 4 to Annex 2;
- d) certificate of registration of each RPA;
- e) certificate of airworthiness of each RPA;
- f) radio station licence(s), if applicable;
- g) noise certificate(s), if applicable;
- h) documents of any additional RPAS components, if applicable;
- i) flight manual(s) of each model of RPA;

- j) operations manual;
- k) maintenance control manual (MCM);
- l) contract(s) and service level agreement(s) with third parties providing safety-related services, if applicable;
- m) third party liability insurance certificate(s) if required;
- n) emergency response plan (ERP) to cover actions resulting from risks to the RPS, such as earthquakes, floods, security incidents, etc.; and
- o) any other document required by the State of the Operator.

## 6.25 DOCUMENTS CARRIED ON BOARD THE RPA

6.25.1 A certified true copy of the ROC specified in Chapter 4, 4.2.1, and a copy of the operations specifications relevant to the RPA, issued in conjunction with the certificate shall be carried on the RPA and be available at each RPS used in the operation. When the ROC and the associated operations specifications are issued by the State of the Operator in a language other than English, an English translation shall be included.

6.25.2 Additionally, the following documents shall be readily accessible on board each RPA and be available at each RPS used in the operation, for inspection by authorized inspection authorities. When these documents are issued in a language other than English, an English translation shall be included:

- a) RPA certificate of registration;
- b) RPA certificate of airworthiness;
- c) appropriate licences for each member of the remote flight crew;
- d) RPA radio station licence;
- e) noise certificate, if applicable;
- f) RPA journey log book;

Note.— In addition, the RPA journey log book may have sections that are also maintained at each RPS, used in the operation.

- g) RPA technical log; and
- h) if it carries cargo, a manifest and detailed declarations of the cargo.

6.25.3 The format and access (e.g. paper or electronic) of the documents listed in 6.25.1 and 6.25.2 shall be acceptable to all States involved in the operation.

Note 1. — The documents listed above may be accessed electronically through information on board the RPA, such as a QR code.

Note 2. — States involved in the operation could include the State of Registry, the State where the RPA departed, the State of intended landing and any States that are overflown.

## 6.26 DOCUMENTS AT THE RPS

6.26.1 As a minimum, the following documents, manuals and information shall be available at each RPS used for the operation:

- a) appropriate licences for each member of the remote flight crew involved in the operation, during respective duty periods;
- b) flight manual, or pertinent subset thereof, including configuration deviation list (CDL);
- c) operations manual or pertinent subset thereof, including the minimum equipment list (MEL);
- d) applicable checklists;
- e) operations specifications relevant to the RPA and RPS models;
- f) RPA journey log book;
- g) RPA technical log;
- h) RPS technical log;
- i) details of the filed and the current ATS and operational flight plans, if applicable;
- j) current and suitable aeronautical charts for the route of flight and all routes along which it is reasonable to expect that the flight may be diverted, including departure, arrival and approach charts for all relevant aerodromes/heliports, or electronic access to such charts;
- k) information concerning search and rescue services for the area of the intended flight;
- l) NOTAM and aeronautical information service (AIS) briefing documentation or electronic access to it;
- m) meteorological information;
- n) fuel requirements, fuel load and records;
- o) if the RPA carries cargo, a manifest and detailed declarations of the cargo;
- p) if the RPA carries dangerous goods, the notification of dangerous goods;

- q) mass and balance documentation; and
- r) any other documentation that may be pertinent to the flight or be required by the State(s) involved in the operation.

6.26.2 The format and access (e.g. electronic) of the documents listed above shall be acceptable to the State of the Operator and the State where the RPS is located.

6.26.3 Documents, manuals and information retained at the RPS shall be provided upon request to a State authority inspecting the RPS or the RPA, in the most efficient manner available.

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## CHAPTER 7. RPAS COMMUNICATION, NAVIGATION AND SURVEILLANCE EQUIPMENT

### 7.1 COMMUNICATION EQUIPMENT

7.1.1 The RPAS communication equipment readily available to the remote pilot shall be capable of:

- a) conducting two-way communication for aerodrome control purposes;
- b) receiving meteorological information at any time during flight; and
- c) conducting two-way communication at any time during flight with at least one aeronautical station and with such other aeronautical stations and on such frequencies as may be prescribed by the appropriate authority.

*Note.— The requirements of 7.1.1 are considered fulfilled if the ability to conduct the communications specified therein is established during radio propagation conditions which are normal for the route.*

7.1.2 The RPAS radio communication equipment shall provide for communication on the aeronautical emergency frequency 121.5 MHz.

7.1.3 For operations where communication equipment is required to meet RCP specification for performance-based communication (PBC), the RPAS shall, in addition to the requirements specified in 7.1.1:

- a) be provided with communication equipment which will enable it to operate in accordance with the prescribed required communication performance (RCP) specification(s);
- b) have information relevant to the RPAS RCP specification capabilities listed in the flight manual or other RPAS documentation approved by the State of Design or State of Registry; and
- c) have information relevant to the RPAS RCP specification capabilities included in the MEL.

*Note 1.— Information on the performance-based communication and surveillance (PBCS) concept and guidance material on its implementation are contained in the Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869).*

*Note 2.— Guidance on RPAS RCP specification capabilities is contained in the Manual on C2 Links for Remotely Piloted Aircraft Systems (forthcoming).*

7.1.4 The State of the Operator shall, for operations where an RCP specification for PBC has been prescribed, ensure that the operator has established and documented:

- a) normal and abnormal procedures, including contingency procedures;
- b) remote flight crew qualification and proficiency requirements, in accordance with appropriate RCP specifications;
- c) a training programme for relevant personnel consistent with the intended operations; and
- d) appropriate maintenance procedures to ensure continuing airworthiness, in accordance with appropriate RCP specifications.

*Note.* — *The State of the Operator may require an alternate means of communication with ATC, if ATC communications are relayed via the RPA, in order to mitigate failure of the RPA relay function.*

- 7.1.5 The State of the Operator shall ensure that, in respect of those RPAS mentioned in 7.1.3, adequate provisions exist for:
- a) receiving the reports of observed communication performance issued by monitoring programmes established in accordance with Annex 11, Chapter 3; and
  - b) taking immediate corrective action for individual RPAS, RPAS types or operators, identified in such reports as not complying with the RCP specification(s).

## 7.2 NAVIGATION EQUIPMENT

7.2.1 An RPAS shall be provided with navigation equipment which will enable the remote pilot to proceed:

- a) in accordance with the operational flight plan; and
- b) in accordance with the requirements of air traffic services.

7.2.2 For operations where a navigation specification for performance-based navigation (PBN) has been prescribed, an RPAS shall, in addition to the requirements specified in 7.2.1:

- a) be provided with navigation equipment which will enable it to operate in accordance with the prescribed navigation specification(s);
- b) have information relevant to the RPAS navigation specification capabilities listed in the flight manual or other RPAS documentation approved by the State of Design or State of Registry; and
- c) have information relevant to the RPAS navigation specification capabilities included in the MEL.

*Note.* — *Guidance on the navigation specification is contained in the Performance-based Navigation (PBN) Manual (Doc 9613).*

7.2.3 The State of the Operator shall, for operations where a navigation specification for PBN has been prescribed, ensure that the operator has established and documented:

- a) normal and abnormal procedures including contingency procedures;
- b) remote flight crew qualification and proficiency requirements in accordance with the appropriate navigation specifications;
- c) a training programme for relevant personnel consistent with the intended operations; and
- d) appropriate maintenance procedures to ensure continuing airworthiness in accordance with the appropriate navigation specifications.

*Note 1.— Guidance on safety risks and mitigations for PBN operations, in accordance with Annex 19, are contained in the Performance-based Navigation (PBN) Operational Approval Manual (Doc 9997).*

*Note 2. — Electronic navigation data management is an integral part of normal and abnormal procedures. 83*

7.2.4 The State of the Operator shall issue a specific approval for operations based on PBN authorization required (AR) navigation specifications.

*Note. — Guidance on specific approvals for PBN authorization required (AR) navigation specifications is contained in Doc 9997.*

7.2.5 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, minimum navigation performance specifications (MNPS) are prescribed, an RPAS shall include navigation equipment which:

- a) continuously provides indications to the remote flight crew of adherence to or departure from track to the required degree of accuracy at any point along that track; and
- b) has been authorized by the State of the Operator for the MNPS operations concerned.

*Note.— The prescribed minimum navigation performance specifications and the procedures governing their application are published in the Regional Supplementary Procedures (Doc 7030).*

7.2.6 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, a reduced vertical separation minimum (RVSM) of 300 m (1 000 ft.) is applied between FL 290 and FL 410 inclusive:

- a) an RPAS shall be provided with equipment which is capable of:
  - 1) indicating to the remote flight crew the flight level being flown;

- 2) automatically maintaining a selected flight level;
  - 3) providing an alert to the remote flight crew when a deviation occurs from the selected flight level. The threshold for the alert shall not exceed  $\pm 90$  m (300 ft.);
  - 4) automatically reporting pressure-altitude; and
- b) the State of the Operator shall issue a specific approval for RVSM operations.

7.2.7 Prior to granting the RVSM specific approval required in accordance with 7.2.6 b), the State shall be satisfied that:

- a) the vertical navigation performance capability of the RPAS satisfies the requirements specified in Appendix 4;
- b) the operator has instituted appropriate procedures in respect of continuing airworthiness (maintenance and repair) practices and programmes; and
- c) the operator has instituted appropriate remote flight crew procedures for operations in RVSM airspace.

*Note. — An RVSM specific approval is valid globally on the understanding that any operating procedures specific to a given region will be stated in the operations manual or appropriate remote flight crew guidance.*

7.2.8 The State of the Operator, in consultation with the State of Registry if appropriate, shall ensure that, in respect of those RPAS mentioned in 7.2.6, adequate provisions exist for:

- a) receiving the reports of height-keeping performance issued by the monitoring agencies established in accordance with Annex 11, Chapter 3; and
- b) taking immediate corrective action for individual RPAS, or type of RPAS, identified in such reports as not complying with the height-keeping requirements for operation in airspace where RVSM is applied.

7.2.9 The State of the Operator that has issued an RVSM specific approval to an operator shall establish a requirement which ensures that a minimum of two RPA from each RPA type grouping of the operator have their height keeping performance monitored, at least once every two years or within intervals of 1 000 flight hours per RPA, whichever period is longer. If an operator RPA type grouping consists of a single RPA, monitoring of that RPA shall be accomplished within the specified period.

*Note. — Monitoring data from any regional monitoring programme established in accordance with Annex 11, Chapter 3, may be used to satisfy the requirement.*

7.2.10 All States that are responsible for airspace where RVSM has been implemented, or that have issued RVSM specific approvals to owners/operators within their State, shall establish provisions and procedures which ensure that appropriate action will be taken in respect of

RPAS and owners/operators found to be operating in RVSM airspace without a valid RVSM specific approval.

*Note 1. — These provisions and procedures need to address both the situation where the RPAS in question was operating without a specific approval in the airspace of the State, and the situation where an operator for which the State has regulatory oversight responsibility is found to be operating without the required specific approval in the airspace of another State.*

*Note 2.— Guidance material relating to the specific approval for operation in RVSM airspace is contained in the Manual on a 300 m (1 000 ft.) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).*

- 7.2.11 The RPAS shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the RPAS to navigate in accordance with 7.2.1 and where applicable 7.2.2, 7.2.5 and 7.2.6.

*Note 1. — This requirement may be met by means other than the duplication of equipment.*

*Note 2.— Guidance material relating to RPAS equipment necessary for flight in airspace where a 300 m (1 000 ft.) RVSM is applied above FL 290 is contained in the Manual on a 300 m (1 000 ft.) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).*

- 7.2.12 At each aerodrome at which an RPAS operator intends to execute an instrument approach and landing, including at any designated alternate aerodromes, an RPAS shall be provided with a navigation capability that provides:

- a) sufficient performance and functionality to guide the RPA to landing; or
- b) to allow the remote pilot to conduct a landing under VLOS or through indirect observation utilizing appropriately certified visual surveillance system or methodology.

- 7.2.13 When the RPA is taxiing, the RPAS shall be provided with a navigation capability providing sufficient performance and functionality to guide the RPA to a designated point on the movement area.

*Note. — This requirement applies equally for situations where the RPA is being taxied under the direct control of the remote pilot, or where the RPA is taxiing under an automated function.*

### **7.3 SURVEILLANCE EQUIPMENT**

- 7.3.1 An RPAS shall be provided with surveillance equipment which will enable it to operate in accordance with the requirements of air traffic services.

- 7.3.2 For operations where surveillance equipment is required to meet a required surveillance performance (RSP) specification for performance-based surveillance (PBS), an RPAS shall, in addition to the requirements specified in 7.3.1:

- a) be provided with surveillance equipment which will enable it to operate in accordance with the prescribed RSP specification(s);
- b) have information relevant to the RPAS RSP specification capabilities listed in the flight manual or other RPAS documentation approved by the State of Design or State of Registry; and
- c) have information relevant to the RPAS RSP specification capabilities included in the MEL.

*Note 1.— Information on surveillance equipment is contained in the Aeronautical Surveillance Manual (Doc 9924).*

*Note 2.— Information on RSP specifications for performance-based surveillance is contained in the Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869).*

7.3.3 The State of the Operator shall, for operations where an RSP specification for PBS has been prescribed, ensure that the operator has established and documented:

- a) normal and abnormal procedures, including contingency procedures;
- b) remote flight crew qualification and proficiency requirements, in accordance with appropriate RSP specifications;
- c) a training programme for relevant personnel consistent with the intended operations; and
- d) appropriate maintenance procedures to ensure continuing airworthiness, in accordance with appropriate RSP specifications.

7.3.4 The State of the Operator shall ensure that, in respect of those RPAS mentioned in 7.3.2, adequate provisions exist for:

- a) receiving the reports of observed surveillance performance issued by monitoring programmes established in accordance with Annex 11, Chapter 3; and
- b) taking immediate corrective action for individual RPAS, RPAS types or operators, identified in such reports as not complying with the RSP specification(s).

## 7.4 INSTALLATION

The equipment installation shall be such that the failure of any single unit required for communication, navigation or surveillance purposes or any combination thereof will not result in the failure of another unit required for communication, navigation or surveillance purposes.

*Note. — For more information on safety-significant factors such as reliance upon a common source for surveillance and/or navigation, refer to PANS-ATM (Doc 4444) Chapter 2.*

## 7.5 ELECTRONIC NAVIGATION DATA MANAGEMENT

- 7.5.1 The operator shall not employ electronic navigation data products that have been processed for application in the air and on the ground unless the State of the Operator has approved the operator's procedures for ensuring that the process applied and the products delivered have met acceptable standards of integrity and that the products are compatible with the intended function of the equipment that will use them. The State of the Operator shall ensure that the operator continues to monitor both process and products.

*Note 1.— Guidance relating to the processes that data suppliers may follow is contained in RTCA DO-200A/EUROCAE ED-76 and RTCA DO-201A/EUROCAE ED-77.*

*Note 2.— Specifications concerning the order of accuracy, resolution, integrity classification and digital data error detection techniques related to aeronautical data are contained in the PANS-AIM (Doc 10066).*

- 7.5.2 The operator shall implement procedures that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all necessary RPAS.
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## CHAPTER 8. RPA CONTINUING AIRWORTHINESS

*Note 1. — For the purpose of this chapter, “RPA” includes: engines, propellers, components, accessories, instruments, equipment and apparatus including emergency equipment.*

*Note 2. — While a certificate of airworthiness is only issued to the aircraft component of an RPAS, the continuing airworthiness aspects of RPS are also indirectly provided in this chapter.*

*Note 3. — Reference is made throughout this chapter to the requirements of the State of Registry. When the State of the Operator is not the same as the State of Registry, it may be necessary to consider any additional requirements of the State of the Operator.*

*Note 4.— Guidance on continuing airworthiness requirements is contained in the Airworthiness Manual (Doc 9760).*

### 8.1 OPERATOR’S CONTINUING AIRWORTHINESS RESPONSIBILITIES

8.1.1 Operators shall ensure that, in accordance with procedures acceptable to the State of Registry:

- a) each RPA is maintained in an airworthy condition;
- b) the operational and emergency equipment necessary for an intended flight is serviceable;
- c) the certificate of airworthiness of the RPA remains valid; and
- d) each RPS conforms to the approved design and is maintained in a condition for the safe operation of the RPAS.

8.1.2 The operator shall not operate an RPAS unless maintenance on the RPAS, including any associated engine, propeller and part, is carried out:

- a) by an organization complying with Annex 8, Part II, Chapter 6 that is either approved by the State of Registry of the RPA or is approved by another Contracting State and is accepted by the State of Registry; or
- b) by a person or organization in accordance with procedures that are authorized by the State of Registry;

and there is a maintenance release in relation to the maintenance carried out.

8.1.3 The operator shall employ a person or group of persons to ensure that all maintenance is carried out in accordance with the maintenance control manual.

8.1.4 The operator shall ensure that the maintenance of its RPAS is performed in accordance with the maintenance programme.

- 8.1.5 The operator shall ensure that maintenance personnel receive initial and continuation training acceptable to the State of the Operator that includes the application of Human Factors principles.

*Note.* — *Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).*

## 8.2 OPERATOR'S MAINTENANCE CONTROL MANUAL

- 8.2.1 The operator shall provide, for the use and guidance of maintenance and operational personnel concerned, a maintenance control manual for the RPA and RPS, acceptable to the State of Registry, in accordance with the requirements of 11.2. The design of the manual shall observe Human Factors principles.

*Note 1.*— *Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).*

*Note 2.* — *This document may consist of separate parts, or even separate manuals, addressing the RPA and the RPS.*

- 8.2.2 The operator shall ensure that the maintenance control manual is amended as necessary to keep the information contained therein up to date.
- 8.2.3 Copies of all amendments to the operator's maintenance control manual shall be furnished promptly to all organizations or persons to whom the manual has been issued.
- 8.2.4 The operator shall provide the State of the Operator and the State of Registry with a copy of the operator's maintenance control manual, together with all amendments and/or revisions to it and shall incorporate in it such mandatory material as the State of the Operator or the State of Registry may require.

## 8.3 MAINTENANCE PROGRAMME

- 8.3.1 The operator shall provide, for the use and guidance of maintenance and operational personnel concerned, maintenance programme(s), approved by the State of Registry, containing the information required by 11.3 for RPA, the RPS, any ground-based infrastructure and ground-based equipment under the direct control of the operator. The design and application of the operator's maintenance programme shall observe Human Factors principles.

*Note 1.*— *Ground-based infrastructure and equipment includes, inter alia, launch and recovery equipment and any C2 Link equipment under the operator's control, associated with the operation of RPAS.*

*Note 2.*— *Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).*

- 8.3.2 Copies of all amendments to the maintenance programme(s) shall be furnished promptly to all organizations or persons to whom the maintenance programme has been issued.

## 8.4 CONTINUING AIRWORTHINESS RECORDS

- 8.4.1 The operator shall ensure that the following records are kept for the periods mentioned in 8.4.2:

- a) the total time in service (hours, calendar time and cycles, as appropriate) of the RPA and all life-limited components of the RPAS;
- b) the current status of compliance with all applicable mandatory continuing airworthiness information;
- c) appropriate details of modifications and repairs;
- d) the time in service (hours, calendar time and cycles, as appropriate) since the last overhaul of the RPA or RPAS components subject to a mandatory overhaul life;
- e) the current status of the RPAS compliance with the maintenance programme(s); and
- f) the detailed maintenance records to show that all requirements for the signing of a maintenance release have been met.

- 8.4.2 The records in 8.4.1 a) to e) shall be kept for a minimum period of 90 days after the unit to which they refer has been permanently withdrawn from service and the records in 8.4.1 f) for a minimum period of one year after the signing of the maintenance release.

- 8.4.3 In the event of a temporary change of operator, the records shall be made available to the new operator. In the event of any permanent change of operator, the records shall be transferred to the new operator.

*Note. — In the context of 8.4.3, a judgement on what should be considered as a temporary change of operator will need to be made by the State of Registry in the light of the need to exercise control over the records, which will depend on access to them and the opportunity to update them.*

- 8.4.4 For each RPA and each RPS, records kept and transferred in accordance with 8.4 shall be maintained in a form and format that ensures readability, security and integrity of the records at all times.

*Note 1. — The form and format of the records may include, for example, paper records, film records, electronic records or any combination thereof.*

*Note 2.— Guidance regarding electronic aircraft continuing airworthiness records is included in the Airworthiness Manual (Doc 9760).*

## 8.5 CONTINUING AIRWORTHINESS INFORMATION

8.5.1 The operator of an RPAS certificated in accordance with Annex 8 shall monitor and assess maintenance and operational experience with respect to continuing airworthiness and provide the information as prescribed by the State of Registry and report through the system specified in Annex 8, Part II, Chapter 4, 4.2.3.1 f) and 4.2.5.

8.5.2 The operator of an RPAS certificated in accordance with Annex 8 shall obtain and assess continuing airworthiness information and recommendations available from the organization responsible for the type design and shall implement resulting actions considered necessary in accordance with a procedure acceptable to the State of Registry.

*Note.* — Guidance on the interpretation of “the organization responsible for the type design” is contained in the Airworthiness Manual (Doc 9760).

## 8.6 MODIFICATIONS AND REPAIRS

All modifications and repairs shall comply with airworthiness requirements acceptable to the State of Registry. Procedures shall be established to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained.

## 8.7 APPROVED MAINTENANCE ORGANIZATION

An approved maintenance organization shall comply with Annex 8, Part II, Chapter 6 — Maintenance organization approval.

## 8.8 MAINTENANCE RELEASE

8.8.1 When maintenance is carried out by an approved maintenance organization, the maintenance release shall be issued by the approved maintenance organization in accordance with the provisions of Annex 8, Part II, Chapter 6, 6.8.

8.8.2 When maintenance is not carried out by an approved maintenance organization, the maintenance release shall be completed and signed by a person appropriately licensed in accordance with Annex 1 to certify that the maintenance work performed has been completed satisfactorily and in accordance with approved data and procedures acceptable to the State of Registry.

8.8.3 When maintenance is not carried out by an approved maintenance organization, the maintenance release shall include the following:

- a) basic details of the maintenance carried out including detailed reference of the approved data used;
- b) the date such maintenance was completed; and
- c) the identity of the person or persons signing the release.

## **CHAPTER 9. REMOTE FLIGHT CREW**

### **9.1 COMPOSITION OF THE REMOTE FLIGHT CREW**

- 9.1.1 The number and composition of the remote flight crew shall not be less than that specified in the operations manual. When necessitated by considerations related to the type(s) of RPA and RPS used, the type of operation involved and the duration of flight between points where remote flight crews are changed, the remote flight crew shall include remote flight crew members in addition to the minimum numbers specified in the flight manual or other documents associated with the certificate of airworthiness.
- 9.1.2 The operator shall establish procedures for remote flight crew rostering, particularly in consideration of long duration flights.

#### **9.1.3 Radio operator**

At all times during an RPAS operation, the remote flight crew shall include at least one member who holds a valid licence, issued by, or rendered valid by, the State of the Registry authorizing operation of the type of communication equipment to be used.

### **9.2 REMOTE FLIGHT CREW MEMBER DUTIES**

- 9.2.1 The operator shall define the roles and task allocation of remote flight crew members for the operation of the RPAS.
- 9.2.2 The operator shall, for each type of RPS, assign to all remote flight crew members the necessary functions they are to perform in an emergency or in a situation requiring emergency evacuation of the RPS.
- 9.2.3 Recurrent training in accomplishing these functions shall be contained in the operator's training programme and shall include instruction in the use of all emergency and life-saving equipment required to be installed, and drills in the emergency evacuation of the RPS, when appropriate.

### **9.3 REMOTE FLIGHT CREW MEMBER TRAINING PROGRAMMES**

- 9.3.1 The operator shall establish and maintain a ground and flight training programme, approved by the State of the Operator, which ensures that all remote flight crew members are adequately trained to perform their assigned duties. The training programme shall:

- a) include ground and flight training facilities and properly qualified RPAS instructors as determined by the State of the Operator;
- b) consist of ground and flight training in the class or type of RPAS for which the remote flight crew member will be assigned;
- c) include appropriate remote flight crew coordination and training in all types of emergency and abnormal situations or procedures caused by engine, airframe or systems malfunctions;
- d) include RPS malfunctions, including fire, natural disaster such as earthquakes, or other abnormalities;
- e) include training on the causes of upsets and means of prevention;
- f) include training in knowledge and skills related to flight procedures for the intended area of operation, human performance including threat and error management and in the transport of dangerous goods;
- g) ensure that all remote flight crew members know the duties for which they are responsible and the relation of these duties to the duties of other remote flight crew members, particularly in regard to abnormal or emergency procedures;
- h) be given on a recurrent basis, as determined by the State of the Operator and shall include an assessment of competence;
- i) establish a recurrent crew resource management (CRM) training programme for the remote flight crew; and
- j) for RPAS equipped with a DAA capability, ensure that each remote flight crew member has been appropriately trained to be competent in the use of such equipment.

*Note 1. — Paragraph 4.2.6 prohibits the in-flight simulation of emergency or abnormal situations when cargo is being carried.*

*Note 2. — Flight training may, to the extent deemed appropriate by the State of the Operator, be given in flight simulation training devices approved by the State for that purpose.*

*Note 3. — The scope of the recurrent training required by 9.2 and 9.3 may be varied and need not be as extensive as the initial training given in a particular type of RPA and RPS.*

*Note 4. — The use of correspondence courses and written examinations as well as other means may, to the extent deemed feasible by the State of the Operator, be utilized in meeting the requirements for periodic ground training.*

*Note 5.— For more information on dangerous goods training requirements, see Chapter 14.*

*Note 6.— Guidance material to design training programmes to develop knowledge and skills in human performance can be found in the Human Factors Training Manual (Doc 9683).*

*Note 7.— Information for pilots and RPAS operations personnel on flight procedures and aircraft operating procedures are contained in PANS-OPS (Doc 8168), Volume I and Volume III, respectively. Criteria for the construction of flight procedures are contained in PANS-OPS*

*(Doc 8168), Volume II. Obstacle clearance criteria and procedures used in certain States may differ from PANS-OPS, and knowledge of these differences is important for safety reasons.*

*Note 8.— Guidance material to design remote flight crew training programmes can be found in the Manual of Evidence-based Training (Doc 9995).*

*Note 9.— Guidance material on the different means used to assess competence can be found in the Attachment to Chapter 2 of the Procedures for Air Navigation Services — Training (PANS-TRG, Doc 9868).*

*Note 10. — Procedures for upset prevention and recovery training in a flight simulation training device are contained in the PANS-TRG).*

*Note 11.— Guidance on upset prevention and recovery training in a flight simulation training device is contained in the Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011).*

9.3.2 The requirement for recurrent flight training for a particular type of RPA or RPS shall be considered fulfilled by:

- a) the use, to the extent deemed feasible by the State of the Operator, of flight simulation training devices approved by that State for that purpose; or
- b) the completion within the appropriate period of the proficiency check required by 9.4.6 in that type of RPAS.

## 9.4 QUALIFICATIONS

*Note. — See the Manual of Procedures for Establishment and Management of a State's Personnel Licensing System (Doc 9379) for guidance of a general nature on cross-crew qualification, mixed-fleet flying and cross-credit.*

9.4.1 The operator shall only designate a remote pilot to act as remote pilot-in-command if they have:

- a) the minimum level of training, experience and currency specified in the operations manual; and
- b) in the case of multi-crew operations, completed a command course appropriate for the envisaged operations.

9.4.2 The operator shall ensure each remote flight crew member:

- a) holds a valid licence issued by, or rendered valid by, the State of the Operator;
- b) holds the appropriate ratings; and
- c) is competent to carry out assigned duties.

9.4.3 When a remote pilot-in-command or a remote co-pilot is flying several variants of the same RPAS or different RPAS with similar characteristics in terms of operating procedures, systems and handling, the State of the Operator shall decide under which conditions the requirements of 9.4.2 a) for which variants of RPA and RPS can be combined.

#### 9.4.4 Recent experience

9.4.4.1 The operator shall not assign a remote pilot to act as remote pilot-in-command to perform take-off and landing duties or to operate the flight controls of an RPAS during take-off and landing unless that remote pilot has conducted at least three take-offs and landings within the preceding 90 days with the same combination of RPA and RPS or a flight simulation training device approved for that purpose.

9.4.4.2 The operator shall not assign a remote pilot to act as remote pilot-in-command or remote co-pilot for any portion of a flight unless that remote pilot has conducted at least three flights within the preceding 90 days with the same combination of RPA and RPS or a flight simulation training device approved for that purpose.

#### 9.4.5 Remote pilot-in-command area, route and aerodrome qualification

9.4.5.1 The operator shall not utilize a remote pilot as remote pilot-in-command on a route or route segment for which that remote pilot is not currently qualified until such remote pilot has complied with 9.4.5.2 and 9.4.5.3.

9.4.5.2 Each such remote pilot shall demonstrate to the operator an adequate knowledge of:

- a) the route to be flown, and the aerodromes which are to be used. This shall include knowledge of:
  - 1) the terrain and minimum safe altitudes;
  - 2) the seasonal meteorological conditions;
  - 3) the meteorological, communication and air traffic facilities, services and procedures;
  - 4) the search and rescue procedures;
  - 5) the navigational facilities and procedures, including any long-range navigation procedures, associated with the route along which the flight is to take place; and
- b) procedures applicable to flight paths over heavily populated areas and areas of high air traffic density, obstructions, physical layout, lighting, approach aids and arrival, departure, holding and instrument approach procedures, and applicable operating minima.

*Note. — That portion of the demonstration relating to arrival, departure, holding and instrument approach procedures may be accomplished in an appropriate training device which is adequate for this purpose.*

9.4.5.3 A remote pilot-in-command shall have made an actual approach into each aerodrome of landing on the route, accompanied by a remote pilot who is qualified for the aerodrome, as a member of the remote flight crew or as a remote pilot observing at the RPS, unless:

- a) the approach to the aerodrome is not over difficult terrain and the instrument approach procedures and aids available are similar to those with which the remote pilot is familiar, and a margin to be approved by the State of the Operator is added to the normal operating minima, or there is reasonable certainty that approach and landing can be made in visual conditions; or
- b) the descent from the initial approach altitude can be made by day in visual conditions; or
- c) the operator qualifies the remote pilot-in-command to land at the aerodrome concerned by means of an adequate pictorial presentation; or
- d) the aerodrome concerned is adjacent to another aerodrome at which the remote pilot-in-command is currently qualified to land.

9.4.5.4 The operator shall maintain a record, sufficient to satisfy the State of the Operator of the qualification of the remote pilot and of the manner in which such qualification has been achieved.

9.4.5.5 The operator shall not continue to utilize a remote pilot as a remote pilot-in-command on a route or within an area specified by the operator and approved by the State of the Operator unless, within the preceding 12 months, that remote pilot has made at least one trip as a remote pilot, or as a remote check pilot, or as a remote pilot observing at the RPS:

- a) within that specified area; and
- b) if appropriate, on any route where procedures associated with that route or with any aerodromes intended to be used for take-off or landing require the application of special skills or knowledge.

9.4.5.6 In the event that more than 12 months elapse in which a remote pilot-in-command has not made such a trip on a route in close proximity and over similar terrain, within such a specified area, route or aerodrome, and has not practised such procedures in a training device which is adequate for this purpose, prior to again serving as a remote pilot-in-command within that area or on that route, that remote pilot must requalify in accordance with 9.4.5.2 and 9.4.5.3. 95

## 9.4.6 Remote pilot proficiency checks

9.4.6.1 The operator shall ensure that piloting technique and the ability to execute emergency procedures is checked in such a way as to demonstrate the remote pilot's competence on each combination of RPA and RPS.

9.4.6.2 Where the operation may be conducted under IFR, the operator shall ensure that the remote pilot's competence to comply with such rules is demonstrated to either a remote check pilot of the operator or a representative of the State of the Operator.

9.4.6.3 Checks in 9.4.6.1 and 9.4.6.2 shall be performed twice within any period of one year. Any two such checks which are similar and which occur within a period of four consecutive months shall not alone satisfy this requirement.

*Note 1. — Flight simulation training devices approved by the State of the Operator may be used for those parts of the checks for which they are specifically approved.*

*Note 2.— See the Manual of Criteria for the Qualification of Flight Simulation Training Devices (Doc 9625).*

9.4.6.4 When the operator schedules remote flight crew on several combinations of RPA and RPS or different combinations of RPA and RPS with similar characteristics in terms of operating procedures, systems and handling, the State of the Operator shall decide under which conditions the requirements of 9.4.6.1 for which variants of RPA and RPS can be combined.

## 9.5 REMOTE FLIGHT CREW EQUIPMENT

A remote flight crew member assessed as fit to exercise the privileges of a licence, subject to the use of suitable correcting lenses, shall have a spare set of the correcting lenses readily available when exercising those privileges.

## CHAPTER 10. FLIGHT OPERATIONS OFFICER/FLIGHT DISPATCHER

- 10.1 When the State of the Operator requires that a flight operations officer/flight dispatcher, employed in conjunction with an approved method of control and supervision of flight operations, be licensed, that flight operations officer/flight dispatcher shall be licensed in accordance with the provisions of Annex 1.
- 10.2 In accepting proof of qualifications other than the option of holding of a flight operations officer/flight dispatcher licence, the State of the Operator, in accordance with the approved method of control and supervision of flight operations, shall require that, as a minimum, such persons meet the requirements specified in Annex 1 for the flight operations officer/flight dispatcher licence.
- 10.3 A flight operations officer/flight dispatcher shall not be assigned to duty unless that person has:
- a) satisfactorily completed the operator-specific training course that addresses all the specific components of its approved method of control and supervision of flight operations specified in 4.2.1.4;  
*Note. — Guidance on the composition of such training syllabi is provided in the Manual on Flight Operations Officers/Flight Dispatchers Competency-based Training and Assessment (Doc 10106).*
  - b) made, within the preceding 12 months, at least one qualification flight observing the remote flight crew at the RPS over any area for which that individual is authorized to exercise flight supervision. The flight should include landings at as many aerodromes as practicable;  
*Note. — For the purpose of the qualification flight, the flight operations officer/flight dispatcher must be able to monitor the remote flight crew intercommunication system and radio communications, and be able to observe the actions of the remote flight crew.*
  - c) demonstrated to the operator a knowledge of:
    - 1) the contents of the operations manual described in Appendix 2;
    - 2) the radio equipment used by the RPAS;
    - 3) the navigation equipment used by the RPAS;
  - d) demonstrated to the operator a knowledge of the following details concerning operations for which the officer is responsible and areas in which that individual is authorized to exercise flight supervision:
    - 1) the seasonal meteorological conditions and the sources of meteorological information;
    - 2) the effects of meteorological conditions on C2 Link and radio reception in the RPAS used;
    - 3) the peculiarities and limitations of each navigation system which is used by the operation;
    - 4) the RPA loading instructions;

- e) demonstrated to the operator knowledge and skills related to human performance relevant to dispatch duties; and
- f) demonstrated to the operator the ability to perform the duties specified in 4.7.

10.4 **Recommendation.** — *A flight operations officer/flight dispatcher assigned to duty should maintain complete familiarization with all features of the operation which are pertinent to such duties, including knowledge and skills related to human performance.*

*Note.* — *Guidance material to design training programmes to develop knowledge and skills in human performance can be found in the Human Factors Training Manual (Doc 9683).*

10.5 **Recommendation.** — *Flight operations officer/flight dispatcher should not be assigned to duty after 12 consecutive months of absence from such duty, unless the provisions of 10.3 are met.*

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## CHAPTER 11. MANUALS, LOGS AND RECORDS

*Note.* — *The following additional manuals, logs and records are associated with this Annex but are not included in this chapter:*

*Fuel and oil records (see 4.2.11)*

*Continuing airworthiness records (see 8.4)*

*Flight time, flight duty periods, duty periods and rest periods records (see 4.10.7)*

*Flight preparation forms (see 4.3)*

*Operational flight plan (see 4.3.3.1)*

*Remote pilot-in-command route and airport qualification records (see 9.4.5.4).*

### 11.1 FLIGHT MANUAL

*Note.* — *The flight manual contains the information specified in Annex 8.*

The flight manual shall be updated by implementing changes made mandatory by the State of Registry.

### 11.2 OPERATOR'S MAINTENANCE CONTROL MANUAL

The operator's maintenance control manual provided in accordance with 8.2, which may be issued in separate parts, shall contain the following information:

- a) a description of the procedures required by 8.1.1 including, when applicable:
  - 1) a description of the administrative arrangements between the operator and the approved maintenance organization;
  - 2) a description of the RPA and RPS maintenance procedures and the procedures for completing and signing the maintenance release when maintenance is based on a system other than that of an approved maintenance organization;
- b) names and duties of the person or persons required by 8.1.3;
- c) a reference to the maintenance programme(s) required by 8.3.1;
- d) a description of the methods used for the completion and retention of the operator's continuing airworthiness records required by 8.4;
- e) a description of the procedures for monitoring, assessing and reporting maintenance and operational experience required by 8.5.1;
- f) a description of the procedures for complying with the service information reporting requirements of Annex 8, Part II, Chapter 4, 4.2.3.1 f) and 4.2.5;

- g) a description of procedures for assessing continuing airworthiness information and implementing any resulting actions, as required by 8.5.2;
- h) a description of the procedures for implementing action resulting from mandatory continuing airworthiness information;
- i) a description of establishing and maintaining a system of analysis and continued monitoring of the performance and efficiency of the maintenance programme(s), in order to correct any deficiency in that programme;
- j) a description of the RPA and RPS types and models to which the manual applies;
- k) a description of procedures for ensuring that unserviceabilities affecting airworthiness are recorded and rectified; and
- l) a description of the procedures for advising the State of Registry of significant in-service occurrences.

### 11.3 MAINTENANCE PROGRAMME

11.3.1 A maintenance programme for each RPA, each RPS and any ground-based communication infrastructure as required by 8.3 shall contain the following information:

Note. — Ground-based infrastructure and equipment includes, inter alia, launch and recovery equipment and any C2 Link equipment under the operator's control, associated with the operation of RPAS.

- a) maintenance tasks and the intervals at which these are to be performed, taking into account the anticipated utilization of the RPAS;
- b) when applicable, a continuing structural integrity programme;
- c) procedures for changing or deviating from a) and b) above; and
- d) when applicable, condition monitoring and reliability programme descriptions for the RPAS and all its components.

11.3.2 Maintenance tasks and intervals that have been specified as mandatory in approval of the type design shall be identified as such.

11.3.3 **Recommendation.** — The maintenance programme(s) should be based on maintenance programme information made available by the State of Design or by the organization responsible for the type design, and any additional applicable experience.

### 11.4 JOURNEY LOG BOOK

11.4.1 A journey log book shall be maintained for every RPA engaged in international air navigation in which particulars of the RPAS and its crew shall be entered at the end of the duty period of each remote pilot-in-command.

*Note.* — An RPA journey log may also consist of a section that stays in the RPA and an RPS section at each remote pilot station.

11.4.2 **Recommendation.** — The RPA journey log should contain the following items:

- a) RPA nationality and registration;
- b) a record of each RPS used in the course of a flight;
- c) the duration of use for each RPS and the times of transfer between RPS;
- d) date;
- e) names and duty assignments of remote flight crew members and other remote crew members;
- f) departure and arrival points and times;
- g) hours of flight;
- h) purpose and type of flight;
- i) incidents, observations regarding the RPAS, if any; and
- j) signature(s) of the remote pilot(s)-in-command.

11.4.3 **Recommendation.** — A signature should be required for each instance in which the remote pilot-in-command is changed, which, during long duration flights, may occur while the RPA remains airborne.

11.4.4 **Recommendation.** — Completed journey log book should be retained to provide a continuous record of the last six months' operations.

*Note.* — The journey log may need to accommodate multiple remote pilot-in-command signature blocks.

## 11.5 OPERATOR RECORD-KEEPING

11.5.1 The operator shall establish a system of record-keeping that allows adequate storage and reliable traceability of all activities, covering in particular all the elements related to RPAS operations as defined in the operations manual and management system processes as defined in this chapter.

11.5.2 The format of the records shall be specified in the operator's procedures.

11.5.3 Records shall be stored in a manner that ensures protection from damage, alteration and theft, for a period determined by the State of the Operator.

## **11.6 RECORDS OF EMERGENCY AND SURVIVAL EQUIPMENT CARRIED**

Reserved for future use.

## **11.7 FLIGHT RECORDER RECORDS**

11.7.1 The operator shall ensure, to the extent possible, in the event the RPAS becomes involved in an accident or incident, the preservation of all related RPA-RS and RPS-RS records and, if necessary, the associated recorders, and their retention in safe custody pending their disposition as determined in accordance with Annex 13.

11.7.2 In the event a contracted RPS service provider is used, the operator shall ensure, in the event the RPAS becomes involved in an accident or incident, the preservation of all related RPS-RS records and, if necessary, the associated recorders, and their retention in safe custody pending their disposition as determined in accordance with Annex 13.

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## CHAPTER 12. CABIN CREW

*Reserved for future use.*

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## CHAPTER 13. SECURITY<sup>2</sup>

### 13.1 GENERAL

- 13.1.1 Each Contracting State shall establish the structure, responsibilities, processes and procedures to promote and establish a culture of continuous improvement and enhancement of aviation security for RPAS operations.

*Note. — The Aviation Security Manual (Doc 8973-Restricted) provides detailed procedures and guidance on aviation security, including on the protection of civil aviation infrastructure against unmanned aircraft. It is intended to assist States in the implementation of their respective national civil aviation security programmes required by the specifications in the Annexes to the Convention on International Civil Aviation.*

- 13.1.2 Each Contracting State shall ensure the development and implementation of RPAS-related training programmes and a certification system that ensures that RPAS instructors are qualified in the applicable subject matters in accordance with the national civil aviation security programme.

### 13.2 AERODROME OPERATIONS

Each Contracting State shall require aerodromes serving RPAS operations to include within their written airport security programme measures for RPAS operations appropriate to meet the requirements of the national civil aviation security programme.

### 13.3 RPAS OPERATORS

Each Contracting State shall ensure that operators of RPAS have established, implemented and maintained a written RPAS operator security programme, and an associated training programme, that meets the requirements of the national civil aviation security programme of that State.

*Note. — The Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019) provides additional guidance on security requirements for RPAS.*

### 13.4 REPORTING ACTS OF UNLAWFUL INTERFERENCE

- 13.4.1 Following an act of unlawful interference, the remote pilot-in-command shall submit, without delay, a report of such an act to the designated local authority.
- 13.4.2 Each Contracting State concerned with an act of unlawful interference involving RPAS shall provide ICAO with all pertinent information concerning the security aspects of the act of unlawful interference as soon as practicable after the act is resolved.

<sup>2</sup> In the context of this chapter, the word “security” is used in the sense of prevention of illicit acts against civil aviation.

## 13.5 DOMESTIC RPAS OPERATIONS

Recommendation. — *International Standards and Recommended Practices set forth in this chapter should be applied by all Contracting States also in the case of domestic RPAS operations.*

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## CHAPTER 14. DANGEROUS GOODS

### 14.1 STATE RESPONSIBILITIES

*Note 1.— Annex 18, Chapter 11, contains requirements for each Contracting State to establish oversight procedures for all entities (including packers, shippers, ground handling service provider and operators) performing dangerous goods functions.*

*Note 2.— Operator responsibilities for the transport of dangerous goods are contained in Chapters 8, 9 and 10 of Annex 18. Part 7 of the Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284) (Technical Instructions) contains the operator's responsibilities and requirements for incident and accident reporting.*

*Note 3.— Operator material (COMAT) that meets the classification criteria of the Technical Instructions for dangerous goods are considered cargo and must be transported in accordance with Part 1; 2.2.2 or Part 1; 2.2.3 of the Technical Instructions (e.g. aircraft parts such as lithium ion batteries, lithium metal batteries, chemical oxygen generators, fuel control units, fire extinguishers, oils, lubricants, cleaning products).*

*Note 4.— See also Chapter 15 regarding cargo compartment safety.*

### 14.2 GENERAL

Transport of dangerous goods as cargo on board RPA shall not be permitted unless the State of the Operator has issued a specific approval.

### 14.3 OPERATORS WITH NO SPECIFIC APPROVAL FOR THE TRANSPORT OF DANGEROUS GOODS AS CARGO

The State of the Operator shall ensure that operators with no specific approval to transport dangerous goods have:

- a) established a dangerous goods training programme that meets the requirements of Annex 18, the applicable requirements of Technical Instructions, Part 1, Chapter 4, and the requirements of the State's regulations, as appropriate. Details of the dangerous goods training programme shall be included in the operator's operations manuals;
- b) established dangerous goods policies and procedures in its operations manual to meet, at a minimum, the requirements of Annex 18, the Technical Instructions and the State's regulations to allow operator personnel to:
  - 1) identify and reject undeclared dangerous goods, including COMAT classified as dangerous goods;
  - 2) report to the appropriate authorities of the State of the Operator and the State in which it occurred any:

- i. occasions when undeclared dangerous goods are discovered in cargo or mail; and
- ii. dangerous goods accidents and incidents.

#### **14.4 OPERATORS WITH A SPECIFIC APPROVAL FOR THE TRANSPORT OF DANGEROUS GOODS AS CARGO**

The State of the Operator shall issue specific approval for the transport of dangerous goods and ensure that the operator:

- a) establishes a dangerous goods training programme that meets the requirements of Annex 18, the Technical Instructions, Part 1, Chapter 4, and the requirements of the State regulations, as appropriate. Details of the dangerous goods training programme shall be included in the operator's operations manuals;
- b) establishes dangerous goods policies and procedures in its operations manual to meet, at a minimum, the requirements of Annex 18, the Technical Instructions and the State's regulations to enable operator personnel to:
  - 1) identify and reject undeclared or misdeclared dangerous goods, including COMAT classified as dangerous goods;
  - 2) report to the appropriate authorities of the State of the Operator and the State in which it occurred any:
    - i. occasions when undeclared or misdeclared dangerous goods are discovered in cargo or mail;
    - ii. dangerous goods accidents and incidents;
  - 3) report to the appropriate authorities of the State of the Operator and the State of Origin any occasions when dangerous goods are discovered to have been carried;
    - i. when not loaded, segregated, separated or secured in accordance with Technical Instructions, Part 7, Chapter 2;
    - ii. without information having been provided to the remote pilot-in-command;
  - 4) accept, handle, store, transport, load and unload dangerous goods, including COMAT classified as dangerous goods as cargo on board an RPA;

5) provide the remote pilot-in-command with accurate information concerning dangerous goods that are to be carried as cargo in the format required in Annex 18 and the Technical Instructions; and

6) notify emergency services at the scene of an incident or accident of the information provided to the remote pilot on the NOTOC.

*Note. — Article 35 of the Convention on International Civil Aviation refers to certain classes of cargo restrictions.*

## 14.5 PROVISION OF INFORMATION

The operator shall ensure that all personnel, including third-party personnel, involved in the acceptance, handling, loading and unloading of cargo are informed of the operator's specific approval and limitations with regard to the transport of dangerous goods.

## 14.6 DOMESTIC RPAS OPERATIONS

*Recommendation. — International Standards and Recommended Practices set forth in this chapter should be applied by all Contracting States also in the case of domestic RPAS operations.*

*Note. — Annex 18 contains a similar provision in this regard.*

## CHAPTER 15. CARGO COMPARTMENT SAFETY

*Note.— Guidance on the hazards associated with the transport of items in the cargo compartment, the conduct of a specific safety risk assessment in accordance with the Safety Management Manual (Doc 9859), and the responsibilities for the transport of dangerous goods, is contained in the Guidance for Safe Operations Involving Aeroplane Cargo Compartments (Doc 10102).*

### 15.1 TRANSPORT OF ITEMS IN THE CARGO COMPARTMENT

The State of the Operator shall ensure that the operator establishes policies and procedures for the transport of items in the cargo compartment, which include the conduct of a specific safety risk assessment. The safety risk assessment shall include at least the:

- a) hazards associated with the properties of the items to be transported;
- b) capabilities of the operator;
- c) operational considerations (e.g. area of operations, diversion time);
- d) capabilities of the RPA and its systems (e.g. cargo compartment fire suppression capabilities);
- e) containment characteristics of unit load devices;
- f) packing and packaging;
- g) safety of the supply chain for items to be transported; and
- h) quantity and distribution of dangerous goods items to be transported.

*Note.* — Additional operational requirements for the transport of dangerous goods are contained in Chapter 14.

### 15.2 FIRE PROTECTION

15.2.1 The elements of the cargo compartment(s) fire protection system, as approved by the State of Design or State of Registry, and a summary of the demonstrated cargo compartment fire protection certification standards, shall be provided in the flight manual or other documentation supporting the operation of the RPAS.

*Note.* — *Guidance on the elements of cargo compartment fire protection and associated demonstrated standards are provided in the Guidance for Safe Operations Involving Aeroplane Cargo Compartments (Doc 10102).*

15.2.2 The Operator shall establish policies and procedures that address the items to be transported in the cargo compartment. These shall ensure, to a reasonable certainty, that in the event of a

fire involving those items, it can be detected and sufficiently suppressed or contained by the elements of the RPA design associated with cargo compartment fire protection, until the RPA makes a safe landing.

*Note. — Guidance on policies and procedures that address the items to be transported in the cargo compartment are provided in the Guidance for Safe Operations Involving Aeroplane Cargo Compartments (Doc 10102).*

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## APPENDIX 1. LIGHTS TO BE DISPLAYED BY RPA

(Chapter 6, 6.12, refers)

### 1. TERMINOLOGY

When the following terms are used in this Appendix, they have the following meanings:

**Angles of coverage.**

- a) Angle of coverage A is formed by two intersecting vertical planes making angles of 70 degrees to the right and 70 degrees to the left respectively, looking aft along the longitudinal axis to a vertical plane passing through the longitudinal axis.
- b) Angle of coverage F is formed by two intersecting vertical planes making angles of 110 degrees to the right and 110 degrees to the left respectively, looking forward along the longitudinal axis to a vertical plane passing through the longitudinal axis.
- c) Angle of coverage L is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the RPA, and the other 110 degrees to the left of the first, when looking forward along the longitudinal axis.
- d) Angle of coverage R is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the RPA, and the other 110 degrees to the right of the first, when looking forward along the longitudinal axis.

**Horizontal plane.** The plane containing the longitudinal axis and perpendicular to the plane of symmetry of the RPA.

**Longitudinal axis of the RPA.** A selected axis parallel to the direction of flight at a normal cruising speed, and passing through the centre of gravity of the RPA.

**Making way.** An RPA on the surface of the water is “making way” when it is under way and has a velocity relative to the water.

**Under command.** An RPA on the surface of the water is “under command” when it is able to execute manoeuvres as required by the International Regulations for Preventing Collisions at Sea for the purpose of avoiding other vessels.

**Under way.** An RPA on the surface of the water is “under way” when it is not aground or moored to the ground or to any fixed object on the land or in the water.

**Vertical planes.** Planes perpendicular to the horizontal plane.

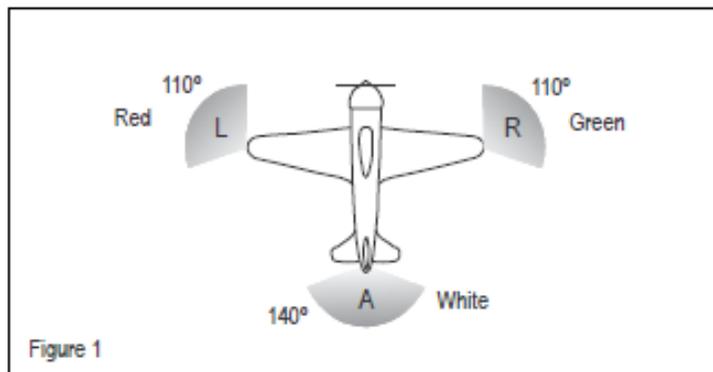
**Visible.** Visible on a dark night with a clear atmosphere. 109

### 2. NAVIGATION LIGHTS TO BE DISPLAYED IN THE AIR

*Note. — The lights specified herein are intended to meet the requirements of Annex 2 for navigation lights.*

As illustrated in Figure 1, the following unobstructed navigation lights shall be displayed:

- a) a red light projected above and below the horizontal plane through angle of coverage L;
- b) a green light projected above and below the horizontal plane through angle of coverage R;
- c) a white light projected above and below the horizontal plane rearward through angle of coverage A.



### 3. LIGHTS TO BE DISPLAYED ON THE WATER

#### 3.1 General

*Note. — The lights specified herein are intended to meet the requirements of Annex 2 for lights to be displayed by RPA on the water.*

The International Regulations for Preventing Collisions at Sea require different lights to be displayed in each of the following circumstances:

- a) when under way;
- b) when towing another vessel, or aircraft;
- c) when being towed;
- d) when not under command and not making way;

- e) when making way but not under command;
- f) when at anchor; and
- g) when aground.

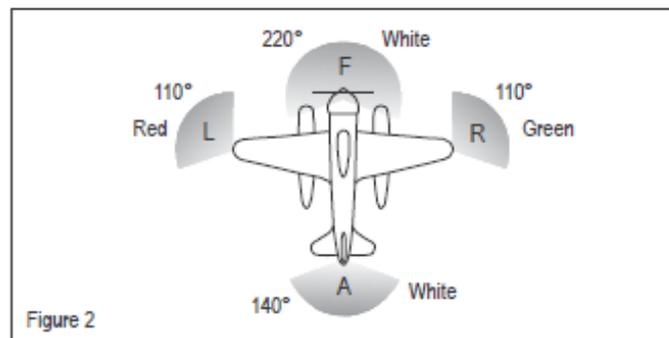
The lights required by RPA in each case are described below.

### 3.2 When under way

As illustrated in Figure 2, the following appearing as steady unobstructed lights:

- a) a red light projected above and below the horizontal through angle of coverage L;
- b) a green light projected above and below the horizontal through angle of coverage R;
- c) a white light projected above and below the horizontal through angle of coverage A; and
- d) a white light projected through angle of coverage F.

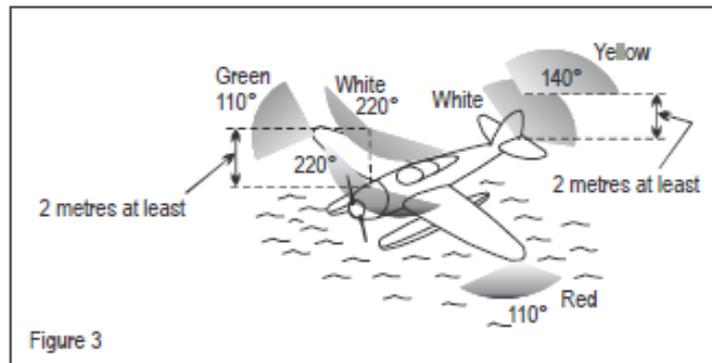
The lights described in 3.2 a), b) and c) should be visible at a distance of at least 3.7 km (2 NM). The light described in 3.2 d) should be visible at a distance of 9.3 km (5 NM) when fitted to an RPA of 20 m or more in length or visible at a distance of 5.6 km (3 NM) when fitted to an RPA of less than 20 m in length.



### 3.3 When towing another vessel or RPA

As illustrated in Figure 3, the following appearing as steady, unobstructed lights:

- a) the lights described in 3.2;
- b) a second light having the same characteristics as the light described in 3.2 d) and mounted in a vertical line at least 2 m above or below it; and
- c) a yellow light having otherwise the same characteristics as the light described in 3.2 c) and mounted in a vertical line at least 2 m above it.



### 3.4 When being towed

The lights described in 3.2 a), b) and c) appearing as steady, unobstructed lights.

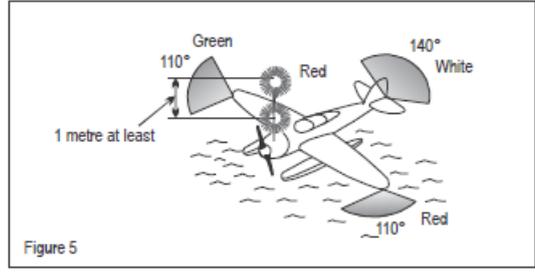
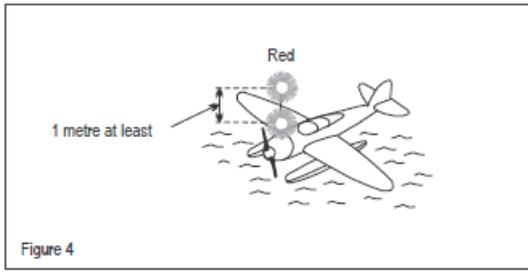
### 3.5 When not under command and not making way

As illustrated in Figure 4, two steady red lights placed where they can best be seen, one vertically over the other and not less than 1 m apart, and of such a character as to be visible all around the horizon at a distance of at least 3.7 km (2 NM).

### 3.6 When making way but not under command

As illustrated in Figure 5, the lights described in 3.5 plus the lights described in 3.2 a), b) and c).

*Note. — The display of lights prescribed in 3.5 and 3.6 is to be taken by the crews of other aircraft as signals that the RPA showing them is not under command and cannot therefore get out of the way. They are not signals of an RPA in distress and requiring assistance.*

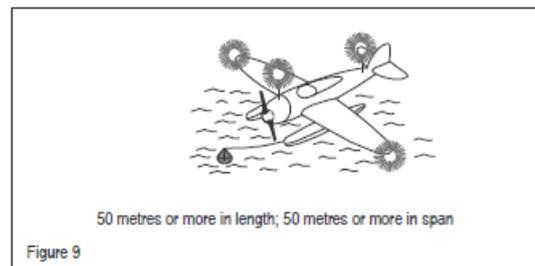
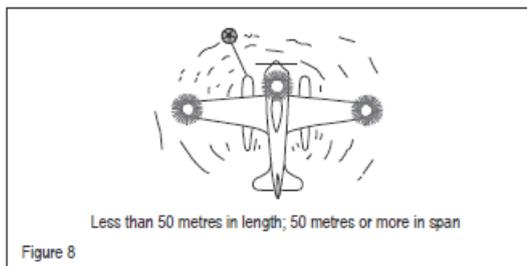
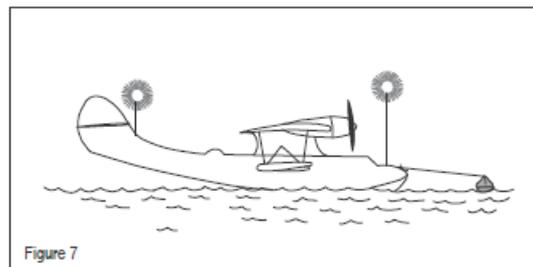
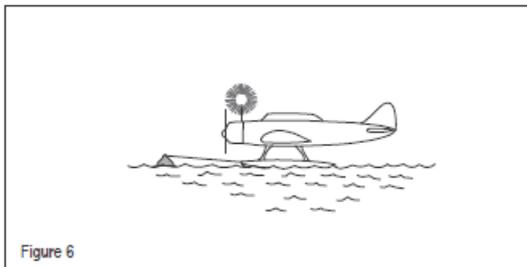


### 3.7 When at anchor

If less than 50 m in length, where it can best be seen, a steady white light (Figure 6), visible all around the horizon at a distance of at least 3.7 km (2 NM).

If 50 m or more in length, where they can best be seen, a steady white forward light and a steady white rear light (Figure 7) both visible all around the horizon at a distance of at least 5.6 km (3 NM).

If 50 m or more in span a steady white light on each side (Figures 8 and 9) to indicate the maximum span and visible, so far as practicable, all around the horizon at a distance of at least 1.9 km (1 NM).



### 3.8 When aground

The lights prescribed in 3.7 and in addition two steady red lights in vertical line, at least 1 m apart so placed as to be visible all around the horizon.

## APPENDIX 2. ORGANIZATION AND CONTENTS OF AN OPERATIONS MANUAL

(Chapter 4, 4.2.4.1, refers)

### 1. ORGANIZATION

An operations manual, which may be issued in separate parts corresponding to specific aspects of RPAS operations, provided in accordance with Chapter 4, 4.2.4.1, shall be organized with the following structure:

- a) General;
- b) RPAS operating information;
- c) Areas, routes and aerodromes; and
- d) Training.

### 2. CONTENTS

The operations manual referred to in 1 shall contain at the least the following:

#### 2.1 General

- 2.1.1 Instructions outlining the responsibilities of operations personnel pertaining to the conduct of flight operations.
- 2.1.2 Information and policy relating to fatigue management including:
  - a) policies pertaining to flight time, flight duty period, duty period limitations and rest requirements for remote flight crew members in accordance with Chapter 4, 4.10.2 a); and
  - b) where applicable, policy and documentation pertaining to the operator's FRMS in accordance with Appendix 7.
- 2.1.3 A list of the navigational equipment to be carried including any requirements relating to operations where performance-based navigation is prescribed.
- 2.1.4 Where relevant to the operations, the long-range navigation procedures and the nomination and utilization of diversion aerodromes.
- 2.1.5 The circumstances in which a radio listening watch is to be maintained.
- 2.1.6 The method for determining minimum flight altitudes.
- 2.1.7 The methods for determining aerodrome operating minima.

- 2.1.8 Ground handling arrangements and procedures.
- 2.1.9 Procedures, as prescribed in Annex 12, for remote pilots-in-command observing an accident.
- 2.1.10 The remote flight crew for each type of operation including the designation of the succession of command.
- 2.1.11 Specific instructions for the computation of the quantities of fuel and oil to be carried, taking into account all circumstances of the operation including the possibility of the failure of one or more engines while en-route.
- 2.1.12 Instructions for mass and balance control.
- 2.1.13 Instructions for the conduct and control of ground de-icing/anti-icing operations.
- 2.1.14 The specifications for the operational flight plan.
- 2.1.15 Standard operating procedures (SOPs) for each phase of flight.
- 2.1.16 Instructions on the use of normal checklists and the timing of their use.
- 2.1.17 Departure contingency procedures.
- 2.1.18 Instructions on the maintenance of altitude awareness and the use of automated or remote flight crew altitude call out.
- 2.1.19 Instructions on the use of autopilots and auto-throttles.  
*Note. — Instructions on the use of autopilots and auto-throttles, together with 2.1.24 and 2.1.28, are essential for avoidance of approach and landing accidents and controlled flight into terrain accidents.*
- 2.1.20 Instructions on the clarification and acceptance of ATC clearances, particularly where terrain clearance is involved.
- 2.1.21 Departure and approach briefings.
- 2.1.22 Procedures for familiarization with areas, routes and aerodromes.
- 2.1.23 Stabilized approach procedure.
- 2.1.24 Limitation on high rates of descent near the surface.
- 2.1.25 Conditions required to commence or to continue an instrument approach.
- 2.1.26 Instructions for the conduct of precision approach (PA) procedures, approach procedures with vertical guidance (APV) and non-precision approach (NPA) procedures.
- 2.1.27 Allocation of remote flight crew duties and procedures for the management of remote crew workload during night and IMC instrument approach operations.
- 2.1.28 Instructions and training requirements for the avoidance of controlled flight into terrain and, when installed, policy for the use of the ground proximity warning system (GPWS).
- 2.1.29 Policy, instructions, procedures and training requirements for the avoidance of collisions and the use of the detect and avoid (DAA) capability.

*Note. — Procedures for the operation of ACAS are contained in PANS-OPS (Doc 8168), Volume I, and in PANS-ATM (Doc 4444), Chapters 12 and 15. 115*

2.1.30 Information and instructions relating to the interception of civil RPA including:

- a) procedures, as prescribed in Annex 2, for remote pilots-in-command of intercepted aircraft; and
- b) visual signals for use by intercepting and intercepted aircraft, as contained in Annex 2.

2.1.31 For RPA intended to be operated above 15 000 m (49 000 ft.), procedures in the event that a decision to descend is taken, covering:

- a) the necessity of giving the appropriate ATS unit prior warning of the situation and of obtaining a provisional descent clearance; and
- b) the action to be taken in the event that communication with the ATS unit cannot be established or is interrupted.

*Note. — Guidance material on the information to be provided is contained in Circular 126 — Guidance Material on SST Aircraft Operations.*

2.1.32 Details of the safety management system (SMS) provided in accordance with Appendix 2 to Annex 19.

2.1.33 Information and instructions on the carriage of dangerous goods, in accordance with Chapter 14, including action to be taken in the event of an emergency.

*Note. — Guidance material on the development of policies and procedures for dealing with dangerous goods incidents on board aircraft is contained in Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (Doc 9481).*

2.1.34 Security instructions and guidance.

## **2.2 RPAS operating information**

2.2.1 Certification limitations and operating limitations.

2.2.2 The normal, abnormal and emergency procedures to be used by the remote flight crew and the checklists relating thereto as required by Chapter 6, 6.1.3.

2.2.3 Operating instructions and information on climb performance with all engines operating, if provided in accordance with Chapter 4, 4.2.5.3.

2.2.4 Flight planning data for pre-flight and in-flight planning with different thrust/power and speed settings.

2.2.5 The maximum crosswind and tailwind components for each RPA type operated and the reductions to be applied to these values having regard to gusts, low visibility, runway surface conditions, remote crew experience, use of autopilot, abnormal or emergency circumstances, or any other relevant operational factors.

2.2.6 Instructions and data for mass and balance calculations.

- 2.2.7 Instructions for RPA loading and securing of load.
- 2.2.8 RPAS systems, associated controls and instructions for their use, as required by Chapter 6, 6.1.3.
- 2.2.9 The minimum equipment list and configuration deviation list for the RPA types operated and specific operations authorized, including any requirements relating to operations where performance-based navigation is prescribed. Checklist of emergency and safety equipment and instructions for its use.
- 2.2.10 Emergency evacuation procedures for the RPS, including type-specific procedures, remote crew coordination, assignment of remote crew's emergency positions and the emergency duties assigned to each remote crew member.
- 2.2.11 Procedures to mitigate at least the emergencies and contingencies as required by Chapter 4, 4.5.5.
- 2.2.12 Procedures related to the quality of the C2 Link and mitigations for degraded C2 Link, as required by Chapter 4, 4.3.3.7.
- 2.2.13 Procedures for the establishment, assurance and termination of the C2 Link, including switchover procedures, as required by Chapter 4, 4.5.1.
- 2.2.14 Procedures to ensure a seamless operation throughout the duration of the flight, as required by Chapter 4, 4.3.3.9.

## 2.3 Routes and aerodromes

- 2.3.1 A route guide to ensure that the remote flight crew will have, for each flight, information relating to communication facilities, navigation aids, aerodromes, instrument approaches, instrument arrivals and instrument departures as applicable for the operation, and such other information as the operator may deem necessary for the proper conduct of flight operations.
- 2.3.2 The minimum flight altitudes for each route to be flown.
- 2.3.3 Aerodrome operating minima for each of the aerodromes that are likely to be used as aerodromes of intended landing or as alternate aerodromes.
- 2.3.4 The increase of aerodrome operating minima in case of degradation of approach or aerodrome facilities.
- 2.3.5 The necessary information for compliance with all flight profiles required by regulations, including but not limited to, the determination of:
  - a) for remotely piloted aircraft, take-off runway length requirements for dry, wet and contaminated conditions, including those dictated by system failures which affect the take-off distance;
  - b) take-off climb limitations;
  - c) en-route climb limitations;
  - d) approach climb limitations and landing climb limitations;

- e) for remotely piloted aircraft, landing runway length requirements for dry, wet and contaminated conditions, including systems failures which affect the landing distance; and
- f) supplementary information, such as tire speed limitations.

## 2.4 Training

2.4.1 Details of the remote flight crew training programme, as required by Chapter 9, 9.3.

2.4.2 Details of the flight operations officer/flight dispatcher training programme when employed in conjunction with a method of flight supervision in accordance with Chapter 4, 4.2.1.

Note. — Details of the flight operations officer/flight dispatcher training programme are contained in Chapter 10, 10.2.

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## APPENDIX 3. ADDITIONAL REQUIREMENTS FOR APPROVED OPERATIONS BY SINGLE-ENGINE RPA OVER HEAVILY POPULATED AREAS

(Chapter 5, 5.4.1, 5.5.1, refer)

### 1. ENGINE RELIABILITY

1.1 Engine reliability shall be shown to have a power loss rate of less than 1 per 100 000 engine hours.

*Note. — Power loss in this context is defined as any loss of power, the cause of which may be traced to faulty engine or engine component design or installation, including design or installation of the fuel ancillary or engine control systems. (See Attachment G.)*

1.2 The operator shall be responsible for engine trend monitoring.

1.3 To minimize the probability of in-flight engine failure, the engine shall be equipped with:

- a) for an engine that has an ignition system, an ignition system that activates automatically, or is capable of being operated manually, for take-off and landing, and during flight, in visible moisture;
- b) a magnetic particle detection or equivalent system that monitors the engine, accessories gearbox, and reduction gearbox, and which includes a flight deck caution indication; and
- c) an emergency engine power control device that permits continuing operation of the engine through a sufficient power range to safely complete the flight in the event of any reasonably probable failure of the fuel control unit, batteries or fuel-cell systems.

### 2. SYSTEMS AND EQUIPMENT

Single-engine RPA approved to operate over heavily populated areas shall be equipped with the following:

- a) Systems and equipment capable of transmitting data or transferring capability to the RPS to ensure continued safe flight and to assist in achieving a safe forced landing after an engine failure, under all allowable operating conditions:
  - 1) a radio altimeter;
  - 2) two attitude indicators, powered from independent sources;
  - 3) a means to provide for at least one attempt at engine re-start;
  - 4) a weather radar, if this capability is provided from the RPA;

- 5) a certified area navigation system capable of being programmed with the positions of aerodromes and safe forced landing areas, and providing instantly available track and distance information to those locations;
  - 6) if the RPAS design is such that a means of external vision from the RPA is available to the remote pilot, a landing light that is independent of the landing gear and is capable of adequately illuminating the touchdown area in a night forced landing; and
  - 7) an engine fire warning system.
- b) Systems intended to ensure continued safe flight and to assist in achieving a safe forced landing after an engine failure, under all allowable operating conditions:
- 1) two separate electrical generating systems, each one capable of supplying all probable combinations of continuous in-flight electrical loads for instruments, equipment and systems; and
  - 2) an emergency electrical supply system of sufficient capacity and endurance, following loss of all generated power, to as a minimum:
    - i. maintain the operation of the C2 Link, detect and avoid (DAA) capabilities and all essential flight instruments, communication and navigation systems during a descent from the maximum certificated altitude in a glide configuration to the completion of a landing;
    - ii. lower the flaps and landing gear, if applicable;
    - iii. provide power to one pitot heater, which must serve an air speed indicator that provides indications to the remote pilot;
    - iv. provide for one engine restart, if applicable; and
    - v. provide for the operation of the radio altimeter.

### **3. MINIMUM EQUIPMENT LIST**

The State of the Operator shall require the minimum equipment list of the operator approved in accordance with Chapter 5, 5.4 or 5.5 to specify the operating equipment required for over heavily populated areas.

### **4. FLIGHT MANUAL INFORMATION**

The flight manual shall include limitations, procedures, approval status and other information relevant to operations by single-engine RPA over heavily populated areas.

### **5. EVENT REPORTING**

- 5.1 The operator approved for operations by single-engine RPA over heavily populated areas shall report all significant failures, malfunctions or defects to the State of the Operator who in turn will notify the State of Design.
- 5.2 The State of the Operator shall review the safety data and monitor the reliability information so as to be able to take any actions necessary to ensure that the intended safety level is achieved. The State of the Operator will notify major events or trends of particular concern to the appropriate Type Certificate Holder and the State of Design. 120

## 6. OPERATOR PLANNING

- 6.1 Operator route planning shall take account of all relevant information in the assessment of intended routes or areas of operations, including the following:
  - a) the nature of the terrain to be overflown, including the potential for carrying out a forced landing without unreasonably elevating risk to persons on the surface or other airspace users in the event of an engine failure or major malfunction;
  - b) weather information, including seasonal and other adverse meteorological influences that may affect the flight; and
  - c) other criteria and limitations as specified by the State of the Operator.
- 6.2 The operator shall identify aerodromes or safe forced landing areas available for use in the event of engine failure, and the position of these shall be programmed into the area navigation system.

*Note 1.— A 'safe' forced landing in this context means a landing in an area at which it can reasonably be expected that it will not lead to serious injury or loss of life, even though the RPA may incur extensive damage.*

*Note 2.— Operation over routes and in weather conditions that permit a safe forced landing in the event of an engine failure, as specified in Chapter 5, 5.1.2, is not required by Appendix 3, 6.1 and 6.2 for RPA approved in accordance with Chapter 5, 5.4 or 5.5. The availability of forced landing areas at all points along a route is not specified for these RPA because of the very high engine reliability, additional systems and operational equipment, procedures and training requirements specified in this Appendix.*

## 7. REMOTE FLIGHT CREW EXPERIENCE, TRAINING AND CHECKING

- 7.1 The State of the Operator shall prescribe the minimum remote flight crew experience required for operations by approved single-engine RPA over heavily populated areas.
- 7.2 The operator's remote flight crew training and checking shall be appropriate to operations over heavily populated areas by approved single-engine RPA, covering normal, abnormal and emergency procedures and, in particular, engine failure, including descent to a forced landing.

## **8. ROUTE LIMITATIONS OVER WATER**

Reserved for future use.

## **9. OPERATOR CERTIFICATION OR VALIDATION**

The operator shall demonstrate the ability to conduct operations by approved single-engine RPA over heavily populated areas through a certification and approval process specified by the State of the Operator.

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## APPENDIX 4. ALTIMETRY SYSTEM PERFORMANCE REQUIREMENTS FOR OPERATIONS IN RVSM AIRSPACE

(Chapter 7, 7.2.7 refers)

1. The design of the altimetry system and any errors therein shall be considered in context of the safety of the entirety of the RPAS flight systems; including but not limited to potential loss or latency of the C2 Link, and the continuing valid operation of the detect and avoid (DAA) capability.
2. In respect of groups of RPA that are nominally of identical design and build with respect to all details that could influence the accuracy of height-keeping performance, the height-keeping performance capability shall be such that the total vertical error (TVE) for the group of RPA shall have a mean no greater than 25 m (80 ft.) in magnitude and shall have a standard deviation no greater than  $28 - 0.013z^2$  for  $0 \leq z \leq 25$  when  $z$  is the magnitude of the mean TVE in metres, or  $92 - 0.004z^2$  for  $0 \leq z \leq 80$  where  $z$  is in feet. In addition, the components of TVE shall have the following characteristics:
  - a) the mean altimetry system error (ASE) of the group shall not exceed 25 m (80 ft.) in magnitude;
  - b) the sum of the absolute value of the mean ASE and of three standard deviations of ASE shall not exceed 75 m (245 ft.); and
  - c) the differences between cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft.), and in addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.
3. In respect of RPA for which the characteristics of the airframe and altimetry system fit are unique and so cannot be classified as belonging to a group of RPA encompassed by paragraph 1, the height-keeping performance capability shall be such that the components of the TVE of the RPA have the following characteristics:
  - a) the ASE of the RPA shall not exceed 60 m (200 ft.) in magnitude under all flight conditions; and
  - b) the differences between the cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft.), and in addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.

## APPENDIX 5. SAFETY OVERSIGHT OF RPAS OPERATORS

(Chapter 4, 4.2 refers)

*Note 1. Appendix 1 to Annex 19 contains the general provisions for a State safety oversight system.*

*Note 2. — This Appendix provides additional provisions for the safety oversight of international RPAS operators.*

### 1. PRIMARY AVIATION LEGISLATION

The State of the Operator shall enact and implement laws that enable the State to regulate the certification and continued supervision of RPAS operators and the resolution of safety issues identified by the authority.

*Note 1. — The term “authority” as used in this Appendix refers to the Civil Aviation Authority as well as equivalent organizations, including inspectors and staff.*

*Note 2. Guidance on the inspection, certification and continued surveillance of operations is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335) and the Airworthiness Manual (Doc 9760).*

### 2. SPECIFIC OPERATING REGULATIONS

The State of the Operator shall adopt regulations that provide for the certification and continued surveillance of RPAS operations and the maintenance of RPAS in conformity with the Annexes to the Convention on International Civil Aviation.

### 3. STATE SAFETY OVERSIGHT SYSTEM AND FUNCTIONS

3.1 The State of the Operator shall ensure that the authority is responsible for the safety oversight of RPAS operators.

3.2 The State of the Operator shall use a methodology to determine its inspector staffing requirements according to the size and complexity of civil RPAS operations in that State.

3.3 **Recommendation.** The methodology in 3.2 should be documented.

3.4 The State of the Operator shall ensure that authority inspectors have adequate support, credentials and transportation to accomplish, independently, their certification and continued surveillance tasks.

3.5 The State of the Operator shall ensure that the operator maintains a complete record of certifications, authorizations and approvals for the RPA, each RPS, and each C2CSP, for each phase of flight, and all operational personnel, covering all phases of the RPAS flight. See Chapter 6, 6.24, 6.25 and 6.26 for detailed documentation requirements. 123

#### **4. QUALIFIED TECHNICAL PERSONNEL**

The State of the Operator shall require that the initial and recurrent training of the authority inspectors include RPAS-specific subjects.

Note. — Guidance on experience and training for inspectors is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335).

#### **5. TECHNICAL GUIDANCE, TOOLS AND PROVISION OF SAFETY-CRITICAL INFORMATION**

5.1 The State of the Operator shall ensure that authority inspectors are provided with technical guidance manuals containing the policies, procedures and standards to be used in the certification and continued surveillance of RPAS operators.

5.2 The State of the Operator shall ensure that authority inspectors are provided with technical guidance manuals containing the policies, procedures and standards to be used in the resolution of safety issues, including enforcement.

5.3 The State of the Operator shall ensure that authority inspectors are provided with technical guidance manuals that address ethics, personal conduct and the avoidance of actual or perceived conflicts of interest in the performance of official duties.

#### **6. CERTIFICATION OBLIGATIONS**

The State of the Operator shall require, prior to commencement of new RPAS operations, RPAS operators to demonstrate that they can safely conduct the proposed operations.

*Note.— Attachment D contains further information in this regard.*

#### **7. CONTINUED SURVEILLANCE OBLIGATIONS**

The State of the Operator shall use an ongoing surveillance plan to confirm that operators continue to meet the relevant requirements for initial certification and that each RPAS operator is functioning satisfactorily.

#### **8. RESOLUTION OF SAFETY ISSUES**

*Note. — Provisions for the resolution of safety issues are contained in Appendix 1 to Annex 19.*

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## APPENDIX 6. FORMAT AND CONTENT OF RPAS OPERATOR CERTIFICATE (ROC)

(Chapter 4, 4.2.1.7 refers)

### 1. PURPOSE AND SCOPE

- 1.1 The ROC and its associated specific operations specifications shall contain the minimum information required as detailed in the paragraphs below, in a standardized format.
- 1.2 The ROC and its associated operations specifications shall define the operations for which the operator is authorized including specific approvals, conditions and limitations.

*Note.* — Attachment D, paragraph 3.2.2, contains additional information that may be listed in the operations specifications associated with the ROC.

### 2. ROC TEMPLATE

*Note.* — An electronic copy of the ROC is required to be carried on board the RPA (see 6.26).

<b>RPAS OPERATOR CERTIFICATE</b>		
1	<b>STATE OF THE OPERATOR<sup>2</sup></b>	1
<b>ISSUING AUTHORITY<sup>3</sup></b>		
ROC number <sup>4</sup> :  Expiration date <sup>5</sup> :	<b>OPERATOR NAME<sup>6</sup></b>  Operator's trading name <sup>7</sup> :  Operator address <sup>8</sup> :  Telephone <sup>9</sup> :  Email:	<b>OPERATIONAL POINTS OF CONTACT<sup>10</sup></b>  Contact details, at which operational management can be contacted without delay, are listed in _____ <sup>11</sup> .
This certificate certifies that _____ <sup>12</sup> is authorized to perform international RPAS operations, as defined in the operations specifications, in accordance with the operations manual and the _____ <sup>13</sup> .		
Date of issue <sup>14</sup> :	Name and signature <sup>15</sup> :  Title	

*Notes.* —

- 1. For use of the State of the Operator.
- 2. Replace by the name of the State of the Operator.
- 3. Replace by the identification of the issuing authority of the State of the Operator.
- 4. Unique ROC number, as issued by the State of the Operator.
- 5. Date after which the ROC ceases to be valid (dd-mm-yyyy).

6. Replace by the operator's registered name.
7. Operator's trading name, if different. Insert "dba" before the trading name (for "doing business as").
8. Operator's principal place of business address.
9. Operator's principal place of business telephone details, including the country code. Email to be provided if available.
10. The contact details include the telephone numbers, including the country code, and the email address (if available) at which operational management can be contacted without undue delay for issues related to flight operations, airworthiness, remote flight crew competency, dangerous goods and other matters, as appropriate.
11. Insert the controlled document, carried on board, in which the contact details are listed, with the appropriate paragraph or page reference, e.g.: "Contact details are listed in the operations manual, Gen/Basic, Chapter 1, 1.1" or "... are listed in the operations specifications, page 1" or "... are listed in an attachment to this document".
12. Operator's registered name.
13. Insertion of reference to the appropriate civil aviation regulations.
14. Issuance date of the ROC (dd-mm-yyyy).
15. Title, name and signature of the authority representative. In addition, an official stamp may be applied on the ROC.

### 3. OPERATIONS SPECIFICATIONS FOR EACH RPAS MODEL

*Note.* — Chapter 6, 6.25.1, requires a copy of the operations specifications of this section to be carried on board the RPA.

- 3.1 For each RPA model in the operator's fleet, identified by RPA make, model and variant, the following information shall be included:
  - a) issuing authority contact details;
  - b) operator name and ROC number;
  - c) date of issue and signature of the authority representative;
  - d) RPA model;
  - e) RPS model;
  - f) types and areas of operations; and
  - g) special limitations and specific approvals.

*Note.* — If specific approvals and limitations are identical for two or more models, these models may be grouped in a single list.

- 3.2 The operations specifications layout referred to in Chapter 4, 4.2.1.8, shall be as follows:

*Note.* — The MEL constitutes an integral part of the operations manual.

**RPAS OPERATIONS SPECIFICATIONS**

(subject to the approved conditions in the operations manual)

**ISSUING AUTHORITY CONTACT DETAILS<sup>1</sup>**

Telephone: \_\_\_\_\_ Mobile telephone: \_\_\_\_\_ Email: \_\_\_\_\_

ROC#<sup>2</sup>: \_\_\_\_\_ Operator name<sup>3</sup>: \_\_\_\_\_ Date<sup>4</sup>: \_\_\_\_\_ Signature: \_\_\_\_\_

Operator trading name<sup>3</sup>: \_\_\_\_\_

RPA model<sup>5</sup> and variant:

RPS model and variant:

Types of operation<sup>6</sup>:

Area(s) of operation<sup>7</sup>:

Special limitations<sup>8</sup>:

SPECIFIC APPROVAL	YES	NO	DESCRIPTION <sup>9</sup>	REMARKS
Dangerous goods	<input type="checkbox"/>	<input type="checkbox"/>		
Low visibility operations				
Approach and landing	<input type="checkbox"/>	<input type="checkbox"/>	CAT <sup>10</sup> : _____ RVR: _____ m DH: _____ ft.	
Take-off	<input type="checkbox"/>	<input type="checkbox"/>	RVR <sup>11</sup> : _____ m	
Operational Credits	<input type="checkbox"/>	<input type="checkbox"/>	<sup>12</sup>	
RVSM <sup>13</sup> <input type="checkbox"/> N/A	<input type="checkbox"/>	<input type="checkbox"/>		
EDTO <sup>14</sup> <input type="checkbox"/> N/A			Threshold time <sup>15</sup> : _____ minutes Maximum diversion time <sup>15</sup> : _____ minutes	
AR navigation specifications for PBN authorizations	<input type="checkbox"/>	<input type="checkbox"/>	<sup>16</sup>	
Continuing airworthiness			<sup>17</sup>	
EFB N/A	<input type="checkbox"/>	<input type="checkbox"/>	<sup>18</sup>	
Other <sup>19</sup>	<input type="checkbox"/>	<input type="checkbox"/>		

Notes. —

1. Telephone and contact details of the authority, including the country code. Email to be provided if available.
2. Insert the associated ROC number.
3. Insert the operator’s registered name and the operator’s trading name, if different. Insert “dba” before the trading name (for “doing business as”).
4. Issuance date of the operations specifications (dd-mm-yyyy) and signature of the authority representative.
5. Insert the Commercial Aviation Safety Team (CAST)/ICAO designation of the RPA make, model and series, or master series, if a series has been

designated. The CAST/ICAO taxonomy is available at: <http://www.intlaviationstandards.org/>.

Note— there could be multiple entries in this section

6. Very high level (VHL) operations above FL 600, aerial work, long duration flight, commercial transport, etc.
  7. List the geographical area(s) of authorized operation (by geographical coordinates or specific routes, flight information region or national or regional boundaries), as defined by the issuing authority.
  8. List the applicable special limitations (e.g. day-only, population density and altitude limitations).
  9. List in this column the most permissive criteria for each specific approval (with appropriate criteria).
  10. Insert the applicable precision approach category (e.g. CAT II, III). Insert the minimum RVR in metres and decision height in feet. One line is used per listed approach category.
  11. Insert the approved minimum take-off RVR in metres, or the equivalent horizontal visibility if RVR is not used. One line per approval may be used if different approvals are granted.
  12. Reserved for future use.
  13. "Not applicable (N/A)" box may be checked only if the RPA maximum ceiling is below FL 290.
  14. Reserved for future use.
  15. Reserved for future use.
  16. Performance-based navigation (PBN): one line is used for each PBN AR navigation specification approval (e.g. RNP AR APCH), with appropriate limitations listed in the "Description" column.
  17. Insert the name of the person/organization responsible for ensuring that the continuing airworthiness of the RPAS is maintained and the regulation that requires the work, i.e. within the ROC regulation or a specific approval (e.g. EC1321/2014, Part M, Subpart G).
  18. N/A for RPAS operations.
  19. Other authorizations or data can be entered here, using one line (or one multi-line block) per authorization (e.g. special approach authorization, approved navigation performance).
-

## APPENDIX 7. FATIGUE RISK MANAGEMENT SYSTEM REQUIREMENTS

*Note.* — Guidance on the development and implementation of FRMS regulations is contained in the Manual for the Oversight of Fatigue Management Approaches (Doc 9966).

A fatigue risk management system (FRMS) established in accordance with Chapter 4, 4.10.1 b), shall contain, at a minimum:

### 1. FRMS POLICY AND DOCUMENTATION

#### 1.1 FRMS policy

1.1.1 The operator shall define its FRMS policy, with all elements of the FRMS clearly identified.

1.1.2 The policy shall require that the scope of FRMS operations be clearly defined in the operations manual.

1.1.3 The policy shall:

- a) reflect the shared responsibility of management, remote flight crews, and other involved personnel;
- b) clearly state the safety objectives of the FRMS;
- c) be signed by the accountable executive of the organization;
- d) be communicated, with visible endorsement, to all the relevant areas and levels of the organization;
- e) declare management commitment to effective safety reporting;
- f) declare management commitment to the provision of adequate resources for the FRMS;
- g) declare management commitment to continuous improvement of the FRMS;
- h) require that clear lines of accountability for management, remote flight crews, and all other involved personnel are identified; and
- i) require periodic reviews to ensure it remains relevant and appropriate.

*Note.* — Effective safety reporting is described in the Safety Management Manual (Doc 9859).

## 1.2 FRMS documentation

The operator shall develop and keep current FRMS documentation that describes and records:

- a) FRMS policy and objectives;
- b) FRMS processes and procedures;
- c) accountabilities, responsibilities and authorities for these processes and procedures;
- d) mechanisms for ongoing involvement of management, remote flight crews members, and all other involved personnel;
- e) FRMS training programmes, training requirements and attendance records;
- f) scheduled and actual duty periods, and flight times as well as rest periods between periods of time-in-position as a remote pilot during a duty period with significant deviations and reasons for deviations noted; and

Note. — Significant deviations are described in the Manual for the Oversight of Fatigue Management Approaches (Doc 9966).

- g) FRMS outputs including findings from collected data, recommendations, and actions taken.

## 2. FATIGUE RISK MANAGEMENT PROCESSES

### 2.1 Identification of hazards

Note. — Provisions on the protection of safety information are contained in Annex 19.

The operator shall develop and maintain three fundamental and documented processes for fatigue hazard identification:

#### 2.1.1 Predictive

The predictive process shall identify fatigue hazards by examining remote crew scheduling and taking into account factors known to affect sleep and fatigue and their effects on performance. Methods of examination may include but are not limited to:

- a) operator or industry operational experience and data collected on similar types of operations;
- b) evidence-based scheduling practices; and
- c) bio-mathematical models.

#### 2.1.2 Proactive

The proactive process shall identify fatigue hazards within current remote flight operations. Methods of examination may include but are not limited to:

- a) self-reporting of fatigue risks;
- b) remote crew fatigue surveys;
- c) relevant, remote flight crew performance data;
- d) available safety databases and scientific studies; and
- e) analysis of planned versus actual time worked.

### 2.1.3 Reactive

The reactive process shall identify the contribution of fatigue hazards to reports and events associated with potential negative safety consequences in order to determine how the impact of fatigue could have been minimized. At a minimum, the process may be triggered by any of the following:

- a) fatigue reports;
- b) confidential reports;
- c) audit reports;
- d) incidents; and
- e) flight data analysis events.

## 2.2 Risk assessment

2.2.1 The operator shall develop and implement risk assessment procedures that determine the probability and potential severity of fatigue-related events and identify when the associated risks require mitigation.

2.2.2 The risk assessment procedures shall review identified hazards and link them to:

- a) operational processes;
- b) their probability;
- c) possible consequences; and
- d) the effectiveness of existing safety barriers and controls.

## 2.3 Risk mitigation

The operator shall develop and implement risk mitigation procedures that:

- a) select the appropriate mitigation strategies;
- b) implement the mitigation strategies; and
- c) monitor the strategies' implementation and effectiveness.

### **3. FRMS SAFETY ASSURANCE PROCESSES**

The operator shall develop and maintain FRMS safety assurance processes to:

- a) provide for continuous FRMS performance monitoring, analysis of trends, and measurement to validate the effectiveness of the fatigue safety risk controls. The sources of data may include, but are not limited to:
  - 1) hazard reporting and investigations;
  - 2) audits and surveys; and
  - 3) reviews and fatigue studies;
- b) provide a formal process for the management of change. This shall include but is not limited to:
  - 1) identification of changes in the operational environment that may affect FRMS;
  - 2) identification of changes within the organization that may affect FRMS; and
  - 3) consideration of available tools which could be used to maintain or improve FRMS performance prior to implementing changes; and
- c) provide for the continuous improvement of the FRMS. This shall include but is not limited to:
  - 1) the elimination and/or modification of risk controls that have had unintended consequences or that are no longer needed due to changes in the operational or organizational environment;
  - 2) routine evaluations of facilities, equipment, documentation and procedures; and
  - 3) the determination of the need to introduce new processes and procedures to mitigate emerging fatigue-related risks.

### **4. FRMS PROMOTION PROCESSES**

FRMS promotion processes support the ongoing development of the FRMS, the continuous improvement of its overall performance, and attainment of optimum safety levels. The following shall be established and implemented by the operator as part of its FRMS:

- a) training programmes to ensure competency commensurate with the roles and responsibilities of management, remote flight crew, and all other involved personnel under the planned FRMS; and
- b) an effective FRMS communication plan that:
  - 1) explains FRMS policies, procedures and responsibilities to all relevant stakeholders; and
  - 2) describes communication channels used to gather and disseminate FRMS-related information.

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## APPENDIX 8. RPAS RECORDER SYSTEMS

(Chapter 6, 6.5, refers)

The material in this Appendix concerns flight recorders intended for installation in RPAS engaged in international air navigation. Recording of RPAS safety critical data will be conducted in both the RPA, on an RPA-RS, and in the RPS, on a RPS-RS. Crash-protected flight recorders on the RPA comprise one or more of the following systems:

- a flight data recorder (FDR),
- an RPA voice recorder (to record voice communications relayed through the RPA),
- an RPA camera recorder (to record data from on-board cameras),
- a data link recorder (DLR).

Flight recorders installed in an RPS should be suitable to the environment where the RPS is located with respect to environmental conditions, security and emergencies that could affect the integrity of the RPS (e.g. fixed location, mobile, separate facility, inside a building, etc.). Where the RPS is carried on board a vehicle, vessel or another aircraft, the RPS-RS shall include crashworthiness and fire protection. Protection of RPS-RS data is addressed in section 6.5.4.

### 1. GENERAL REQUIREMENTS

- 1.1 Non-deployable RPA-RS containers shall be painted a distinctive orange colour.
- 1.2 Non-deployable RPA-RS crash-protected flight recorder containers shall:
  - a) carry reflective material to facilitate their location; and
  - b) have securely attached an automatically activated underwater locating device operating at a frequency of 37.5 kHz. This device shall operate for a minimum of 90 days.
- 1.3 The RPA-RS shall be installed so that:
  - a) the probability of damage to the recordings is minimized;
  - b) there is an aural or visual means for pre-flight checking that the RPA-RS are operating properly; and
  - c) if the RPA-RS has an erasure device, the installation shall be designed to prevent operation of the device during flight time or crash impact; and
  - d) a remote flight crew-operated erase function shall be provided at the RPS which, when activated, modifies the recording of an RPAS-RS so that it cannot be retrieved using normal replay or copying techniques. The installation shall be designed to prevent activation during flight. In addition, the probability of an inadvertent activation of an erase function during an accident shall also be minimized.

Note. — The erase function is intended to prevent access to RPAS-RS recordings by normal replay or copying means, but would not prevent accident investigation authorities access to such recordings by specialized replay or copying techniques.

- 1.4 The RPA-RS shall be installed so as to be powered by the most reliable power source of the RPA or in the case of RPS, the RPS-RS should also be on the most reliable power source, without jeopardizing service to essential or emergency loads.
- 1.5 The RPAS-RS, when tested by methods approved by the appropriate certificating authority, shall be demonstrated to be suitable for the environmental extremes over which they are designed to operate.
- 1.6 Means shall be provided for an accurate time correlation between the RPAS-RS recordings.
- 1.7 The manufacturer shall provide the appropriate certificating authority with the following information in respect of the RPAS-RS:
  - a) manufacturer's operating instructions, equipment limitations and installation procedures;
  - b) parameter origin or source and equations which relate counts to units of measurement;
  - c) manufacturer's test reports; and
  - d) detailed information to ensure the continued serviceability of the RPAS-RS.
- 1.8 The RPAS-RS has three components: the data recording requirements and equipment needed in the RPA; the recording of C2 Link; and the data recording requirements and equipment needed in the RPS. All the data received and transmitted shall be recorded whether it is flight data, audio or image data used to manage the RPA, or flight data transmitted to the RPA. All recorded data shall be time synchronized with UTC, shall not be encrypted (to ensure compatibility with 6.5.7.3) and provided with any documentation needed to extract the data.
- 1.9 The data frame layout documentation should be in electronic format and recorded on the RPS-RS. In addition, if practicable, depending on the size of the RPA, a copy of the data frame layout documentation pertaining to the RPA-RS data should be recorded on the RPA-RS.

Note. — The limitation regarding encryption applies to recorded data and is not intended to limit the use of encryption on systems requiring such protection (e.g. the C2 Link).
- 1.10 The use and protection of data recordings and, in particular, accessibility to audio and image data used to manage the flight of the RPA shall be regulated. The provisions in Annex 13, 5.2 and Attachment E are applicable during accident and incident investigations, and the provisions in Annex 19 are applicable for safety management considerations. Provisions specific to the protection of RPAS recordings can be found in 3.3.4 of this Part.
- 1.11 The data shall be retained for a minimum period of 30 days from the completion of the flight, or flight segment, on the RPS-RS, but considering the possibility for extended, long-endurance, flights, data retention time should be extended accordingly.
- 1.12 RPA flight data is needed to accurately reconstruct the RPA flight. As referred to in 6.5.1 of this Part, the RPA, based on its MCTOM, and the RPS shall have capabilities to record flight

information. For RPA of a MCTOM of 2 250 kg or less, instead of being recorded on the RPA, this flight data may be transmitted throughout the flight for recording by the RPS-RS.

- 1.13 If the RPA is required to carry an RPA-RS in accordance with section 6.5.1, the RPS shall separately record the flight data to reconstruct the flight from the data received by the RPS.
- 1.14 Data relating to the C2 Link between the RPA and RPS shall be recorded on both the RPA, when required to carry an RPA-RS in accordance with 6.5.1, and the RPS in order that the integrity of the C2 Link during the flight can be determined.

## 2. RPA RECORDER SYSTEM

- 2.1 According to section 6.5.1 of this Part, for RPA having an MCTOM of less than 2 250 kg, an RPA-RS is not mandatory. As such, the type and size of the RPA-RS installed on such an RPA should be in relation to the size of the RPA and the type of operations in which it is involved. For RPA having an MCTOM of 2 250 kg or more, the same capability of recorder systems as installed on similar size conventional aircraft should be used.
- 2.2 For RPA having an MCTOM of less than 2 250 kg, where crash and fire protection standards are impractical, flight data should be recorded in such a way that crash and fire protection provisions are commensurate to the risk of losing the flight data as a result of an accident or serious incident.

## 3. RPA FUNCTIONS TO RECORD

An RPA is comprised of numerous complex systems which may require more and different functions to be recorded than for conventional aircraft of similar size. For RPA having an MCTOM of 2 250 kg or more, the functions that shall be recorded at the RPA, include but are not limited to:

- a) telecommand (C2 uplink information) and telemetry (C2 downlink information) received at and sent from the RPA via the C2 Link;
- b) information needed to accurately reconstruct RPA flight path, speed, attitude, altitude and configuration, at a minimum rate of once a second;
- c) information needed to determine the operating status of RPA systems, to include, at a minimum, flight controls, propulsion, power-supply, navigation and flight modes;
- d) parameters related to C2 Link operation for determining types of link errors, interruptions or failures;
- e) information regarding contingency or emergency situations resulting in warning alerts, for example, GPWS failure, detect and avoid (DAA) failure, on-board fire warning, generator failure, etc.;
- f) images related to any image streaming capability used to manage the RPA.

Note. — For RPA having an MCTOM of less than 2 250 kg, determination of those parameters or functions which are to be recorded would be based on the type of operation of the RPA.

#### **4. RPS RECORDER SYSTEM**

- 4.1 Data recording capabilities in the RPS should not normally be restricted by recording system mass and power limitations such as those that exist in conventional aircraft. As such, recorder capabilities can be expanded and larger amounts of data could be recorded with little to no limitations on the duration of recordings. Furthermore, crash protection for RPS-RS in the RPS may not be required. The recording of “duplicate data” should be considered in order to enable reconstruction of uplink errors in the case where such errors occur during the accident or incident flight. In the case of flight data streaming from the RPA, the RPS-RS should be able to record these large amounts of flight data.
- 4.2 An RPS may control several RPA sequentially during various phases of their flight, and a single RPA may utilize several RPS sequentially over the period of a particular flight. Flight data needs to be recorded in order to reconstruct the air situation display that was used to control each individual RPA. In the case of an RPS sequentially controlling multiple RPA, the data exchanged with each RPA needs to be identifiable in the recorded flight data.
- 4.3 In the case of several RPS controlling a single RPA during its entire flight, data needs to be recorded in order to reconstruct the telecommand (C2 uplink) information that was used to manage the RPA.
- 4.4 The determination of the parameters and the parameter list specifications which are to be recorded should be done in relation to the type of operation in which the RPAS is involved.

#### **5. RPS FUNCTIONS TO RECORD**

- 5.1 The RPS can range from a hand-held device up to a multi-console station. It may be stationary (installed in a shipping container or large operational control centre) or mobile (installed in a vehicle/ship/aircraft). Parameters that should be recorded at the RPS are as follows:
- a) uplink and downlink parameters received at and sent from the RPS via C2 Link;
  - b) parameters needed to accurately determine what inputs the remote pilot made to manage the RPA. In cases where the remote pilot has direct attitude control of the RPA, attitude data shall be recorded at an appropriate rate;
  - c) parameters relating to significant remote pilot actions, for example: C2 Link switchovers, RPS handover initiations/completions/attempts as well as the associated time of their occurrences respectively, the actual state of critical RPS systems including switch/control positions and display settings;
  - d) parameters needed to accurately reconstruct what was displayed to the remote pilot during the occurrence flight in terms of flight path, speed, altitude, attitude and configuration of the RPA;

- e) images related to any image streaming capability used to manage the RPA shall be recorded; and
  - f) data link communications applications, including digital communications with air traffic management (ATM), having an effect on the navigation and flight profile of the RPA.
- 5.2 To investigate if and how human factors contributed to the outcomes of the occurrence, the operational environment in which the remote pilots work, including the audio and image data used to manage the RPA, shall be recorded.
- 5.3 The RPS environment is equivalent to the flight deck of a conventional aircraft and as such, all audio shall be recorded. This will include the general environment audio and any operational discussions with ATC, other pilots, operations centre/flight dispatch discussions and all telephone calls.
- 5.4 An area microphone should be used to record the general environment audio, and in multi-pilot operations pilot channel segregation of operating personnel should be incorporated.
- 5.5 Non-audio communications should also be recorded. For example, communications such as text messages and communications similar to controller-pilot data link communications (CPDLC) and/or communication, navigation and surveillance (CNS) ATM messages.
- 5.6 Image data from the RPS needs to provide information about non-verbal communications, remote pilot actions and other external distractions that may have contributed to the occurrence. Image data used to manage the RPA will also provide information about what was effectively displayed to the remote pilot in cases where parameters from flight data recordings were not recorded properly. The image data used to manage the RPA would also clarify what the remote pilot saw as captured by an on-board RPA camera and relayed to the RPS via the C2 Link in cases where the RPA is managed by means of video displayed to the remote pilot.

Note. — To respect remote flight crew privacy, the RPS area view should be designed, as far as practicable, to exclude the head and shoulders of remote flight crew members whilst seated in their normal operating position.

## 6. INSPECTION OF RPAS RECORDER SYSTEMS

- 6.1 The built-in test features for the RPA-RS shall be monitored by automatic checks.
- 6.2 RPA-RS shall have recording inspection intervals of one year. Subject to the approval from the appropriate regulatory authority, this period may be extended to two years provided these systems have demonstrated a high integrity of serviceability and self-monitoring.
- 6.3 Recording inspections shall be carried out as follows:
- a) an analysis of the recorded data from the RPA-RS shall ensure that the recording system operates correctly for the nominal duration of the recording;
  - b) the recording of the parameters from a complete flight shall be examined in engineering units to evaluate the validity of all recorded functions. For flights over 2 hours, such a review shall include each phase of flight including a minimum of 30 minutes at cruise or loiter. Particular attention shall be given to parameters from sensors dedicated to the

RPA-RS. Parameters taken from the RPA's electrical bus system need not be checked if their serviceability can be detected by other RPA systems;

- c) the readout facility shall have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals;
- d) an examination of the images used to manage the RPA, and required to be recorded, shall be carried out by replay of the image recording; and
- e) if a system of cameras is installed in the RPA or RPS to record images, this system shall record test images from each RPAS source and from relevant external sources to ensure that all required images meet recording quality standards.

6.4 RPA-RS and RPS-RS shall be considered unserviceable if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory functions is not recorded correctly.

6.5 The most recent report of the recording inspection shall be made available on request to regulatory authorities for monitoring purposes.

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## APPENDIX 9. LOCATION OF AN RPA IN DISTRESS

(Chapter 6, 6.19, refers)

Reserved for future use.

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## APPENDIX 10. ARTICLE 83 BIS AGREEMENT SUMMARY

(Chapter 6, 6.1.4, refers)

Reserved for future use.

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## **ATTACHMENT A. MEDICAL SUPPLIES AT THE RPS**

### **TYPES AND LOCATION OF MEDICAL SUPPLIES**

#### **1. TYPES**

Medical supplies should be provided as first-aid kit(s) for inclusion at an RPS in accordance with national standards and requirements for medical supplies in the work place.

#### **2. LOCATION**

- 2.1 First-aid and universal precaution kits should be distributed as evenly as practicable throughout the workplace, but should also be readily accessible to the remote flight crew.
  - 2.2 The medical kit, when provided, should be stored in an appropriate secure location.
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## ATTACHMENT B. RPA PERFORMANCE OPERATING LIMITATIONS

Reserved for future use.

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## **ATTACHMENT C. GUIDANCE FOR OPERATIONS BY TURBINE- ENGINE RPA BEYOND 60 MINUTES TO AN EN-ROUTE ALTERNATE AERODROME INCLUDING EXTENDED DIVERSION TIME OPERATIONS (EDTO)**

Reserved for future use.

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## **ATTACHMENT D. RPAS OPERATOR CERTIFICATION AND VALIDATION**

*Supplementary to Chapter 4, 4.2.1*

### **1. PURPOSE AND SCOPE**

#### **1.1 Introduction**

The purpose of this Attachment is to provide guidance concerning actions required by States in connection with the operator certification requirements in Chapter 4, 4.2.1, particularly the means of accomplishing and recording those actions.

#### **1.2 Prior certification required**

In accordance with Standard 4.2.1.4, the issuance of an RPAS operator certificate (ROC) is “dependent upon the operator demonstrating” to the State that its organization, training policy and programmes, flight operations, ground handling and maintenance arrangements are adequate considering the nature and extent of the operations to be conducted. The certification process involves the State’s evaluation of each operator and a determination that the operator is capable of conducting safe operations before initial issuance of an ROC or the addition of any subsequent authorizations to an ROC.

#### **1.3 Standard certification practices**

The State of the Operator is required by Standard 4.2.1.14 to establish a certification system to ensure compliance with the required standards for the type of operation to be conducted. Several States have developed policies and procedures to comply with this certification requirement as industry capabilities evolve. While those States did not develop their certification practices in coordination with each other, their practices are based on longstanding conventional aviation practices and, as such, are remarkably similar and consistent in their requirements. The effectiveness of these practices have been validated over many years, resulting in improved safety records of operators throughout the world. Many of these certification practices have been incorporated by reference in ICAO provisions.

## 2. Required technical safety evaluations

### 2.1 Specific approval, approval and acceptance actions

- 2.1.1 The certification and continued surveillance of an RPAS operator includes actions taken by a State on matters submitted for its review. The actions can be categorized as specific approvals, approvals or acceptances depending on the nature of the response by the State to the matter submitted for its review.
- 2.1.2 A specific approval is an approval which is documented in the Operations Specifications for applicable RPAS operators or RPA models.
- 2.1.3 An approval is an active response by the State to a matter submitted for its review. An approval constitutes a finding or determination of compliance with the applicable standards. An approval will be evidenced by the signature of the approving official, the issuance of a document or certificate, or some other formal action taken by the State.
- 2.1.4 An acceptance does not necessarily require an active response by the State to a matter submitted for its review. A State may accept a matter submitted to it for review as being in compliance with the applicable standards if the State does not specifically reject all or a portion of the matter under review, usually after some defined period of time after submission.
- 2.1.5 The phrase “approved by the State” or similar phrases using the word “approval” are frequently used in Annex 6, Part IV. Provisions indicating a review and implying approval or at least “acceptance” by the State occur even more frequently in Annex 6, Part IV. In addition to these specific phrases, Annex 6, Part IV, contains numerous references to requirements which would, as a minimum, create the need for at least a technical review by the State. This Attachment groups and outlines those specific Standards and Recommended Practices for ease of use by States.
- 2.1.6 The State should make or arrange for a technical safety evaluation before issuing the specific approval, approval or acceptance. The evaluation should:
- a) be accomplished by a person with specific qualifications to make such a technical evaluation;
  - b) be in accordance with written, standardized methodology; and
  - c) where necessary to safety, include a practical demonstration of the operator’s actual ability to conduct such an operation.

### 2.2 Demonstrations before issuance of some specific approvals and approvals

- 2.2.1 Standard 4.2.1.4 obligates the State of the Operator, prior to certification of the operator, to require sufficient demonstrations by the operator to enable the State to evaluate the adequacy of the operator’s organization, method of control and supervision of remote flight operations, ground handling and maintenance arrangements. These demonstrations should be in addition to the review or inspections of manuals, records, facilities and equipment. Some of the specific approvals and approvals required by Annex 6, Part IV, such as specific approval for RVSM or

PBN operations, have significant safety implications and should be validated by demonstration before the State authorizes such operations.

- 2.2.2 While the specific methodology and extent of the required demonstrations and evaluations vary between States, the certification processes of States whose operators have good safety records are generally consistent. In these States, technically qualified inspectors evaluate a representative sample of the actual training, maintenance and operations prior to the issuance of an ROC or additional authorizations to the ROC.

## 2.3 Recording of certification actions

- 2.3.1 It is important that the certification, specific approval, approval and acceptance actions of the State are adequately documented. The State should issue a written instrument, such as a letter or formal document, as an official record of the action. These written instruments should be retained as long as the operator continues to exercise the authorizations for which the specific approval, approval or acceptance action was issued. These instruments are unambiguous evidence of the authorizations held by the operator and provide proof in the event that the State and the operator disagree on the operations that the operator is authorized to conduct.
- 2.3.2 Some States collect certification records such as inspections, demonstrations, specific approvals, approvals and acceptance instruments into a single file which is retained as long as the operator is active. Other States retain these records in files according to the certification action performed, and revise the file as the specific approvals, approvals or acceptance instruments are updated. Regardless of the method used, these certification records are persuasive evidence that a State is complying with its ICAO obligations regarding operator certification.

## 2.4 Coordination of operations and airworthiness evaluations

Some of the references to specific approval, approval or acceptance in Annex 6, Part IV, will require an operations evaluation and an airworthiness evaluation. Specific approvals for by operations and airworthiness specialists. Flight operations specialists should evaluate the operational procedures, training and qualifications. Airworthiness specialists should evaluate the RPA and the RPS, equipment reliability and maintenance procedures. These evaluations may be accomplished separately, but should be coordinated to ensure that all aspects necessary for safety have been addressed before any specific approval, approval or acceptance is issued.

## 2.5 State of the Operator and State of Registry responsibilities

- 2.5.1 Annex 6, Part IV, places the responsibility for initial certification, issuance of the ROC, and ongoing surveillance of an RPAS operator on the State of the Operator. Annex 6, Part IV, also requires the State of the Operator to consider or act in accordance with various approvals and acceptances by the State of Registry. Under these provisions, the State of the Operator should ensure that its actions are consistent with the approvals and acceptances of the State of Registry and that the operator is in compliance with State of Registry requirements.

- 2.5.2 It is essential that the State of the Operator be satisfied with the arrangements by which its RPAS operators use RPA on the register of another State, particularly for maintenance and crew training. The State of the Operator should review such arrangements in coordination with the State of Registry. Where appropriate, an agreement transferring oversight responsibilities from the State of Registry to the State of the Operator pursuant to Article 83 bis to the Convention on International Civil Aviation should be arranged to preclude any misunderstandings regarding which State is responsible for specific oversight responsibilities.

Note. — Guidance concerning the responsibilities of the State of the Operator and the State of Registry in connection with lease, charter and interchange operations is contained in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335). Guidance concerning the transfer of State of Registry responsibilities to the State of the Operator in accordance with Article 83 bis is contained in Guidance on the Implementation of Article 83 bis of the Convention on International Civil Aviation (Cir 295).

### 3. AUTHORISATIONS

An authorization entitles an operator, owner or remote pilot-in-command to undertake the authorized operations. Authorizations can take the form of specific approvals, approvals or acceptances.

#### 3.1 Specific approval actions

- 3.1.1 The term “specific approval” indicates a formal action on the part of the State of the Operator which results in an addition to the operations specification.

- 3.1.2 The following provisions make explicit reference to the need for a specific approval:

- a) automatic landing and take-off capabilities [4.2.9.3 and 4.2.9.4];
- b) low visibility operations when conducted ‘visually’ [4.2.9.3.1 and 4.2.9.4.1];
- c) RNP AR navigation specifications for PBN operations [7.2.4];
- d) reduced vertical separation minimum (RVSM) [7.2.6]; and
- e) dangerous goods [14.4].

- 3.1.3 An example of an Operations Specification template is provided in Appendix 6.

#### 3.2 RPAS operator certificate (ROC)

- 3.2.1 The ROC required by Annex 6, Part IV, Chapter 4, 4.2.1, is a formal instrument. Chapter 4, 4.2.1.7, lists the information to be included in the ROC.
- 3.2.2 In addition to the items in Appendix 6, paragraph 3, operations specifications may include other specific approvals, such as:
- a) special aerodrome operations (e.g. short take-off and landing operations or land and hold short operations);
  - b) special approach procedures (e.g. steep gradient approach, instrument landing system precision runway monitor approach, localizer-type directional aid precision runway monitor approach); and
  - c) operations in areas with special procedures (e.g. operations in areas using different altimetry units or altimeter setting procedures).

### 3.3 Approval actions

- 3.3.1 The term “approval” indicates a more formal action on the part of the State with respect to a certification matter than does the term “acceptance”. Some States require the Director of the Civil Aviation Authority (CAA) or a designated lower-level CAA official to issue a formal written instrument for every “approval” action taken. Other States allow a variety of documents to be issued as evidence of an approval. The approval document issued and the matter addressed by the approval will depend on the delegated authority of the official. In such States, authority to sign routine approvals, such as operator minimum equipment lists for specific RPAS, is delegated to technical inspectors. More complex or significant approvals are normally issued by higher-level officials.

#### 3.3.2 Provisions that require an approval

The following provisions require or encourage approval by specified States. The approval of the State of the Operator is required in all of the certification actions listed below that are not preceded by one or more asterisks. Certification actions listed below that are preceded by one or more asterisk(s) require approval by the State of Registry (single asterisk or “\*”), or by the State of Design (double asterisk or “\*\*”). However, the State of the Operator should take the necessary steps to ensure that operators for which it is responsible comply with any applicable approvals issued by the State of Registry and/or State of Design, in addition to its own requirements.

Note. — Items that require a specific approval are not included here. Refer to 3.1.2 of this Attachment for a list of these provisions.

- a) \*\*Configuration deviation list (CDL) (Definitions);
- b) \*\*Master minimum equipment list (MMEL) (Definitions);
- c) The SLA relating to the C2 Link (3.6.3.4);
- d) The method for establishing minimum flight altitudes (4.2.8.3);

- e) The method of determining aerodrome operating minima (4.2.9.1);
- f) Fatigue Management (4.10);
- g) Additional requirements for operations of approved single-engine RPA over heavily populated areas (5.4 or 5.5);
- h) RPAS specific minimum equipment list (MEL) (6.1.2);
- i) MNPS operations (7.2.5 b));
- j) Performance-based navigation operations (7.2.2);
- k) Procedures for electronic navigation data management (7.5.1);
- l) \*RPA or RPS-specific maintenance programme (8.3.1);
- m) \*Approved maintenance organization (Annex 8, Part II, Chapter 6, 6.2);
- n) \*Maintenance quality assurance methodology (Annex 8, Part II, Chapter 6, 6.4.1);
- o) Remote flight crew training programmes (9.3);
- p) Training in the transport of dangerous goods (9.3.1, Note 5);
- q) Aerodrome additional safety margin (9.4.5.3 a));
- r) Remote pilot-in-command area, route and aerodrome qualifications (9.4.5.5);
- s) Use of flight simulation training devices (9.3.1, Note 2 and 9.4.6.3, Note 1);
- t) Method of control and supervision of remote or split flight operations (4.2.1.4 and 10.1);
- u) \*\*Mandatory maintenance tasks and intervals (11.3.2);
- v) Security training programmes (13.1.2).

### 3.4 Provisions that require a technical evaluation

Other provisions in Annex 6, Part IV, require the State to have made a technical evaluation. These provisions contain the phrases “acceptable to the State”, “determined by the State”, and “prescribed by the State”. While not necessarily requiring an approval by the State, these Standards do require the State to at least accept the matter at issue after it conducts a specific review or evaluation. These provisions are:

- a) details of the RPAS specific checklists (Definition: RPAS operating manual and 6.1.3);

- b) details of the RPAS specific systems (Definition: RPAS operating manual and 6.1.3);
- c) mandatory material for the operations manual (4.2.4.2 and Appendix 2);
- d) engine trend monitoring systems (5.4.2 and 5.5.3);
- e) requirements for approval to operate in RVSM airspace (7.2.6);
- f) monitoring of height-keeping performance of RPA approved to operate in RVSM airspace (7.2.8);
- g) procedures for distribution and insertion of electronic navigation data in RPAS (7.5.2);
- h) \*operator's RPAS-specific maintenance responsibilities (8.1.1);
- i) \*method of maintenance and release (8.1.2);
- j) \*maintenance control manual (8.2.1);
- k) \*mandatory material for the maintenance control manual (8.2.4);
- l) \*reporting of maintenance experience information (8.5.1);
- m) \*implementing necessary maintenance corrective actions (8.5.2);
- n) \*modification and repair requirements (8.6);
- o) \*minimum competence level of maintenance personnel (Annex 8, Part II, Chapter 6, 6.6.4);
- p) training facilities (9.3.1);
- q) qualifications of RPAS instructors (9.3.1);
- r) need for recurrent training (9.3.1);
- s) use of correspondence courses and written examinations (9.3.1, Note 4);
- t) use of flight simulation training devices (9.3.1 and 9.3.2);
- u) remote flight crew qualification records (9.4.5.4);
- v) designated representative of the State of the Operator (9.4.6);
- w) \*flight manual changes (11.1);
- x) altimetry system performance requirements for operations in RVSM airspace (Appendix 4, 1 and 2);

*Single-engine operations*

- y) engine reliability for approved operations by single-engine turbine-powered RPA over heavily populated areas (Appendix 3, 1.1);
- z) systems and equipment (Appendix 3, 2);
- aa) minimum equipment list (Appendix 3, 3);
- bb) flight manual information (Appendix 3, 4);
- cc) event reporting (Appendix 3, 5);
- dd) operator planning (Appendix 3, 6);
- ee) remote flight crew experience, training and checking (Appendix 3, 7);
- ff) operator certification or validation (Appendix 3, 9); and
- gg) RPAS operator security programme (13.3).

### **3.5 Acceptance actions**

#### **3.5.1 Acceptance**

3.5.1.1 The actual extent of the State's technical evaluation of the operator's readiness to conduct certain remote flight operations should be much broader than just those Standards which require or imply approval. During certification, the State should ensure that the operator will be in compliance with all requirements of Annex 6, Part IV, prior to conducting international RPAS operations.

3.5.1.2 The concept of "acceptance" is used by some States as a formal method of ensuring that all critical aspects of operator certification are reviewed by the State prior to the formal issuance of the ROC. Using this concept, these States exercise their prerogative to have technical inspectors review all operators' policies and procedures impacting operational safety. The actual execution of an instrument to reflect this acceptance (assuming such a document is issued) may be delegated to the technical inspector assigned to the certification.

#### **3.5.2 Conformance report**

Some States use a conformance report to document the acceptances it makes with regard to a particular operator. This is a document submitted by the operator detailing how, with specific references to operations or maintenance control manuals, it will comply with all applicable State regulations. This type of document is referenced in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335) and the Airworthiness Manual

(Doc 9760). Such a conformance report should be actively used during the certification process and revised as necessary to reflect modifications required by the State in the operator's policies and procedures. Then a final conformance report is included in the State's certification records, along with other records of certification. The conformance report is an excellent method of demonstrating that the operator was properly certificated with respect to all applicable regulatory requirements.

### 3.5.3 Operations and maintenance control manuals

- 3.5.3.1 Operations and maintenance control manuals, and any subsequent amendments should be submitted to the State (4.3.3.3, 8.1.1, 8.2.4, 8.3.2, and Annex 8, Part II, Chapter 6, 6.3.3). The State also establishes minimum contents for these manuals (11.2, 11.3, 11.4 and Appendix 2). The pertinent portions of the operator's manual for evaluation should be identified in the State's technical guidance, e.g. operations policy manual, operating manual, route guide, and training manual. Some States issue a formal instrument accepting each manual and any subsequent amendments.
- 3.5.3.2 The State's technical evaluation should, in addition to ensuring that all required contents are addressed, consider if the specific policies and procedures would result in the desired outcome. For example, the specifications for the operational flight plan (Appendix 2, 2.1.14) should provide the-step by-step completion guidance necessary for compliance with 4.3 of this Part concerning the content and retention of these plans.
- 3.5.3.3 Proven industry practices, such as an example of an actual completed operational flight plan for reference by the remote flight crew and dispatchers (although not a Standard), may also be required by a State's technical evaluator during certification. This aspect of the technical evaluation should be conducted by inspectors experienced in operator certification. A major consideration with respect to evaluating for proven industry practices that are RPAS specific, equipment-specific or have limited applications is the employment of evaluators who are currently qualified in the practice to be evaluated.

## 4. OTHER APPROVAL OR ACCEPTANCE CONSIDERATIONS

Some States provide for approval or acceptance of certain critical documents, records or procedures specified in Annex 6, Part IV, although the relevant Annex 6 Standards do not require approval or acceptance by the State of the Operator. The following are some examples:

- a) flight data analysis programme (3.3.4);
- b) method for obtaining aeronautical data (4.1.1);
- c) adequacy of the fuel and oil records (4.2.11);
- d) adequacy of flight time, flight duty and rest period records (4.10);
- e) adequacy of the RPA and RPS log (6.25.2 g), 6.26.1 g), h));
- f) adequacy of the load manifest (4.3.1 f), g) and h));

- g) adequacy of the operational plan (4.3.1 i));
- h) method for obtaining weather data (4.3.5.1);
- i) RPA performance operating limitations (5.2.4);
- j) method of obtaining and applying aerodrome obstacle data (5.3);
- k) contents of the journey log book (11.4.1); and
- l) content of the security training programme (13.1.2).

## 5. VALIDATION OF THE STANDARD OF OPERATIONS

Standard 4.2.1.6 requires that the validity of an ROC shall depend upon the operator maintaining the original certification standards (4.2.1.4) under the supervision of the State of the Operator. This supervision requires that a system of continued surveillance be established to ensure the required standards of operations are maintained (4.2.1.14). A good starting point in the development of such a system is to require annual or semi-annual inspections, observations and tests to validate the required certification specific approval, approval and acceptance actions.

## 6. AMENDMENT OF RPAS OPERATOR CERTIFICATES

The certification of the operator is an ongoing process. Few operators will be satisfied over time with the initial authorizations issued with their ROC. Evolving market opportunities will cause the operator to change RPAS models/types and seek approval for new operational areas requiring other additional capabilities. Additional technical evaluations should be required by the State before issuing the formal written instruments approving any changes to the original ROC and other authorizations. Where possible, each request should be “bridged”, using the original authorization as the foundation to determine the extent of the State’s impending evaluation before issuing the formal instrument.

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## ATTACHMENT E. MINIMUM EQUIPMENT LIST (MEL)

*Supplementary to Chapter 6, 6.1.3*

1. If deviations from the requirements of States in the certification of RPA were not permitted, an RPAS could not be operated unless all systems and equipment were operable. Experience has proved that some unserviceability can be accepted in the short term when the remaining operative systems and equipment provide for continued safe operations.
2. Unless the State of the Operator has approved a minimum equipment list (MEL) specifying systems and items of equipment within the RPA and RPS permitted to be inoperative at commencement of flight, no flight can be conducted with inoperative systems or equipment.
3. A minimum equipment list, approved by the State of the Operator, is therefore necessary for each RPA and RPS, based on the master minimum equipment list established for the RPA type and RPS type, if applicable, by the organization responsible for the type design in conjunction with the State of Design.
4. The State of the Operator should require the operator to prepare a minimum equipment list designed to allow the operation of an RPAS with certain systems or equipment inoperative provided an acceptable level of safety is maintained.
5. The minimum equipment list is not intended to provide for operation of the RPAS for an indefinite period with inoperative systems or equipment. The basic purpose of the minimum equipment list is to permit the safe operation of an RPAS with inoperative systems or equipment within the framework of a controlled and sound programme of repairs and parts replacement.
6. Operators are to ensure that no flight is commenced with multiple minimum equipment list items inoperative without determining that any interrelationship between inoperative systems or components will not result in an unacceptable degradation in the level of safety and/or undue increase in the remote flight crew workload.
7. The exposure to additional failures during continued operation with inoperative systems or equipment must also be considered in determining that an acceptable level of safety is being maintained. The minimum equipment list may not deviate from requirements of the flight manual limitations section, emergency procedures or other airworthiness requirements of the State of Registry or of the State of the Operator unless the appropriate airworthiness authority or the flight manual provides otherwise.
8. Systems or equipment accepted as inoperative for a flight should be suitably indicated (placarded) or disabled in the RPA and within the RPS where appropriate, and all such items should be noted in the RPA or RPS technical log to inform the remote flight crew and maintenance personnel of the inoperative system or equipment. This information should also be transferred as part of the handover process when transferring control to another RPS.
9. For a particular system or item of equipment to be accepted as inoperative, it may be necessary to establish a maintenance procedure, for completion prior to flight, to de-activate or isolate the system or equipment. It may similarly be necessary to prepare an appropriate remote flight crew operating procedure.
10. The responsibilities of the remote pilot-in-command in accepting an RPAS for operation with deficiencies in accordance with a minimum equipment list are specified in Chapter 4, 4.3.1.

## ATTACHMENT F. FLIGHT SAFETY DOCUMENTS SYSTEM

*Supplementary to Chapter 3, 3.3.6*

### 1. INTRODUCTION

- 1.1 The following material provides guidance on the organization and development of the operator's flight safety documents system. It should be understood that the development of a flight safety documents system is a complete process, and changes to each document comprising the system may affect the entire system. Guidelines applicable to the development of operational documents have been produced by government and industry sources and are available to operators. Nevertheless, it may be difficult for operators to make the best use of these guidelines, since they are distributed across a number of publications.
- 1.2 Furthermore, guidelines applicable to operational documents development tend to focus on a single aspect of documents design, for example, formatting and typography. Guidelines rarely cover the entire process of operational documents development. It is important for operational documents to be consistent with each other, and consistent with regulations, manufacturer requirements and Human Factors principles. It is also necessary to ensure consistency across departments as well as consistency in application. Hence the emphasis on an integrated approach, based on the notion of the operational documents as a complete system.
- 1.3 The guidelines in this Attachment address the major aspects of the operator's flight safety documents system development process, with the aim of ensuring compliance with Chapter 3, 3.3.6. The guidelines are based not only upon scientific research, but also upon current best industry practices, with an emphasis on a high degree of operational relevance.

### 2. ORGANIZATION

- 2.1 A flight safety documents system should be organized according to criteria which ensure easy access to information required for flight and ground operations contained in the various operational documents comprising the system and which facilitate management of the distribution and revision of operational documents.
- 2.2 Information contained in a flight safety documents system should be grouped according to the importance and use of the information, as follows:
  - a) time-critical information, e.g., information that can jeopardize the safety of the operation if not immediately available;
  - b) time-sensitive information, e.g., information that can affect the level of safety or delay the operation if not available in a short time period;
  - c) frequently used information;
  - d) reference information, e.g., information that is required for the operation but does not fall under b) or c) above; and
  - e) information that can be grouped based on the phase of operation in which it is used.

- 2.3 Time-critical information should be placed early and prominently in the flight safety documents system.
- 2.4 Time-critical information, time-sensitive information, and frequently used information should be placed in cards and quick-reference guides.

### 3. VALIDATION

The flight safety documents system should be validated before deployment, under realistic conditions. Validation should involve the critical aspects of the information use, in order to verify its effectiveness. Interactions among all groups that can occur during operations should also be included in the validation process.

### 4. DESIGN

- 4.1 A flight safety documents system should maintain consistency in terminology and in the use of standard terms for common items and actions.
- 4.2 Operational documents should include a glossary of terms, acronyms and their standard definition, updated on a regular basis to ensure access to the most recent terminology. All significant terms, acronyms and abbreviations included in the flight safety documents system should be defined.
- 4.3 A flight safety documents system should ensure standardization across document types, including writing style, terminology, use of graphics and symbols, and formatting across documents. This includes a consistent location of specific types of information, consistent use of units of measurement and consistent use of codes.
- 4.4 A flight safety documents system should include a master index to locate, in a timely manner, information included in more than one operational document.

Note. — The master index must be placed in the front of each document and consist of no more than three levels of indexing. Pages containing abnormal and emergency information must be tabbed for direct access.

- i) A flight safety documents system should comply with the requirements of the operator's quality system, if applicable.

### 5. DEPLOYMENT

Operators should monitor deployment of the flight safety documents system, to ensure appropriate and realistic use of the documents, based on the characteristics of the operational environment and in a way which is both operationally relevant and beneficial to operational personnel. This monitoring should include a formal feedback system for obtaining input from operational personnel.

## 6. AMENDMENT

- 6.1 Operators should develop an information gathering, review, distribution and revision control system to process information and data obtained from all sources relevant to the type of operation conducted, including, but not limited to, the State of the Operator, State of design, State of Registry, manufacturers and equipment vendors.

Note. — Manufacturers provide information for the operation of specific RPAS that emphasizes the systems and procedures under conditions that may not fully match the requirements of operators. Operators should ensure that such information meets their specific needs and those of the local authority.

- 6.2 Operators should develop an information gathering, review and distribution system to process information resulting from changes that originate within the operator, including:

- a) changes resulting from the installation of new equipment;
- b) changes in response to operating experience;
- c) changes in the operator's policies and procedures;
- d) changes in the operator certificate; and
- e) changes for purposes of maintaining cross fleet standardization.

Note. — Operators should ensure that crew coordination philosophy, policies and procedures are specific to their operation.

- 6.3 A flight safety documents system should be reviewed:

- a) on a regular basis (at least once a year);
- b) after major events (mergers, acquisitions, rapid growth, downsizing, etc.);
- c) after technology changes (introduction of new equipment); and
- d) after changes in safety regulations.

- 6.4 Operators should develop methods of communicating new information. The specific methods should be responsive to the degree of communication urgency.

Note. — As frequent changes diminish the importance of new or modified procedures, it is desirable to minimize changes to the flight safety documents system.

- 6.5 New information should be reviewed and validated considering its effects on the entire flight safety documents system.

- 6.6 The method of communicating new information should be complemented by a tracking system to ensure currency by operational personnel. The tracking system should include a procedure to verify that operational personnel have the most recent updates.

## **ATTACHMENT G. ADDITIONAL GUIDANCE FOR APPROVED OPERATIONS BY SINGLE-ENGINE RPA OVER HEAVILY POPULATED AREAS**

Reserved for future use.

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## **ATTACHMENT H. AUTOMATIC LANDING SYSTEMS, HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS AND VISION SYSTEMS**

*Supplementary to Chapter 4, 4.2.9.2, and Chapter 6, 6.23*

Note. — Guidance provided in the Manual of All-Weather Operations (Doc 9365) should be followed. This Attachment will be completed as specific RPAS design solutions are developed.

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# ATTACHMENT I. RESCUE AND FIREFIGHTING SERVICE (RFFS) LEVELS

*Supplementary to Chapter 4*

Note. — RPAS SARPs do not currently address RPA with persons on board. However, the following text has been included to reflect the level of cover that would be required in order to minimize the effects of an accident involving an RPA at an aerodrome, which includes any cargo that is being carried on board.

## 1. PURPOSE AND SCOPE

### 1.1 Introduction

The purpose of this Attachment is to provide guidance for assessing the level of rescue and firefighting service (RFFS) deemed acceptable by RPA operators using aerodromes for differing purposes. This guidance does not relieve the operator from the obligation to ensure that an acceptable level of protection is available for the RPA intended to be used.

### 1.2 Basic concepts

- 1.2.1 For flight planning purposes, an RPA operator should utilize an aerodrome or heliport whose RFFS category, as required by Annex 14, Volume I, Chapter 9, 9.2 (for aeroplanes), or Annex 14, Volume II, Chapter 6 (for helicopters), matches or exceeds the RPA's RFFS category. Some aerodromes currently used do not, however, meet these requirements. Furthermore, Annex 14, Volumes I and II, provisions relate to the level of aerodrome or heliport RFFS to be provided for RPA normally using an aerodrome; hence, this level of RFFS protection does not take into account RPA for which the aerodrome is selected as an alternate aerodrome.
- 1.2.2 If an aerodrome is exposed to a temporary reduction of its RFFS capability, Annex 14, Volume I, 2.11.3, and Volume II, 2.7.3, require that changes in the level of protection normally available at an aerodrome, or heliport, for rescue and firefighting shall be notified to the appropriate air traffic services units and aeronautical information services units to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly.
- 1.2.3 In order to determine the acceptability of an aerodrome RFFS protection level, the operator should consider:
  - a) for a departure or destination aerodrome, the difference between the aerodrome RFFS category and the RPA RFFS category, and the frequency of flights to that aerodrome; and
  - b) for an alternate aerodrome, the difference between the aerodrome RFFS category and the RPA RFFS category, and the probability that this alternate aerodrome will be used.
- 1.2.4 The intention is that the operator will consider the available RFFS as one element of a safety risk assessment process conducted under their safety management system (SMS), to ensure that the overall safety of the operation can be maximized.

- 1.2.5 This safety risk assessment would also include considerations of aerodrome facilities, availability, terrain, weather conditions, etc. to ensure that the most appropriate aerodrome is selected.

Note. — Annex 19 includes safety management provisions for RPAS operators. Further guidance is contained in the Safety Management Manual (Doc 9859).

- 1.2.6 The following guidance is intended to assist operators in making the assessment required by Chapter 4, 4.1.3 with due consideration of the basic principles described in 1.2.1 to 1.2.4. It is not intended that this guidance limit or regulate the operation of an aerodrome.

## 2. GLOSSARY OF TERMINOLOGY

**Aerodrome RFFS category.** The RFFS category for a given aerodrome, as published in the appropriate Aeronautical Information Publication (AIP).

**RPA RFFS category.** The category derived from Annex 14, Volume I, Table 9-1 (for aeroplanes) or Annex 14, Volume II, Table 6-1 (for helicopters) for a given RPA type.

**Temporary downgrade.** RFFS category as notified, including by NOTAM, and resulting from the downgrade of the level of RFFS protection available at an aerodrome.

## 3. MINIMUM ACCEPTABLE AERODROME RFFS CATEGORY

### 3.1 Planning

- 3.1.1 In principle, the published RFFS category for each of the aerodromes used for a given flight should be equal to or better than the RPA's RFFS category. However, if the RPA's RFFS category is not available at one or more of the aerodromes required to be specified in the operational flight plan, the operator should ensure that the aerodrome has a level of RFFS category which is deemed acceptable, based on a safety risk assessment conducted as part of the operator's safety management system (SMS). When establishing acceptable levels of RFFS category for these situations, the operator may use the criteria in Table I-1 and Table I-2, below. Notwithstanding these criteria, the operator may determine other acceptable levels of RFFS category in accordance with 3.1.3 of this Attachment.

- 3.1.1.1 Intended operations to aerodromes with RFFS categories below the levels specified in Annex 14, Volume I, Chapter 9, 9.2 (for aeroplanes), or Volume II, Chapter 6 (for helicopters), should be coordinated between the RPAS operator and the aerodrome operator.

- 3.1.1.2 For departure and destination aerodromes, during flight planning, the acceptable RFFS protection level should equal or exceed the values specified in Table I-1.

**Table I-1. Acceptable aerodrome category for rescue and firefighting (departure and destination aerodrome)**

Aerodromes	Acceptable aerodrome RFFS category
(Required to be specified in the operational flight plan)	(Based on published aerodrome RFFS category, including any modification by NOTAM)

*Note. — If an individual aerodrome serves more than one purpose, the highest required category corresponding to that purpose at the time of expected use applies.*

Departure and destination aerodrome	RFFS category for each aerodrome should be equal to or better than the RPA RFFS category.
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Where a suitable safety risk assessment has been conducted by the operator:

**One** category below the RPA RFFS category, or

**Two** categories below the RPA RFFS category, in the case of a temporary downgrade of 72 hours or less

but not lower than aerodrome RFFS Category 4 for RPA with maximum certificated take-off mass of over 27 000 kg and not lower than Category 1 for other RPA.

3.1.1.3 So as to comply with the operational regulations applicable to a given flight, the operator selects alternate aerodrome(s) for various uses. During flight planning, the acceptable aerodrome RFFS category at a selected alternate aerodrome may equal or exceed the values specified in Table I-2.

**Table I-2. Acceptable aerodrome category for rescue and firefighting (alternate aerodromes)**

**Aerodromes**

**Acceptable aerodrome RFFS protection level**

(Required to be specified in the operational flight plan)

(Based on published aerodrome RFFS category, including any modification by NOTAM)

*Note. — If an individual aerodrome serves more than one purpose, the highest required category corresponding to that purpose at the time of expected use applies.*

Take-off alternate and destination alternate aerodromes

Where a suitable safety risk assessment has been conducted by the operator:

**Two** categories below the RPA RFFS category, or

**Three** categories below the RPA RFFS category in the case of a temporary downgrade of 72 hours or less

but not lower than aerodrome RFFS Category 4 for RPA with maximum certificated take-off mass of over 27 000 kg and not lower than Category 1 for other RPA.

En-route alternate aerodromes

If at least 30 minutes notice is given to the aerodrome operator prior to the arrival of the RPA, a minimum of RFFS Category 4 for RPA with maximum certificated take-off mass of over 27 000 kg, and RFFS Category 1 for other RPA.

If less than 30 minutes notice can be given to the aerodrome operator prior to the arrival of the RPA:

**Two** categories below the RPA RFFS category, or

**Three** categories below the RPA RFFS category in the case of a temporary downgrade of 72 hours or less

but not lower than aerodrome RFFS Category 4 for RPA with maximum certificated take-off mass of over 27 000 kg and not lower than Category 1 for other RPA.

### 3.1.2 Variations

3.1.2.1 Notwithstanding the guidance developed in 3.1.1, an aerodrome RFFS category below the protection levels defined in Tables I-1 and I-2 may be acceptable if other considerations prevail, such as weather conditions, runway(s), heliport or landing location characteristics, or length of diversion. Such variations should be based on a specific safety risk assessment conducted by the operator as part of its safety management system (SMS).

3.1.2.2 Variations to the aerodrome RFFS category may concern, among other cases:

- a) an occasional flight; or
- b) temporary downgrades exceeding 72 hours.

Where applicable, a variation may be used for a group of aerodromes selected for the same purpose, for a given RPA type.

3.1.2.3 The aforementioned variations may be based on additional or other criteria relevant to the type of operations. For instance, the 72-hour threshold for RFFS temporary downgrades may not be relevant for a single flight to or from the aerodrome concerned, such as a non-scheduled flight, whereas it is fully relevant for operations carried out on a continuous and daily basis. A variation may be time limited. A variation may also be modified to reflect the changes of the RFFS protection level available at the aerodrome(s) concerned. In accordance with Chapter 4, 4.1.4, the variations and their validity periods should be included in the operations manual.

3.1.2.4 For variations to the acceptable RFFS category at departure and destination aerodromes, the RPAS operator's specific safety risk assessment for an aerodrome intended to be used as a departure or destination aerodrome may be based on the following elements:

- a) the frequency of flights intended by the RPAS operator in relation to a lowered aerodrome RFFS category;
- b) coordination between the RPAS operator and the aerodrome operator (for instance, reducing intervention time by prepositioning the existing RFFS means along the runway before the intended take-off or landing).

3.1.2.5 For regular flights, the coordination should take into account the principles of Annex 14, Volume I, Chapter 9, 9.2.5 and 9.2.6 or Volume II, Chapter 6, 6.2.2, which are applicable to the

aerodrome or heliport operator, as well as the possibilities to modulate the aerodrome RFFS category available on a daily cycle or seasonal cycle.

3.1.2.6 For variations in acceptable RFFS for an alternate aerodrome, the RPAS operator's specific safety risk assessment for an aerodrome selected as a take-off alternate aerodrome, a destination alternate aerodrome or an en-route alternate aerodrome may be based on the following elements:

- a) the probability of effective use of the aerodrome concerned; and
- b) the frequency of selection of the aerodrome for the respective purpose of use.

## 3.2 In flight

3.2.1 The information contained in the operations manual according to Chapter 4, 4.1.4 about the aerodrome RFFS category acceptable at the planning stage (including Tables I-1, I-2 and, where usable, the variations under the specifications in 3.1.2) is applicable at the in-flight re-planning point.

3.2.2 In flight, the remote pilot-in-command may decide to land at an aerodrome regardless of the RFFS category if, in the remote pilot's judgement after due consideration of all prevailing circumstances, to do so would be safer than to divert.

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## ATTACHMENT J. DANGEROUS GOODS

*Supplementary to Chapter 14*

### 1. PURPOSE AND SCOPE

The material in this Attachment provides guidance regarding the carriage of dangerous goods as cargo. Chapter 14 includes dangerous goods operational requirements that apply to all operators. Operators that have a specific approval to transport dangerous goods as cargo need to meet additional requirements. In addition to the operational requirements contained in Annex 6, there are other requirements in Annex 18 and the Technical Instructions that also need to be complied with.

### 2. DEFINITIONS

Where the following term is used in this Attachment, it has the meaning indicated:

**Cargo.** Any property carried on an RPA other than mail.

Note 1.— This definition differs from the definition of “cargo” given in Annex 9.

Note 2.— COMAT that meets the classification criteria of dangerous goods and which is transported in accordance with Part 1;2.2.2 or Part 1;2.2.3 or Part 1;2.2.4 of the Technical Instructions are considered as “cargo” (e.g. aircraft parts such as lithium ion batteries, lithium metal batteries, chemical oxygen generators, fuel control units, fire extinguishers, oils, lubricants, cleaning products).

### 3. STATES

- 3.1 The State of the Operator should indicate in the operations specification if an operator has been issued a specific approval to transport dangerous goods as cargo. Any limitations should be included.
- 3.2 A specific approval may be granted for the transport of specific types of dangerous goods only (e.g. dry ice; biological substance, Category B; and dangerous goods in excepted quantities) or COMAT.
- 3.3 The Supplement to the Technical Instructions contains guidance on a State’s responsibilities with respect to operators. This includes additional information to Part 7 of the Technical Instructions on storage and loading, provision of information, inspections, enforcement and Annex 6 information relevant to the State’s responsibilities for dangerous goods.
- 3.4 Carriage of dangerous goods other than as cargo (e.g. equipment including lithium batteries) are addressed in Part 1, Chapter 1 of the Technical Instructions. The exceptions for the carriage of dangerous goods that are either equipment or for use on board the RPA during flight are detailed in Part 1, 2.2.1 of the Technical Instructions.

## 4. OPERATOR

- 4.1 Operators are required to establish a dangerous goods training programme regardless of whether or not they have specific approval to transport dangerous goods as cargo. The training programme should meet, as a minimum, the provisions in Part 1.4 of the Technical Instructions. The objective of the training programme is to ensure that personnel are competent to perform any function for which they are responsible prior to performing any of these functions. Recurrent training must be provided within 24 months of previous training, except as otherwise provided by the Technical Instructions.
- 4.2 Details of the dangerous goods training programme including the policies and procedures regarding third-party personnel involved in the acceptance, handling, loading and unloading of dangerous goods cargo should be included in the operations manual.
- 4.3 The Technical Instructions require that operators provide information in the operations manual and/or other appropriate manuals that will enable remote flight crews, other employees and ground handling service providers to carry out their responsibilities with regard to the transport of dangerous goods and that initial training be conducted prior to performing a job function involving dangerous goods.
- 4.4 Operators should meet and maintain requirements established by the States in which operations are conducted in accordance with 4.2.3.3 of this Part.
- 4.5 Operators may seek a specific approval to transport, as cargo, specific dangerous goods only, such as dry ice, biological substance, Category B, COMAT and dangerous goods in excepted quantities.
- 4.6 Attachment 1 to Part S-7, Chapter 7, of the Supplement to the Technical Instructions contains additional guidance and information on requirements regarding operators not holding a specific approval to transport dangerous goods as cargo and for operators that have a specific approval to transport dangerous goods as cargo.
- 4.7 All operators should develop and implement a system that ensures they will remain current with regulatory changes and updates. The Technical Instructions contain detailed instructions necessary for the safe transport of dangerous goods by air. These instructions are issued biennially, becoming effective on 1 January of an odd-numbered year.
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## ATTACHMENT K. LOCATION OF AN RPA IN DISTRESS

Reserved for future use.

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## ATTACHMENT L. GUIDE TO CURRENT FLIGHT RECORDER PROVISIONS

Reserved for future use.

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End of new Part IV.

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