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Международная
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منظمة الطيران
المدني الدولي

国际民用
航空组织

Tel.: +1 514-954-8219 ext. 6190

Ref.: AN 7/67.2-21/18

31 March 2021

Subject: Adoption of the first edition of Volume VI to Annex 10

Action required: a) Notify any disapproval before 12 July 2021; b) Notify any differences and compliance before 26 October 2026; c) Consider the use of the Electronic Filing of Differences (EFOD) System for notification of differences and compliance

Sir/Madam,

1. I have the honour to inform you that the first edition of the *International Standards and Recommended Practices, Annex 10 — Aeronautical Telecommunications, Volume VI — Communication Systems and Procedures relating to Remotely Piloted Aircraft Systems C2 Link* was adopted by the Council at the fifth meeting of its 222nd Session on 1 March 2021. Copies of the Volume VI and the Resolution of Adoption are available as attachments to the electronic version of this State letter on the ICAO-NET (<http://portal.icao.int>) where you can access all other relevant documentation.

2. When adopting Volume VI, the Council prescribed 12 July 2021 as the date on which it will become effective, except for any part concerning which a majority of Contracting States have registered their disapproval before that date. In addition, the Council resolved that Volume VI, to the extent it becomes effective, will become applicable on 26 November 2026.

3. The first edition of Volume VI to Annex 10 was developed by the thirteenth meeting of the Remotely Piloted Aircraft Systems Panel (RPASP/13). The proposal concerns the “C2 Link Procedures” and the “C2 Link Systems”.

4. The subject is given in the Foreword of Annex 10, a copy of which is in Attachment A.

5. In conformity with the Resolution of Adoption, may I request:

- a) that before 12 July 2021 you inform me if there is any part of the adopted Standards and Recommended Practices (SARPs) in the first edition of Volume VI concerning

which your Government wishes to register disapproval, using the form in Attachment B for this purpose. Please note that only statements of disapproval need be registered and if you do not reply it will be assumed that you do not disapprove of the new volume;

- b) that before 26 October 2026 you inform me of the following, using the Electronic Filing of Differences (EFOD) System or the form in Attachment C for this purpose:
 - 1) any differences that will exist on 26 November 2026 between the national regulations or practices of your Government and the provisions of the whole of the first edition of Volume VI to Annex 10, and thereafter of any further differences that may arise; and
 - 2) the date or dates by which your Government will have complied with the provisions of the whole of the first edition of Volume VI to Annex 10.

6. With reference to the request in paragraph 5 a) above, it should be noted that a registration of disapproval of the first edition of Volume VI or any part of it in accordance with Article 90 of the Convention does not constitute a notification of differences under Article 38 of the Convention. To comply with the latter provision, a separate statement is necessary if any differences do exist, as requested in paragraph 5 b) 1). It is recalled in this respect that international Standards in Annexes have a conditional binding force, to the extent that the State or States concerned have not notified any difference thereto under Article 38 of the Convention.

7. With reference to the request in paragraph 5 b) above, it should be also noted that the ICAO Assembly, at its 39th Session (27 September to 6 October 2016), resolved that Member States should be encouraged to use the EFOD System when notifying differences (Resolution A39-22 refers). The EFOD System is currently available on the Universal Safety Oversight Audit Programme (USOAP) restricted website (<http://www.icao.int/usoap>) which is accessible by all Member States. You are invited to consider using this for notification of compliance and differences.

8. Guidance on the determination and reporting of differences is given in the Note on the Notification of Differences in Attachment D. Please note that a detailed repetition of previously notified differences, if they continue to apply, may be avoided by stating the current validity of such differences.

9. I would appreciate it if you would also send a copy of your notifications, referred to in paragraph 5 b) above, to the ICAO Regional Office accredited to your Government.

10. At the fifth meeting of its 204th Session, the Council requested that States, when being advised of the adoption of an Annex amendment, be provided with information on implementation and available guidance material, as well as an impact assessment. This is presented for your information in Attachments E and F, respectively.

11. As soon as practicable after the first edition of Volume VI becomes effective, on 12 July 2021, it will be forwarded to you.

Accept, Sir/Madam, the assurances of my highest consideration.

Fang Liu
Secretary General

Enclosures:

- A — Foreword of the first edition of Annex 10, Volume VI
- B — Form on notification of disapproval of all or part of the first edition of Volume VI to Annex 10
- C — Form on notification of compliance with or differences from the first edition of Volume VI to Annex 10
- D — Note on the Notification of Differences
- E — Implementation task list and outline of guidance material in relation to new Volume VI to Annex 10
- F — Impact assessment in relation to the adoption of Volume VI to Annex 10

ATTACHMENT A to State letter AN 7/67.2-21/18

FOREWORD OF THE FIRST EDITION OF ANNEX 10, VOLUME VI

Add the following elements at the end of Table A:

<i>Amendment</i>	<i>Source(s)</i>	<i>Subject</i>	<i>Adopted/Approved Effective Applicable</i>
First edition	Thirteenth meeting of the Remotely Piloted Aircraft Systems Panel (RPASP/13)	Standards and Recommended Practices concerning the “C2 Link Procedures” and the “C2 Link Systems”.	1 March 2021 12 July 2021 26 November 2026

ATTACHMENT B to State letter AN 7/67.2-21/18

**NOTIFICATION OF DISAPPROVAL OF ALL OR PART OF THE
FIRST EDITION OF VOLUME VI TO ANNEX 10**

To: The Secretary General
International Civil Aviation Organization
999 Robert-Bourassa Boulevard
Montréal, Quebec
Canada H3C 5H7

(State) _____ hereby wishes to disapprove the following parts of
the first edition of Volume VI to Annex 10:

Signature _____

Date _____

NOTES

- 1) If you wish to disapprove all or part of the first edition of Annex 10, Volume VI please dispatch this notification of disapproval to reach ICAO Headquarters by 12 July 2021. If it has not been received by that date it will be assumed that you do not disapprove of the new volume. **If you approve of all parts of the first edition of Volume VI to Annex 10, it is not necessary to return this notification of disapproval.**
- 2) This notification should not be considered a notification of compliance with or differences from the first edition of Volume VI to Annex 10. Separate notifications on this are necessary. (See Attachment C.)
- 3) Please use extra sheets as required.

ATTACHMENT C to State letter AN 7/67.2-21/18

**NOTIFICATION OF COMPLIANCE WITH OR DIFFERENCES
FROM THE FIRST EDITION OF VOLUME VI TO ANNEX 10**

To: The Secretary General
International Civil Aviation Organization
999 Robert-Bourassa Boulevard
Montréal, Quebec
Canada H3C 5H7

1. No differences will exist on _____ between the national regulations and/or practices of **(State)** _____ and the provisions of Annex 10, Volume VI.

2. The following differences will exist on _____ between the regulations and/or practices of **(State)** _____ and the provisions of Annex 10, Volume VI (Please see Note 2) below.)

a) Annex Provision (Please give exact paragraph reference)	b) Details of Difference (Please describe the difference clearly and concisely)	c) Remarks (Please indicate reasons for the difference)
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(Please use extra sheets as required)

3. By the dates indicated below, (State) _____ will have complied with the provisions of Annex 10, Volume VI for which differences have been notified in 2 above.

a) Annex Provision (Please give exact paragraph reference)	b) Date	c) Comments
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(Please use extra sheets as required)

Signature _____ Date _____

NOTES

- 1) If paragraph 1 above is applicable to your State, please complete paragraph 1 and return this form to ICAO Headquarters. If paragraph 2 is applicable to you, please complete paragraphs 2 and 3 and return the form to ICAO Headquarters.
- 2) A detailed repetition of previously notified differences, if they continue to apply, may be avoided by stating the current validity of such differences.
- 3) Guidance on the notification of differences is provided in the Note on the Notification of Differences and in the *Manual on Notification and Publication of Differences* (Doc 10055).
- 4) Please send a copy of this notification to the ICAO Regional Office accredited to your Government.

ATTACHMENT D to State letter AN 7/67.2-21/18

NOTE ON THE NOTIFICATION OF DIFFERENCES
(Prepared and issued in accordance with instructions of the Council)

1. *Introduction*

1.1 Article 38 of the *Convention on International Civil Aviation* (“Convention”) requires that a Contracting State notify ICAO any time it does not comply with a Standard in all respects, it does not bring its regulations or practices into full accord with any Standard, or it adopts regulations or practices differing in any particular respect from the Standard.

1.2 The Assembly and the Council, when reviewing the notification of differences by Contracting States in compliance with Article 38 of the Convention, have repeatedly noted that the timeliness and currency of such notifications is not entirely satisfactory. Therefore, this note is issued to reiterate the primary purpose of Article 38 of the Convention and to facilitate the determination and notification of differences.

1.3 The primary purpose of the notification of differences is to promote safety, regularity and efficiency in air navigation by ensuring that governmental and other agencies, including operators and service providers, concerned with international civil aviation are made aware of all national regulations and practices in so far as they differ from those prescribed in the Standards contained in Annexes to the Convention.

1.4 Contracting States are, therefore, requested to give particular attention to the notification of differences with respect to Standards in all Annexes, as described in paragraph 4 b) 1) of the Resolution of Adoption.

1.5 Although differences from Recommended Practices are not notifiable under Article 38 of the Convention, the Assembly has urged Contracting States to extend the above considerations to Recommended Practices contained in Annexes to the Convention, as well.

2. *Notification of differences from Standards and Recommended Practices (SARPs)*

2.1 Guidance to Contracting States in the notification of differences to Standards and Recommended Practices (SARPs) can only be given in very general terms. Contracting States are further reminded that compliance with SARPs generally extends beyond the issuance of national regulations and requires establishment of practical arrangements for implementation, such as the provision of facilities, personnel and equipment and effective enforcement mechanisms. Contracting States should take those elements into account when determining their compliance and differences. The following categories of differences are provided as a guide in determining whether a notifiable difference exists:

- a) *A Contracting State’s requirement is more exacting or exceeds a SARP (Category A)*. This category applies when the national regulation and practices are more demanding than the corresponding SARP, or impose an obligation within the scope of the Annex which is not covered by the SARP. This is of particular importance where a Contracting State requires a higher standard which affects the operation of aircraft of other Contracting States in and above its territory;

- b) *A Contracting State's requirement is different in character or the Contracting State has established other means of compliance (Category B)**. This category applies, in particular, when the national regulation and practices are different in character from the corresponding SARP, or when the national regulation and practices differ in principle, type or system from the corresponding SARP, without necessarily imposing an additional obligation; and
- c) *A Contracting State's requirement is less protective, partially implemented or not implemented (Category C)*. This category applies when the national regulation and practices are less protective than the corresponding SARP; when no national regulation has been promulgated to address the corresponding SARP, in whole or in part; or when the Contracting State has not brought its practices into full accord with the corresponding SARP.

These categories do not apply to Not Applicable SARP. Please see the paragraph below.

2.2 **Not Applicable SARP.** When a Contracting State deems a SARP concerning aircraft, operations, equipment, personnel, or air navigation facilities or services to be not applicable to the existing aviation activities of the State, notification of a difference is not required. For example, a Contracting State that is not a State of Design or Manufacture and that does not have any national regulations on the subject, would not be required to notify differences from Annex 8 provisions related to the design and construction of an aircraft.

2.3 **Differences from appendices, tables and figures.** The material comprising a SARP includes not only the SARP itself, but also the appendices, tables and figures associated with the SARP. Therefore, differences from appendices, tables and figures are notifiable under Article 38. In order to file a difference against an appendix, table or figure, States should file a difference against the SARP that makes reference to the appendix, table or figure.

2.4 **Differences from definitions.** Contracting States should notify differences from definitions. The definition of a term used in a SARP does not have independent status but is an essential part of each SARP in which the term is used. Therefore, a difference from the definition of the term may result in there being a difference from any SARP in which the term is used. To this end, Contracting States should take into consideration differences from definitions when determining compliance or differences to SARPs in which the terms are used.

2.5 The notification of differences should be not only to the latest amendment but to the whole Annex, including the amendment. In other words, Contracting States that have already notified differences are requested to provide regular updates of the differences previously notified until the difference no longer exists.

2.6 Further guidance on the identification and notification of differences, examples of well-defined differences and examples of model processes and procedures for management of the notification of differences can be found in the *Manual on Notification and Publication of Differences* (Doc 10055).

* The expression "different in character or other means of compliance" in b) would be applied to a national regulation and practice which achieve, by other means, the same objective as that of the corresponding SARPs or for other substantive reasons so cannot be classified under a) or c).

3. *Form of notification of differences*

3.1 Differences can be notified:

- a) by sending to ICAO Headquarters a form on notification of compliance or differences;
or
- b) through the Electronic Filing of Differences (EFOD) System at www.icao.int/usoap.

3.2 When notifying differences, the following information should be provided:

- a) the number of the paragraph or subparagraph which contains the SARP to which the difference relates*;
- b) the reasons why the State does not comply with the SARP, or considers it necessary to adopt different regulations or practices;
- c) a clear and concise description of the difference; and
- d) intentions for future compliance and any date by which your Government plans to confirm compliance with and remove its difference from the SARP for which the difference has been notified.

3.3 The differences notified will be made available to other Contracting States, normally in the terms used by the Contracting State when making the notification. In the interest of making the information as useful as possible, Contracting States are requested to ensure that:

- a) statements be as clear and concise as possible and be confined to essential points;
- b) the provision of extracts from national regulations not be considered as sufficient to satisfy the obligation to notify differences; and
- c) general comments, unclear acronyms and references be avoided.

* This applies only when the notification is made under 3.1 a).

**IMPLEMENTATION TASK LIST AND OUTLINE OF GUIDANCE MATERIAL
IN RELATION TO NEW VOLUME VI TO ANNEX 10**

1. IMPLEMENTATION TASK LIST

1.1 Essential steps to be followed by a State in order to implement provisions in the new Volume VI to Annex 10:

- a) identification of the rule-making process necessary to transpose the new and modified ICAO provisions into national regulations taking into consideration the applicability date;
- b) establishment of a national implementation plan that takes into consideration the new and modified provisions;
- c) drafting of the amendment(s) to the national requirements and means of compliance;
- d) filing of State differences with ICAO, and publication of significant differences in the Aeronautical Information Publication (AIP), if necessary;
- e) training of oversight personnel to fully understand the changes introduced in relation to RPAS operations;
- f) training of operational staff in the provision and use of new information;
- g) introduction by States of new or amended regulations to implement this new volume; and
- h) operational acceptance of policy and procedures of operator(s) to comply with applicable requirements.

2. STANDARDIZATION PROCESS

2.1 Effective date: 12 July 2021

2.2 Applicability date: 26 November 2026

2.3 Embedded date(s): N/A

3. SUPPORTING DOCUMENTATION

3.1 ICAO documentation:

Title/Doc no.	Type (PANS/TI/Manual/Circ.)	Planned publication date
<i>Manual on Remotely Piloted Aircraft Systems (RPAS)</i> (Doc 10019), First Edition	Manual: – Volume I: Will supersede the First Edition, with updates included	2022
	– Volume II: To be developed	2024
<i>Manual on the C2 Link for RPAS</i> , First Edition	Manual (new)	2022

3.2 External documentation:

Title	External Organization	Publication date
Nil		

4. IMPLEMENTATION ASSISTANCE TASKS

Type	Global	Regional
Increased awareness	RPAS Symposia	Workshops/webinars

5. UNIVERSAL SAFETY OVERSIGHT AUDIT PROGRAMME (USOAP)

5.1 New protocol questions (PQs) may be required. This will be assessed during future amendments of the protocol questions. However, as the SARPs are planned for applicability in November 2026, the development of related protocol questions will be addressed in due course.

**IMPACT ASSESSMENT IN RELATION TO
THE ADOPTION OF VOLUME VI TO ANNEX 10**

1. INTRODUCTION

1.1 The first edition of Volume VI to Annex 10 is intended to introduce a regulatory structure for C2 Link procedures and systems characteristics, which are addressed separately under Part I (C2 Link Procedures) and Part II (C2 Link Systems).

2. IMPACT ASSESSMENT

2.1 *Safety impact:* RPAS are new entrants that need to be integrated safely into the aviation system. C2 Link communications, which are an essential component of RPAS, require international standardization to support global safety. Volume VI to Annex 10 contains provisions addressing the roles of RPAS operators and C2 Link communication service providers (C2CSP). Details on State and C2CSP responsibilities related to the oversight of C2 Link service provision will be contained in Annex 6, Part IV.

2.2 *Financial impact:* The adoption of Volume VI to Annex 10, Volume V will generate costs associated with the development of relevant regulations and policies incorporating these new requirements. However, States would save significant resources in the development of said regulations and guidance. For the industry, research and development costs can be expected, but the industry would ultimately benefit from harmonized rules on C2 Link amongst States.

2.3 *Security impact:* The security of the information exchange between the remote pilot station (RPS) and remotely piloted aircraft (RPA) is a major element in supporting the safety of RPAS operations. This initial package of SARPs contains high-level provisions, addressing the need to prevent unauthorized interference with RPAS. The RPAS C2 Link design, monitoring system and operating procedures would minimize the potential for any unauthorized control of the RPA or the RPS during any operating phases.

2.4 *Environmental impact:* Since RPAS operations will primarily involve the operation of modern, energy-efficient aircraft, no negative environmental impacts are anticipated with the implementation of this proposal.

2.5 *Efficiency impact:* Standardization and harmonization of C2 Link requirements are expected to improve safe integration of RPAS into the airspace.

2.6 *Expected implementation time:* While implementation time for the C2 Link SARPs is expected to be minimal, it should be noted that these requirements are enablers for the RPAS-related provisions in Annex 6 — *Operation of Aircraft* and Annex 8 — *Airworthiness*. Since the related SARPs will become applicable on 26 November 2026, significant time is also allowed for implementation of the C2 Link provisions. Additionally, the second package of C2 Link SARPs which is currently being developed by RPASP will address details for interoperability, spectrum utilization and compatibility with existing CNS systems, including sharing of the proposed frequency bands. In that context, it is expected that the applicability date of 26 November 2026 will allow sufficient time for said studies to be completed.

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES
AND PROCEDURES FOR AIR NAVIGATION SERVICES**

**AERONAUTICAL
TELECOMMUNICATIONS**

**ANNEX 10
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**

**VOLUME VI
(COMMUNICATION SYSTEMS AND PROCEDURES RELATING TO REMOTELY PILOTED
AIRCRAFT SYSTEMS C2 LINK)**

The first edition of Volume VI to Annex 10 contained in this document was adopted by the Council of ICAO on **1 March 2021**. Such parts of this new volume as have not been disapproved by more than half of the total number of Contracting States on or before **12 July 2021** will become effective on that date and will become applicable on **26 November 2026** as specified in the Resolution of Adoption. (State letter AN 7/67.2-21/18 refers.)

MARCH 2021

INTERNATIONAL CIVIL AVIATION ORGANIZATION

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

**ANNEX 10 — AERONAUTICAL TELECOMMUNICATIONS,
VOLUME VI — COMMUNICATION SYSTEMS AND PROCEDURES RELATING TO
REMOTELY PILOTED AIRCRAFT SYSTEMS C2 LINK**

RESOLUTION OF ADOPTION

The Council

Acting in accordance with the Convention on International Civil Aviation, and particularly with the provisions of Articles 37, 54 and 90 thereof,

1. *Hereby adopts* on 1 March 2021 the International Standards and Recommended Practices contained in the document entitled *International Standards and Recommended Practices, Aeronautical Telecommunications — Communication Systems and Procedures relating to Remotely Piloted Aircraft Systems C2 Link* which for convenience is designated Annex 10, Volume VI, to the Convention;
2. *Prescribes* 12 July 2021 as the date upon which the said new volume shall become effective, except for any part thereof in respect of which a majority of the Contracting States have registered their disapproval with the council before that date;
3. *Resolves* that the said amendment or such parts thereof as have become effective shall become applicable on 26 November 2026;
4. *Requests the Secretary General:*
 - a) to notify each Contracting State immediately of the above action and immediately after 12 July 2021 of those parts of the new volume which have become effective;
 - b) to request each Contracting State:
 - 1) to notify the Organization (in accordance with the obligation imposed by Article 38 of the Convention) of the differences that will exist on 26 November 2026 between its national regulations or practices and the provisions of the Standards in the Annex, such notification to be made before 26 October 2026, and thereafter to notify the Organization of any further differences that arise;
 - 2) to notify the Organization before 26 October 2026 of the date or dates by which it will have complied with the provisions of the Standards in the Annex;
 - c) to invite each Contracting State to notify additionally any differences between its own practices and those established by the Recommended Practices, when the notification of such differences is important for the safety of air navigation, following the procedure specified in subparagraph b) above with respect to differences from Standards.

NEW VOLUME VI TO ANNEX 10

The text of the new volume is shown in clean format

TEXT OF FIRST EDITION OF
INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES
AERONAUTICAL TELECOMMUNICATIONS
ANNEX 10
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION
VOLUME VI
COMMUNICATION SYSTEMS AND PROCEDURES RELATING TO REMOTELY
PILOTED AIRCRAFT SYSTEMS C2 LINK

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Part I — C2 LINK PROCEDURES

CHAPTER 1. DEFINITIONS

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

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

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

C2 Link coverage area. The area in which the C2 Link service can be received including the area where the QoSD does not meet the QoSr.

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.

C2 Link log. A record of the activities related to the C2 Link.

C2 Link service. A communication service providing the C2 Link.

C2 Link service area. The area within the C2 Link coverage area where the C2 Link QoSD meets the QoSr.

C2 Link specification. The minimum performance to be achieved by the C2 Link equipment in conformity with the applicable airworthiness system design requirements.

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

Lost C2 Link decision state. The state of the RPAS in which a C2 Link interruption has occurred, but the duration of which does not exceed the lost C2 Link decision time.

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.

Nominal C2 Link state. The state of the RPAS when the C2 Link performance is sufficient to allow the remote pilot to actively manage the flight of the RPA in a safe and timely manner appropriate to the airspace and operational conditions.

Quality of service (QoS). The totality of the characteristics of an entity that bear on its ability to satisfy stated and implied needs.

Quality of service delivered (QoSD). A statement of the QoS achieved or delivered to the RPAS operator by the C2CSP.

Quality of service experienced (QoSE). A statement expressing the QoS that the remote pilot believes they have experienced.

Quality of service required (QoSR). A statement of the QoS requirements of the RPAS operator to the C2CSP.

Note.— The QoSR may be expressed in descriptive terms (criteria) listed in the order of priority, with preferred performance value for each criterion. The C2CSP then translates these into parameters and metrics pertinent to the service.

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 component as specified in the type design.

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.

Switchover. The act of transferring the active datalink 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.

CHAPTER 2. SPECIFICATIONS

2.1 GENERAL

Note 1.— The C2 Link is the logical connection, however physically realized, used for the exchange of information between the remote pilot station (RPS) and the remotely piloted aircraft (RPA). It enables the remote pilot's manipulation of the flight controls in the RPS to be sent to the RPA and for the RPA to return its status to the remote pilot. The C2 Link also enables the remote pilot to manage the safe integration of the remotely piloted aircraft system into the global aviation, communications, navigation and surveillance operational environment.

Note 2.— Guidance on the systems and procedures relating to the C2 Link is included in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019)

2.1.1 Any time reference to the C2 Link service and timestamping of the information carried by the C2 Link shall be in Coordinated Universal Time (UTC).

Note 1.— This does not apply to the timestamping internal to the network communication protocol.

Note 2.— The timestamp includes the date and time.

2.2 SUPPORTED FUNCTIONS

2.2.1 The C2 Link shall only support the remote pilot tasks required for the safe and efficient operation of the RPAS.

Note.— Annex 6 contains requirements for safe operation of the RPAS.

2.2.2 When the C2 Link includes support for the remote pilot tasks required for air traffic control (ATC) purposes, such as relay of ATC communications, the C2 Link performance shall, in a secure manner, meet the performance required for those tasks appropriate to the airspace requirements.

Note 1.— Airspace requirements vary depending upon air traffic density and complexity and may be reflected in equipage or separation requirements.

Note 2.— Alternate means of communications between the remote pilot and air traffic control may obviate the need for the C2 Link to be used for ATC communications.

2.3 SERVICE PROVISION

2.3.1 The C2 Link service shall only be used for the transmission of information relating to the safe and efficient operation of the RPAS and be limited to the information described in 2.2.1.

2.3.2 Each State shall designate the authority responsible for documenting and implementing a C2CSP oversight process, in accordance with Annex 6.

Note.— Details on State and C2CSP responsibilities related to the oversight of C2 Link service provision can be found in Annex 6.

2.3.3 The duration between C2 Link initiation and C2 Link termination shall not exceed the time of flight and ground operations, plus the time necessary to perform safety and security checking before and after each flight.

Note.— Efficient use of the limited frequency spectrum resource requires that a link be released and made available to other users when not in use.

2.3.4 The C2 Link specification shall be commensurate with the C2 Link performance required for safe operations.

2.3.5 The C2 Link's QoS_R shall be commensurate with the C2 Link specification required for safe operations.

2.3.6 The C2 Link's QoS_D shall be commensurate with the C2 Link QoS_R.

2.3.7 The C2 Link service area geographical coordinates and time of provision, intended for RPAS operational use, shall be validated and verified to ensure that C2 link service area is safe for use by its intended recipients.

Note 1.— ICAO Doc 9674 contains requirements for data quality.

Note 2.— Intended recipients can be remote pilot or ATC units concerned..

2.3.8 A pro-active process for anticipating and mitigating interrupted or lost C2 Link states shall be implemented and described by the C2CSP to the RPAS operator.

2.3.8.1 The C2CSP shall notify the RPAS operator of any scheduled outages of the C2 Link service provision.

2.3.8.2 Arrangements shall be in place to ensure that the scheduled outage does not affect any RPA during any phase of flight.

2.3.9 The C2CSP shall notify the RPAS operator of any unscheduled degradation in their service provision, the kind of degradation being experienced and an estimated duration for that degradation.

2.3.10 Before providing any C2 Link service, the C2CSP shall demonstrate initial compliance with the provisions contained in 2.3.1 and 2.3.3 through 2.3.8 to the responsible authority.

2.4 C2 LINK SERVICE AREA

2.4.1 The C2 Link service area shall be compatible with the planned (including contingency) areas of operation of the RPA and the location of all of the RPSs involved in the operation.

2.4.2 The RPA and RPS shall always remain within the C2 Link service area.

2.4.3 **Recommendation.**— *To ensure the QoS is always met, a margin to account for the expected worst-case propagation fluctuations in the received signal level should be included while determining the C2 Link service area.*

CHAPTER 3. PROCEDURES

Note.— Provisions contained in Annex 6 require an operator to provide, for the use and guidance of personnel concerned, an operations manual containing all the instructions and information necessary for operations personnel to perform their duties.

3.1 GENERAL

3.1.1 Prior to the flight, the C2CSP shall provide the RPAS operator with appropriate means to establish that the C2 Link QoSD, security, and service area meet the requirements for safe operation of the planned flight (including contingency operations).

3.1.2 **Recommendation.**— *In the case where the C2 Link service can be provided by more than one link, the RPAS should use the link with the highest QoSD.*

3.2 ESTABLISHMENT, ASSURANCE AND TERMINATION OF THE C2 LINK

3.2.1 Human factors principles shall be considered in the design of the RPS, in order for the remote pilot to manage the C2 Link during the flight and prevent its unintentional termination.

Note.— Situations may occur in which the C2 Link would need to be terminated during the flight in order to increase the safety level of the flight. However, unintentional termination must be prevented.

3.2.2 Appropriate technical and procedural means shall be provided to the remote pilot to establish and maintain the C2 Link, including the interaction with the C2CSP. These means shall be documented in the operations manual.

3.2.3 An indication shall be provided to the remote pilot when the C2 Link has been successfully established between the RPS and the RPA and when it is interrupted, lost or terminated.

3.2.4 Information about any C2 Link-related outages that are planned to occur during the expected duration of the flight shall be provided to the remote pilot during flight planning.

3.2.5 Means shall be provided to the remote pilot to verify that the C2 Link meets the QoS as part of the pre-flight check of the RPAS.

3.2.6 The procedure supporting the switchover between links or networks that comprise the entire C2 Link shall be contained in the operations manual.

3.2.7 Before performing a switchover to another link or network, the remote pilot shall be provided with sufficient information on the QoSD of the accepting link or network to confirm that it will meet the QoS.

3.2.8 **Recommendation.**— *Switchovers between the links or networks that constitute the C2 Link during flight should be minimized.*

3.2.9 The procedure and the phraseology supporting handover of the C2 Link provision between RPS shall be contained in the operations manual.

3.2.10 The procedure supporting the handover shall include a report on the status of the QoSE of the C2 Link prior to initiating the handover.

3.2.11 A handover shall only be initiated if the accepting RPS is able to confirm that its C2 Link with the RPA achieves the QoS needed to ensure that the handover will be successful.

3.2.12 The condition of a lost C2 Link state shall be initiated by the RPAS or through an action by the remote pilot when the performance of the C2 Link has been insufficient to enable active management of the RPA for longer than the lost C2 Link decision time.

3.2.13 The duration of the lost C2 Link decision time shall be in accordance with the operational management and safety requirements of the airspace.

3.2.14 Only the remote pilot shall terminate or authorize the termination of the C2 Link.

3.2.15 The C2CSP shall not intentionally terminate a C2 Link without the explicit consent of the remote pilot.

3.3 ESTABLISHMENT AND ASSURANCE OF ATC COMMUNICATIONS

3.3.1 ATC communications relayed through the RPA and the C2 Link shall be consistent with those defined for manned aircraft.

Note.— ATC communication procedures contained in Annex 10 — Aeronautical Telecommunications, Volume II — Communication Procedures including those with PANS status, and the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444).

3.3.2 **Recommendation.**— *Switchovers between links and networks that make up the C2 Link should be avoided during transfer of ATC communications.*

3.4 CONTINGENCY AND EMERGENCY PROCEDURES

3.4.1 The remote pilot shall be provided with all the available RPAS status information pertinent to expedite the recovery of the C2 Link.

3.4.2 Technical and procedural means shall be provided to indicate to the remote pilot/RPS and the RPA when the C2 Link has been successfully restored after a lost C2 Link state has occurred.

3.4.3 From the lost C2 Link decision state, the RPAS shall either return to the nominal C2 Link state or enter the lost C2 Link state once the lost C2 Link decision time has been exceeded.

3.4.4 After being in a lost C2 Link state, a remote pilot action shall be required to return the RPAS to a nominal C2 Link state, in accordance with the procedures contained in the operations manual.

3.5 SECURITY

3.5.1 Information exchange between the RPS and RPA carried on the C2 Link shall be sufficiently secure to prevent unauthorized interference with the RPAS.

3.5.2 The RPAS C2 Link design, monitoring system and operating procedures shall be such as to minimize the potential for any unauthorized control of the RPA or the RPS during any operating phases.

3.6 DISPLAY

3.6.1 RPS controls and displays shall present data in a manner minimizing the potential for errors, misinterpretation or misunderstandings.

3.6.2 The C2 Link state information shall be presented to the remote pilot.

3.6.2.1 An indication of the C2 Link QoSD, in real-time, shall be provided to the remote pilot.

3.7 MONITORING

3.7.1 An automatic monitoring system shall be implemented in the RPA and RPS, to provide an alert to the remote pilot if any of the following occur within the period of operation:

- a) RPA or RPS C2 Link and/or sub-system link and/or C2CSP emission has ceased;
- b) RPA or RPS C2 Link and/or sub-system link and/or C2CSP reception has ceased;
- c) transmission of the amount of information required for the safe control of the aircraft has fallen below a level specified by the type certificate holder;
- d) interruption of the C2 Link has occurred; or
- e) the C2 Link QoSD has degraded below the stated QoSR.

3.7.2 The monitoring system shall provide an alert to the remote pilot in the event of the failure of the monitoring system itself.

3.8 RECORDS

3.8.1 A C2 Link log, written or electronic, shall be maintained in each RPS.

3.8.2 The record shall commence as soon as the C2 Link is established and end only after the C2 Link is terminated.

3.8.3 Written log entries shall be made only by authorized and on-duty persons in the RPS.

Note.— Authorized on-duty persons can be remote pilots or any other person having knowledge of facts pertinent to the entries.

3.8.4 All entries shall be complete, clear, correct and intelligible. Unnecessary marks or notations shall not be made in the log.

3.8.5 In written logs, any correction in the log shall be made by the authorized on-duty person.

3.8.5.1 Corrections shall be initialled, dated and a rationale given for traceability.

3.8.6 The following information shall be entered in logs by the authorized on-duty person:

- a) the name of the authorized on-duty person in charge of the log;
- b) the identification of the RPS;
- c) the date;
- d) the time of opening and closing of the RPS;
- e) the time of establishment and termination of the C2CSP service;
- f) the time of establishment and termination of the C2 Link;
- g) the QoSE of the links and networks used;
- h) the reason for the switchover of links and networks that make up the C2 Link;
- i) the signature of the authorized on-duty person;
- j) all lost C2 Link and lost C2 Link decision state events, location of the RPA with time of occurrence, and probable assessed cause when practicable;
- k) any detected harmful or notable radio frequency interference, with as much detail as possible; and
- l) any information relevant to C2 Link provision considered by the remote pilot as valuable.

3.8.6.1 In the log, all time related information shall use a UTC reference and all geographical related information shall use a WGS-84 reference.

3.8.7 The C2 Link messages related to the C2 Link management shall be electronically recorded in the RPA and in any RPS which is in control of the RPA.

3.8.8 The C2 Link management message record shall be retained for at least 30 days after completion of the flight. When the record is pertinent to accident and incident investigations, it shall be retained for longer periods until it is evident that the record will no longer be required.

3.8.9 The RPA shall maintain an electronic log, automatically recording any information described in 3.8.1 to 3.8.8 that is available to it.

3.8.10 The RPA shall maintain an automatically recorded electronic log of any received or transmitted ATC/remote pilot communication either voice or data, if relayed through the RPA.

3.8.11 The RPS shall maintain an automatically recorded electronic log of any received and transmitted ATC/remote pilot communication either voice or data.

Part II — C2 LINK SYSTEMS

CHAPTER 1. DEFINITIONS

To be developed

CHAPTER 2. GENERAL

2.1 SYSTEM DESCRIPTION

2.1.1 The RPAS communication system shall comprise the following systems:

2.1.1.1 A communication system supporting communications external to the RPAS dedicated to the airspace requirements functions;

2.1.1.2 A C2 Link communication system supporting communications internal to the RPAS, which comprises at a minimum:

- a) an interface with the RPS;
- b) an interface with the RPA;
- c) a transmitter located in the RPS communicating with a receiver located in the RPA; and
- d) a transmitter located in the RPA communicating with a receiver located in the RPS.

Note 1.— The C2 Link communication system between the RPS and the RPA may comprise one or more different communication links and may be provided by one or more C2CSPs.

Note 2.— The C2 Link communication system may comprise ground and/or airborne and/or satellite links and systems.

2.1.2 The RPAS shall be equipped with a lost C2 Link state detection system designed with a level of assurance that is in accordance with the intended operation.

2.2 SPECTRUM

2.2.1 The RPAS C2 Link system shall be operated only in frequency bands which are appropriately allocated and protected by the ITU Radio Regulations.

2.2.2 C2 Link system frequency assignment planning shall be designed to provide immunity from harmful interference and not create harmful interference.

Note.— Provision for international frequency channel assignment planning can be found in the C2 Link System Guidance Manual.

2.3 SYSTEM CHARACTERISTICS

2.3.1 The C2 Link system shall enable the RPA to unambiguously and at any time ensure that it is controlled by an authorized RPS.

2.3.2 The total period of radiation of the C2 Link system transmitters shall be as short as practicable, consistent with the need for avoiding saturation of the spectrum while limiting interruption of the C2 Link.

2.3.3 The C2 Link system radio frequency transmitters shall radiate no more power than is necessary to achieve the C2 Link specification.

2.4 DATA TRANSMISSION CHARACTERISTICS

2.4.1 The C2 Link system message sequencing shall be based on priority criteria.

2.4.2 The C2 Link system messages sequence management shall use timestamping.

2.4.3 The order of priority of the transmission of information between the RPS and the RPA shall be:

- a) RPA flight control and configuration messages;
- b) high priority detect and avoid (DAA) messages;
- c) air traffic control communications including distress calls and urgency messages;
- d) flight safety telemetry messages including low priority DAA messages;
- e) other flight safety messages;
- f) routine telemetry messages;
- g) air traffic services other than ATC communications; and
- h) other messages.

Note 1.— The above order of priority is for the transmission of information over the C2 Link. The order of priority of messages transmitted by communication systems other than the C2 Link will remain as listed in Annex 10, Volume II, Chapter 4 and Volume III, Part 1, Table 3-1.

Note 2.— Distress and urgency messages are defined in Annex 10, Volume II, section 5.3.1.1.

2.5 SIGNAL ACQUISITION AND TRACKING

To be developed

2.6 PRIORITY AND PRE-EMPTIVE ACCESS

To be developed

2.7 PERFORMANCE REQUIREMENTS

2.7.1 The QoSD of the C2 Link system shall be sufficient to support the operational and performance requirements for ATC service in the planned and contingency areas of operation of the RPA.

Note.— These requirements include required communication performance (RCP), required surveillance performance (RSP) and required navigation performance (RNP) when appropriate.

2.8 SYSTEMS INTERFACES

To be developed

2.9 RECORDS

To be developed

2.10 C2 LINK COMMUNICATION SERVICE PROVIDERS (C2CSP)

2.10.1 The RPAS operator shall establish a service level agreement (SLA) with one or more C2CSPs concerning the C2 Link service provision.

Note 1.— An SLA is required even when the operator is its own C2CSP.

Note 2.— The SLA defines the relationship and responsibilities of the two parties in accordance with the following Standards.

2.10.2 The C2CSP shall ensure that the QoSD is at any time meeting the QoS R.

2.10.2.1 The C2CSP shall conduct, with RPAS operators, real-time interference monitoring, estimation and prediction of interference risks and planning solutions for potential harmful interference scenarios under the oversight of the competent authority.

2.10.3 The C2CSPs, RPAS operators and competent authorities shall act immediately when their attention is drawn to any harmful interference.

2.10.4 The C2CSP shall have the qualified resources and adequate documentation that will allow competent authorities to perform their oversight.

2.10.5 Terrestrial C2 communication service providers

2.10.5.1 Terrestrial RPAS equipment shall operate in frequency spectrum with an allocation as described in Annex 10, Volume V, Chapter 5, section 5.2.

2.10.6 Satellite C2 communication service providers

2.10.6.1 Satellite RPAS equipment shall operate in frequency spectrum with an allocation as described in Annex 10, Volume V, Chapter 5, section 5.1.

2.10.6.2 SLAs between satellite C2CSPs and RPAS operators shall ensure that, once a satellite network has completed successful coordination, which guarantees the level of protection necessary to ensure the overall RPAS C2 Link QoS, the protection level is not eroded as a result of subsequent satellite coordination agreements.

2.10.6.3 SLAs between satellite C2CSPs and RPAS operators shall ensure that satellite C2CSPs act immediately when their attention is drawn to any harmful interference.

2.10.6.4 The satellite C2CSP shall be responsible for ensuring that once a satellite network has completed successful coordination, the C2 Link specifications continue to be met as a result of subsequent agreements between satellite operators.

CHAPTER 3. FSS SYSTEMS

To be developed



CHAPTER 4. C BAND SATCOM SYSTEMS

To be developed

CHAPTER 5. C BAND TERRESTRIAL SYSTEMS

To be developed

CHAPTER 6. SELF-ORGANIZED AIRBORNE SYSTEMS

To be developed

End of new text.

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