



ICAO

International Civil Aviation Organization

Fourth Meeting of Spectrum Review Working Group (SRWG/4)

Web-conference, 9 - 10 June 2020

Agenda Item 5: Next meeting and any other business**ANNEX 10 VOLUME V AND VI ON RPAS C2 LINK**

(Presented by the Secretariat)

SUMMARY

This paper presents the proposals from the RPAS Panel to amend Annex 10, Volume V and to add a new Volume VI to Annex 10, dedicated to the SARPs on the “C2 Link Procedures” and the “C2 Link Systems”. It is reproduced from IP30 of CNS SG/23.

1. INTRODUCTION

1.1 As unmanned aircraft are evolving very fast, there will be an increasing demand for remotely piloted aircraft systems (RPAS) to operate in non-segregated airspace and at aerodromes. States, Industry and operators need Standards and Recommended Practices (SARPs) and related guidance in order to safely and efficiently integrate RPAS into the air navigation system.

1.2 The *Manual on Remotely Piloted Aircraft Systems (RPAS)* (**Doc 10019**, first edition published in 2015) was drafted by the Unmanned Aircraft Systems Study Group (UASSG), which was established in 2008 and closed after UASSG/15 in July, 2014, with extensive consultation by the Secretariat. It addresses all the main topics and provides guidance on how this new component of the aviation system is affected by and affects the existing regulatory framework. Following discussions in the UASSG, it was concluded that, in order to fully integrate unmanned aircraft into non-segregated airspace in a safe, secure and efficient mode, RPA must be recognized and must operate in the same manner as other aircraft. Consequently, it was decided that provisions related to RPAS have to be integrated in current Annexes in the same way as for manned aviation.

1.3 On 6 May 2014, the Air Navigation Commission (196-2) considered the establishment of the Remotely Piloted Aircraft Systems Panel (RPASP) (AN-WP/8857). The RPASP is to work collaboratively in proposing SARPs that will guide States in setting their own national regulations regarding RPAS. The current focus of the Panel’s work is on standards related to airworthiness, operations, operator certification, licensing of remote pilots, air traffic management, command and control links (C2 Links), detect and avoid and security.

1.4 On 23 August 2019, ICAO Secretary General Dr. Fang Liu signed a State Letter with Ref.: AN 7/67.1.1-19/52 and **Subject:** *Proposals for the amendment of Annex 10, Volume V, new first edition of Volume VI and consequential amendments to Annexes 1 and 2 arising from the thirteenth meeting of the Remotely Piloted Aircraft Systems Panel (RPASP/13)*, for a 6-month consultation.

1.5 The background of the aforementioned **proposals** in the State Letter is explained in its Attachment A. The proposals for amendment to Annex 10 (Volume V and new Volume VI) and Annexes 1 and 2 are contained in Attachments B, C, D and E of the State Letter, respectively.

Agenda Item 5

09-10/06/20

2. DISCUSSION

2.1 RPAS C2 Link communications require standardisation at an international level to support global safety. Annex 10, which already gathered the SARPs applicable to communications systems supporting safety, is appropriate to host the proposed SARPs related to the RPAS C2 Link.

2.2 The SARPs in Volumes 1 through 4 of Annex 10 are typically intended to ensure compatibility and/or interoperability between the disassociated systems used for air/ground and air/air communications, navigation and surveillance.

2.3 The RPAS C2 Link is of a different nature, it is internal to the RPAS only, there is no requirement for technical interoperability between C2 Link systems of separate RPAS. Hence the current Volumes, Volumes 2 and 3 in particular, are not considered as appropriate Volumes for the SARPs concerning the RPAS C2 Link communication system and procedures.

2.4 Due to this different nature, the C2 Link systems and procedures SARPs require a new dedicated volume, the benefits for an additional volume in Annex 10 would be:

2.4.1. A smoother evolution of the current ICAO SARPs, therefore better clarity for the airspace users and service providers in complying with the new RPAS related SARPs;

2.4.2. The anticipation of few or no adjustments to subsequent existing volumes of Annex 10, including the modification of the currently defined aeronautical telecommunication services;

2.4.3. Limiting the coordination needs with other ICAO panels or working groups who are responsible for the maintenance of those Annexes/Volumes/SARPs in the context of the very limited schedule for RPAS SARPs development by the RPASP.

2.5 The proposed Volume 6, “Communication Systems and Procedures relating to Remotely Piloted Aircraft Systems C2 Link”, is constituted in two parts: Part I, dealing with procedural SARPs, organized similarly to Annex 10 Volume 2; and part II organized similarly to Annex 10 Volume 3. This approach provides consistency with the overall structure of Annex 10. The following structure is therefore proposed:

2.5.1 Annex 10 Volume VI Part I (Procedures)

2.5.2 Annex 10 Volume VI Part II (Systems)

2.6 The C2 Link SARPs are being developed as a two-step approach. The State Letter, provided as **Appendix A** to this paper, introduces generic and technology-neutral C2 Link SARPs, the first of the two planned C2 Link deliverables. It provides stakeholders, including regulators, manufacturers and operators, with a framework enabling them to plan for the introduction of the C2 Link.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

- a) note the information contained in the **Appendix A** to this paper; and
- b) discuss any relevant matter as appropriate.



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Ref.: AN 7/67.1.1-19/52

23 August 2019

Subject: Proposals for the amendment of Annex 10, Volume V, first edition of Volume VI and consequential amendments to Annexes 1 and 2 arising from the thirteenth meeting of the Remotely Piloted Aircraft Systems Panel (RPASP/13)

Action required: Comments to reach Montréal by 21 February 2020

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission, at the eleventh meeting of its 211th Session held on 12 June 2019, considered proposals developed by the thirteenth meeting of the Remotely Piloted Aircraft Systems Panel (RPASP/13) for the amendment of Standards and Recommended Practices (SARPs) in Annex 10 — *Aeronautical Telecommunications*, Volume V — *Aeronautical Radio Frequency Spectrum Utilization*, first edition of Annex 10 — *Aeronautical Telecommunications*, the first edition of Annex 10, Volume VI — *Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link* and consequential amendments to Annex 1 — *Personnel Licensing* and Annex 2 — *Rules of the Air*. The Commission authorized their transmission to Member States and appropriate international organizations for comments.

2. The background of the aforementioned proposals is explained in Attachment A. The proposals for amendment to Annex 10 (Volume V and new Volume VI) and Annexes 1 and 2 are contained in Attachments B, C, D and E, respectively. A rationale box providing more information has been included immediately following each proposal.

3. May I request that any comments you wish to make on the amendment proposals be dispatched to reach me not later than 21 February 2020. To facilitate the processing of replies with substantive comments, I invite you to submit an electronic version in Word format to icaohq@icao.int. The Air Navigation Commission has asked me to specifically indicate that comments received after the due date may not be considered by the Commission and the Council. In this connection, should you anticipate a delay in the receipt of your reply, please let me know in advance of the due date.

4. For your information, the proposed amendment to Annex 10, Volume V, the new Volume VI and the consequential amendments to Annexes 1 and 2 are envisaged for applicability on 28 November 2024, subject to related Annex amendment proposals also being ready. Any comments you may have thereon would be appreciated.

5. The subsequent work of the Air Navigation Commission and the Council would be greatly facilitated by specific statements on the acceptability or otherwise of the proposals. Please note that for the review of your comments by the Air Navigation Commission and the Council, replies are normally classified as “agreement with or without comments”, “disagreement with or without comments” or “no indication of position”. If in your reply the expressions “no objections” or “no comments” are used, they will be taken to mean “agreement without comment” and “no indication of position”, respectively. In order to facilitate proper classification of your response, a form has been included in Attachment F which may be completed and returned together with your comments, if any, on the proposals in Attachments B, C, D and E.

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

Fang Liu
Secretary General

Enclosures:

- A — Background information
- B — Proposed amendment to Annex 10, Volume V
- C — Proposed first edition of Annex 10, Volume VI
- D — Proposed amendment to Annex 1
- E — Proposed amendment to Annex 2
- F — Response form

BACKGROUND INFORMATION

1. DEVELOPMENT OF RPAS SARPS FOR ANNEX 10

1.1 The Remotely Piloted Aircraft Systems Panel (RPASP) works on developing Standards and Recommended Practices (SARPs) that will guide States in setting their national regulations regarding remotely piloted aircraft systems (RPAS). It also works to provide the necessary regulatory provisions to support international instrument flight rules (IFR) operations in controlled airspace and at controlled aerodromes.

1.2 The C2 Link is one of the essential technical components of RPAS. RPAS C2 Link communications require international standardization to support global safety. Annex 10 — *Aeronautical Telecommunications* contains the SARPs applicable to communication systems supporting safety and is therefore the appropriate Annex for the proposed SARPs related to the RPAS C2 Link.

1.3 An RPAS contains two different logical communication systems: one is the same as is found in current manned aircraft and is designed to support all of the communications required for airspace integration; the other, the C2 Link, is dedicated to the exchange of information between the two main physical components of the RPAS: the remote pilot station (RPS) and the remotely piloted aircraft (RPA). The C2 Link is therefore the logical connection, however physically realized, for the exchange of information between the RPS and the RPA to enable the remote pilot to safely integrate the RPAS into the global aviation operational environment, in particular communications, navigation and surveillance. The C2 Link is identified as a service like other aeronautical telecommunications.

1.4 The proposals contained in the attachments introduce generic and technology-neutral C2 Link SARPs, which are the first of two planned C2 Link deliverables. The RPASP is currently working on the second and more detailed package containing technology-specific SARPs with a projected delivery date of 2022.

1.5 This first package is necessary to provide stakeholders, including regulators, manufacturers and operators, with a framework enabling them to plan for the introduction of the C2 Link. Some additional sections and chapters identified in the proposed new Volume VI and are marked “to be developed”. The SARPs for these sections and chapters will be included in the second package of amendments and will focus on technology-specific solutions for the C2 Link. Several technologies have already been identified and placeholders have been inserted for them.

2. PROPOSAL TO AMEND EXISTING SARPS IN ANNEX 10, VOLUME V

2.1 Attachment B contains proposals for Annex 10, Volume V — *Aeronautical Radio Frequency Spectrum Utilization* to include specifics of the management of the spectrum solely used for the C2 Link. The C2 Link spectrum management considerations have been coordinated with the Frequency Spectrum Management Panel (FSMP).

3. **PROPOSAL FOR THE FIRST EDITION OF ANNEX 10,
VOLUME VI**

3.1 The C2 Link systems and procedures SARPs require a dedicated new volume, proposed as Volume VI “*Communication Systems and Procedures relating to Remotely Piloted Aircraft Systems C2 Link*”. Attachment C contains proposals for a new volume to Annex 10 structured with the procedures and systems characteristics grouped separately, namely: Part I (C2 Link Procedures) and Part II (C2 Link Systems).

4. **CONSEQUENTIAL AMENDMENTS TO ANNEXES 1
AND 2**

4.1 Attachments D and E contain proposals to update Annexes 1 and 2, respectively, as definitions of “Command and control (C2) link” and “C2 link” both need to be aligned for consistency as a consequence of the amendment to Annex 10 introducing SARPs for RPAS.

ATTACHMENT B to State letter AN 7/67.1.1-19/52

PROPOSED AMENDMENT TO ANNEX 10, VOLUME V

NOTES ON THE EDITORIAL PRESENTATION OF THE AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

~~Text to be deleted is shown with a line through it.~~

text to be deleted

New text to be inserted is highlighted with grey shading.

new text to be inserted

~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.

new text to replace existing text

**PROPOSED AMENDMENT TO
INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

AERONAUTICAL TELECOMMUNICATIONS

ANNEX 10

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

**VOLUME V
AERONAUTICAL RADIO FREQUENCY SPECTRUM UTILIZATION**

INITIAL PROPOSAL 1

CHAPTER 4. UTILIZATION OF FREQUENCIES ABOVE 30 MHz

...

4.1.1 General allotment of frequency band 117.975 – 137.000 MHz

Note.[†]— *The plan includes...*

Note 2.— As of 28 November 2024, the frequency 136.925 MHz may be used for the provision of RPAS C2 Link communication services described in Annex 10, Volume V, Chapter 5.

...

4.2 Utilization in the frequency band 108 – 117.975 MHz

4.2.1 The block allotment of the frequency band 108 – 117.975 MHz shall be as follows:

...

— Band 111.975 – 117.975 MHz:

...

Note 3.— As of 28 November 2024, the frequency 113.250 MHz may be used for the provision of RPAS C2 Link communication services described in Annex 10, Volume V, Chapter 5.

...

[†] As of 28 November 2024, this Note becomes Note 1.

4.3 Utilization in the frequency band 960 – 1 215 MHz for DME

*Note.**— *Guidance on the frequency...*

Note 2.— As of 28 November 2024, this band is shared with RPAS C2 Link communication services described in Annex 10, Volume V, Chapter 5.

...

4.4 Utilization in the frequency band 5 030.4 – 5 150.0 MHz

...

Note 3.— As of 28 November 2024, this band is shared with RPAS C2 Link communication services described in Annex 10, Volume V, Chapter 5.

...

Origin:	Rationale:
RPASP	Notes have been added to refer to Annex 10, Volume V, Chapter 5 which will contain all the RPAS C2 Link SARPs.

INITIAL PROPOSAL 2

Editorial Note.— Insert the following new Chapter 5 in Annex 10, Volume V.

CHAPTER 5. UTILIZATION OF FREQUENCIES FOR RPAS C2 LINK COMMUNICATION SERVICES

Applicable as of 28 November 2024

5.1 Satellite-based C2 Link systems

5.1.1 Satellite-based RPAS C2 Link systems shall operate in the following frequency bands:

- a) *frequency bands with an appropriate allocation to aeronautical safety services under the aeronautical mobile satellite (route) service (AMS(R)S). Frequency bands that meet these criteria and can be used for RPAS C2 Links are: 1 610 – 1 626.5 MHz and 5 030 – 5 091 MHz;*

Note.— The SARPs contained in Annex 10, Volume III, Part I, Chapter 4 and Part II, Chapter 2 address requirements for ATC communications.

- b) *frequency bands with an allocation to aeronautical safety services under the mobile-satellite service (MSS) where AMS(R)S operations have priority access. Frequency bands that meet these criteria and can be used for RPAS C2 Links are: 1 545 – 1 555 MHz and 1 646.5 – 1 656.5MHz;*

* As of 28 November 2024, this Note becomes Note 1.

Note.— The SARPs contained in Annex 10, Volume III, Part I, Chapter 4 and Part II, Chapter 2 address requirements for ATC communications.

- c) *frequency bands with an allocation to the fixed satellite service (FSS) where the conditions in ITU Resolution 155 (WRC-15) are met.* Frequency bands in which this resolution applies are:
- 10.95 – 11.2 GHz (space-to-Earth);
 - 11.45 – 11.7 GHz (space-to-Earth);
 - 11.7 – 12.2 GHz (space-to-Earth) in Region 2;
 - 12.2 – 12.5 GHz (space-to-Earth) in Region 3;
 - 12.5 – 12.75 GHz (space-to-Earth) in Regions 1 and 3;
 - 19.7 – 20.2 GHz (space-to-Earth);
 - 14.0 – 14.47 GHz (Earth-to-space); and
 - 29.5 – 30.0 GHz (Earth-to-space) with an ITU satellite earth station class of “UG”.

Note 1.— UG is an earth station on board an unmanned aircraft communicating with a space station of a geostationary-satellite network in the fixed-satellite service for the control and non-payload communications of unmanned aircraft systems in non-segregated airspaces in the frequency bands listed under resolves 1 of ITU Resolution 155 (WRC-15).

Note 2.— Particular note needs to be taken of the timing and order of functions as delineated in ITU Resolution 155 (WRC-15), and in particular the references to necessary actions.

5.1.2 RPA and RPS earth stations shall operate within the notified and recorded technical parameters of the associated satellite network, including specific or typical earth stations as published by the ITU.

5.1.3 RPA and RPS earth stations operating in accordance with 5.1.1.3 shall use FSS assignments that have been successfully coordinated under Article 9 of the ITU Radio Regulations and recorded in the Master International Frequency Register (MIFR) with a favourable finding under Article 11 of the ITU Radio Regulations including Nos. 11.31, 11.32 or 11.32A where applicable, and except those assignments that have not successfully completed coordination procedures under No. 11.32 by applying Appendix 5 paragraph 6.d.i of the ITU Radio Regulations.

5.2 Terrestrial C2 Link communication systems

5.2.1 Terrestrial RPAS C2 Link systems shall operate in bands allocated to the Aeronautical Mobile (Route) Service (AM(R)S). Suitable frequencies or frequency bands with such allocations include 113.250 MHz and 136.925 MHz (common signalling frequencies for VDL Mode 4), 960-1164 MHz and 5030-5091 MHz. The operation of the C2 Link within any of these bands shall be determined on the basis of regional air navigation agreements.

End of new text.

Origin: RPASP	Rationale: The new Chapter 5 introduces the spectrum allocation for the RPAS C2 link. Where necessary, this is linked to ITU requirements. Also, where necessary, this is linked to regional air navigation agreement to protect existing CNS use of frequency bands.
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ATTACHMENT C to State letter AN 7/67.1.1-19/52

PROPOSED 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
Applicable as of 28 November 2024

NOTES ON THE PRESENTATION OF THE AMENDMENT

The text of the new Volume VI to Annex 10 is shown in clean format.

The source of the proposed new volume arises from proposals developed by the Remotely Piloted Aircraft Systems Panel (RPASP).

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**PROPOSED 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**
Applicable as of 28 November 2024

INITIAL PROPOSAL 1

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.

Origin: RPASP	Rationale: The RPASP noted the many terms in use across industry and States (e.g. command and control; command, control and communications; command and non-payload communications) and recommended using “C2 Link” as a stand-alone term with a definition which focuses on the management of the flight.
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C2 Link communication service provider (C2CSP). An entity which provides a portion of, or all of, the C2 Link service.

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 interruptions. 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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The definition for C2 Link already exists in Annexes 1 and 2. The definitions above for C2 Link log and C2 Link service area are similar to definitions of aeronautical telecommunication log and aeronautical telecommunication service, respectively, in Annex 10, Volume II. Other terms are new and the RPASP believes the definitions are needed to ensure consistent understanding by States and industry.</p>
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C2 Link specification. The minimum performance that the C2 Link equipment shall achieve pursuant to 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. A state 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 RPAS state 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 RPAS state when the C2 Link performance is sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner appropriate to the airspace and operational conditions.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The above definitions are required when defining the behaviour of the C2 Link, including its three different standardized states (nominal C2 Link state, lost C2 Link decision state and lost C2 Link state). They support implementation of the logic between those states to improve predictability of the behaviour of the RPAS in the case of a C2 Link contingency event.</p>
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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.

Origin:	Rationale:
RPASP	These definitions of quality of service (QoS) are in daily use by the telecommunication industry. It is proposed to use these standard definitions of QoS in the context of the C2 Link 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 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 transfer of 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.

INITIAL PROPOSAL 2

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.

Origin:	Rationale:
RPASP	<p>The note under 2.1 complements the C2 Link definition and provides the technical details required to introduce the Volume VI SARPs. The C2 Link may consist of a number of individual links used one at a time or simultaneously.</p> <p>UTC, which is already used in aviation, is proposed for all timestamping.</p>

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.

Origin: RPASP	Rationale: These Standards define the scope of the support offered by the C2 Link in an RPAS. Provision 2.2.1 explicitly excludes support of non-essential (Payload) communications, while 2.2.2 and the note emphasize that the C2 Link performance must be consistent with the performance requirements of data transported by the C2 Link and the airspace in which the RPA is operating.
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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.

Origin: RPASP	Rationale: The C2 Link service provision is critical for the safety of the RPAS and other airspace users. The C2CSP is a radiocommunication and/or telecommunication provider which is contracted by the RPAS operator through a service level agreement for the sole purpose of providing C2 Link. Hence, oversight of the C2CSP will be required. The oversight serves to increase the global level of safety and provide information to continuously improve the service. Annex 6 is identified as the appropriate placeholder for detailing this oversight, while Annexes 11 and 19 also play a role. However, as the issue is about the provision of a communication link, there is requirement for minimal high-level provisions in Annex 10 as well. Provision 2.3.2 is written in a manner consistent with Annex 10, Volume II, paragraph 2.4.1. This provision also links to ITU Resolution 155 (see ITU Radio Regulations, Volume III) which, in the case of use of frequency allocations in the fixed satellite service, delegates the responsibility of ensuring that the system performance is consistent with the provision of a safety service (ITU RR 4.10) to the ICAO regulatory framework.
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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.

Origin: RPASP	Rationale: The above three SARPs support the linkage between the C2 Link specifications in the type design and the service provision of the C2 Link. C2 Link specification is broader than 2.2.2 which only requires the C2 Link performance to meet requirements for ATC services in a given airspace. “C2 Link specifications required for safe operations” describes the actual requirement, while QoS _R is the requirement as determined by the RPAS operator and the QoS _D is the QoS that the C2CSP claims is being provided.
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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.

Origin: RPASP	Rationale: Provision 2.3.7: C2 Link is a dynamic service and operators have to ensure the quality of the link (similar to GPS).
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	<p>Provision 2.3.8 is a proactive requirement; if the C2CSP is aware of a potential decrease of the C2 Link QoSD, it must notify the RPAS operator of such an event so that the remote pilot can take measures to maintain the safety level.</p> <p>Provision 2.3.9 is a reactive requirement; if the C2CSP is aware of an unscheduled decrease of the C2 Link QoSD, it must notify the RPAS operator of such an event so that the remote pilot can mitigate the situation with measures that maintain the safety level.</p> <p>In the pre-planning approach (2.3.10), safety monitoring alone cannot provide assurance that the C2 Link service will meet the QoS_R.</p>
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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_R 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.*

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>Provision 2.4.1 refers to the planning phase and is required to ensure that the C2 Link service provision will not be interrupted or lost because of inconsistencies between the C2 Link service area and the flight planning.</p> <p>Provision 2.4.2 refers to the operational phase; the RPA and the RPS must remain inside the C2 Link service area to ensure that adequate C2 Link performance for the intended operations is maintained.</p> <p>An additional margin to the link power budget is required in case of an RPS contingency or any degradation in the QoSD. This margin is set by the RPAS operator in collaboration with the C2CSP.</p>
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INITIAL PROPOSAL 3

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 QoS, 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 QoS.*

Origin: RPASP	Rationale: During the planning stage, prior to the operation, the operator must have the C2 Link bandwidth, radiating power and the performance for safe operation of the RPA. C2 Link contingency situations must be taken into account. The number of links and frequencies that are required is not specified because it depends on the RPAS configuration and the local situation (frequency spectrum availability, potential harmful interference environment, etc.). In 3.1.1, “appropriate means” conveys both technical and procedural aspects.
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INITIAL PROPOSAL 4

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 QoS 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 QoS 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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The remote pilot must be aware at all time of the status of the C2 Link from the establishment to the termination of the C2 Link. The operations manual is his/her main support for procedures regarding C2 link. Transfer of communication between links that are part of the overall C2 Link service provision is a very critical moment for the operation of the RPA. Active switchover or handover to another RPS must not lead to a lost C2 Link state.</p> <p>The operations manual must describe all of the procedures related to the C2 Link provision, including handovers.</p>
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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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>A lost C2 Link state cannot be declared each time there is an interruption of the C2 Link provision. Acceptable interruptions must be quantified so that the remote</p>
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	<p>pilot (or the RPAS) has an objective assessment of the QoSE of the C2 Link provision. An RPAS lost C2 Link state is an important operational event. The lost C2 Link decision time must be defined with a maximum which is given by the design of the system and the operational context of the flight.</p>
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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.

<p>Origin: RPASP</p>	<p>Rationale:</p> <p>The remote pilot is ultimately responsible for the safety of the flight. The provision of the C2 Link may, however, involve other actors. The C2 Link is critical for safe operation. Since the C2 Link is a part of the RPAS that cannot be removed from the system without interfering with the duties of the remote pilot, only the remote pilot is allowed to terminate the C2 Link.</p> <p>If the QoSE of the C2 Link is down to a level that some other means or functions embedded in the RPAS system provide an improved safety level, then the remote pilot may terminate the C2 Link.</p>
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INITIAL PROPOSAL 5

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.*

<p>Origin: RPASP</p>	<p>Rationale:</p> <p>The same ATC procedure must be used regardless of whether the air traffic controller is interacting with a manned aircraft pilot or a remote pilot.</p> <p>When the C2 Link is supporting ATS functions such as ATC voice communications and controller-pilot data link communications (CPDLC), the procedure for a switchover between links that make up the C2 Link or handover to another RPS during an ATC sector handover may cause delays and technical issues.</p>
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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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The above provisions describe the logical acceptable options after the lost C2 Link state. This is necessary to define a standardized behaviour of the RPAS in a controlled environment.</p>
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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 design 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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>Unauthorized control of the RPA must be prevented at any time there is a new connection or potential for a new connection to the RPAS. The establishment, the switchover between links and networks that constitute the C2 Link, or the termination of the C2 Link provision are examples of such events. A list of potential situations will be included in RPAS-related guidance material. This will be defined in the future C2 Link manual.</p>
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INITIAL PROPOSAL 6

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 A real-time indication of the C2 Link QoS shall be provided to the remote pilot.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The provisions provided under section 3.6 would normally be addressed in Annex 8. However, since the C2 Link is independent from the aircraft (RPA/RPS) and only addressed in Annex 8 as a specification, there is need for some minimal provisions in Annex 10.</p> <p>It is important that the remote pilot is aware of the performance of the C2 Link at all times so that he/she can safely manage the RPA flight. The QoS can be measured by monitoring parameters of the C2 Link. The parameters could include for both directions, but are not limited to: C2 Link specification parameters such as latency, availability, continuity and integrity.</p>
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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 QoS 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.

<p>Origin:</p> <p>RPASP</p>	<p>Rationale:</p> <p>The C2 Link communication monitoring system is a necessary support to the remote pilot to assess the QoS of the C2 Link provision. He/she must be aware if the C2 Link monitoring system is failing. In such a case, the remote pilot will have to pay more attention to directly monitoring the C2 Link QoS.</p>
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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.

Origin:	Rationale:
RPASP	<p>As required in Annex 10 for other aeronautical communications, a log of entries must be created for the C2 Link related to its use, failures and other events. The C2 Link log would also be useful in the case of an investigation.</p> <p>The record of messages, as required in Annex 6, by the RPS will help an investigation team with all the C2 Link information exchanged between the remote pilot and ATC, whether or not relayed through the RPA, during the flight as received by and originated from the RPS. These SARPs remain relevant in the case of ground communications between ATC and the remote pilot.</p>

INITIAL PROPOSAL 7

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.

Origin:	Rationale:
RPASP	<p>The requirements expressed here are technical requirements, while Part I expresses similar global procedure-related requirements.</p> <p>A lost C2 Link state is a significant technical event with many other operational consequences. A lost C2 Link state detection system improves the awareness of the remote pilot about this situation. A high level of confidence of the alerts from the detection system is necessary to avoid a high rate of false alarms or missed occurrences.</p>

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.

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

Origin:	Rationale:
RPASP	The frequencies used for C2 Link of the RPAS must be protected from harmful interference. Efficient use includes avoiding mutual interferences between the users.

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.

Origin:	Rationale:
RPASP	Security provisions and provisions related to the efficient use of the spectrum resource.

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.

Origin:	Rationale:
RPASP	<p>The C2 Link system is carrying messages with a variable criticality regarding the safety of the flight; some prioritization system/protocol has to be implemented. The priority may apply to both the queue of messages that have to be sent as well as messages that have been received and need to be delivered to the recipient.</p> <p>C2 Link system timestamping supports queuing, robustness to transport layer delays and provides reliable information in the sequence of communications between the RPS and the RPA. It also supports accidents and incidents investigations.</p>

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.

Origin: RPASP	Rationale: It describes the order of priority of the RPS – RPA messages, from the most critical to the least critical. This list is adapted from Annex 10 to include RPAS specifics. Urgency messages have been listed with a higher priority than flight safety telemetry messages because telemetry is deemed less urgent than a potential direct safety issue to a person.
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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.

Origin: RPASP	Rationale: The RPAS system has to meet the airspace performance requirements in any given airspace.
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2.8 SYSTEMS INTERFACES

To be developed

2.9 RECORDS

To be developed

INITIAL PROPOSAL 8

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 SR.

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.

Origin: RPASP	Rationale: A formal relationship, the SLA, is required to ensure traceable oversight. C2CSP provisions will be provided in Annex 6. However, there is also a need to maintain the intent of the provisions in Annex 10 as high-level performance-based technical requirements. These Standards define C2CSP. Paragraph 2.10.2 supports that the required C2 Link performance derived from the airspace target level of safety is applied by the RPAS designer to the specific design of the certified RPAS (C2 Link specification) and used by the RPAS operator to contract or to design the C2 Link provision (QoSR). The QoSD must be monitored to ensure that it meets the QoSR at all times, thus ensuring that the airspace target level of safety is met.
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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 QoSD, 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.

Origin: RPASP	Rationale: These Standards guarantee the level of protection necessary to ensure the overall C2 Link specifications to meet the safety case.
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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.

ATTACHMENT D to State letter AN 7/67.1.1-19/52

**PROPOSED AMENDMENT TO
INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES
PERSONNEL LICENSING
ANNEX 1**

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

NOTES ON THE PRESENTATION OF THE AMENDMENT

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text to be deleted

New text to be inserted is highlighted with grey shading.

new text to be inserted

~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.

new text to replace existing text

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

PERSONNEL LICENSING

ANNEX 1

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

INITIAL PROPOSAL 1

ABBREVIATIONS

(used in this Annex)

...

C2 [†]	Command and control
C2 Link ^{††}	Command and control link

...

**CHAPTER 1. DEFINITIONS AND GENERAL RULES
CONCERNING LICENCES**

1.1 Definitions

...

~~**Command and control (C2) Link.**~~^{††} The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

...

Command and control (C2) link.[†] The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

Origin:	Rationale:
RPASP	The RPASP noted the many terms in use across industry and States (e.g. command and control; command, control and communications; command and non-payload communications) and recommended using “C2 Link” as a stand-alone term with a definition which focuses on the management of the flight.

Flight time — remotely piloted aircraft systems.[‡] The total time from the moment a command and control (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 a handover or the C2 link between the RPS and the RPA is terminated at the end of the flight.

[†] Applicable until 27 November 2024.
^{††} Applicable as of 28 November 2024.

Flight time — remotely piloted aircraft systems. The total time from the moment a command and control (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 a handover or the C2 Link between the RPS and the RPA is terminated at the end of the flight.

Origin: Secretariat	Rationale: These changes are consequential to the proposed provisions for Annex 10 related to C2 Link.
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ATTACHMENT E to State letter AN 7/67.1.1-19/52

**PROPOSED AMENDMENT TO
INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

RULES OF THE AIR

ANNEX 2

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

NOTES ON THE PRESENTATION OF THE AMENDMENT

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text to be deleted

New text to be inserted is highlighted with grey shading.

new text to be inserted

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replacement text which is highlighted with grey shading.

new text to replace existing text

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

RULES OF THE AIR

ANNEX 2

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

INITIAL PROPOSAL 1

CHAPTER 1. DEFINITIONS

...

~~*Command and control (C2) link.*~~^{††} The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

...

Command and control (C2) link.[†] The data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

...

Origin: RPASP	Rationale: The RPASP noted the many terms in use across industry and States (e.g. command and control; command, control and communications; command and non-payload communications) and recommended using “C2 Link” as a stand-alone term with a definition which focuses on the management of the flight.
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[†] Applicable until 27 November 2024.

^{††} Applicable as of 28 November 2024.

ATTACHMENT F to State letter AN 7/67.1.1-19/52

RESPONSE FORM TO BE COMPLETED AND RETURNED TO ICAO TOGETHER WITH ANY COMMENTS YOU MAY HAVE ON THE PROPOSED AMENDMENTS

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

(State) _____

Please make a checkmark (✓) against one option for each amendment. If you choose options “agreement with comments” or “disagreement with comments”, **please provide your comments on separate sheets.**

	<i>Agreement without comments</i>	<i>Agreement with comments*</i>	<i>Disagreement without comments</i>	<i>Disagreement with comments</i>	<i>No position</i>
Amendment to Annex 10 — <i>Aeronautical Telecommunications</i> , Volume V — <i>Aeronautical Radio Frequency Spectrum Utilization</i> (Attachment B refers)					
New edition of Annex 10, Volume VI — <i>Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link</i> (Attachment C refers)					
Consequential amendment to Annex 1 — <i>Personnel Licensing</i> (Attachment D refers)					
Consequential amendment to Annex 2 — <i>Rules of the Air</i> (Attachment E refers)					

*“Agreement with comments” indicates that your State or organization agrees with the intent and overall thrust of the amendment proposal; the comments themselves may include, as necessary, your reservations concerning certain parts of the proposal and/or offer an alternative proposal in this regard.

Signature: _____ Date: _____