CIVIL AVIATION PUBLICATION

CAP 25

RPAS OPERATOR CERTIFICATION GREATER THAN 150 KG

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CAP 25

RPAS OPERATOR CERTIFICATION (>150 KG)

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CHAPTER 1

AUTHORISATION PROCESS FOR RPA > 150 KG

1.1 OVERVIEW

This CAP provides guidance for operators of RPA > 150 kg. CAP 24 is applicable for RPA with a MTOM of 150 kg or less. The operation of an RPA of a MTOM of greater than 150 kg is categorised as "Certified" category and is only available for RPA with a Type Certificate or acceptable airworthiness design standard (e.g. STANAG 4671) and eligible for a Certificate of Registration.

Note: A Permit to Fly may be temporarily granted for a RPA designed to USAR version 3, STANAG 4671, or later updates, as the reference airworthiness code without a Type Certificate whilst the Type Certification process is being conducted by the State of Design.

1.2 GENERAL OPERATING REQUIREMENTS

1.2.1 General

[RPA must obtain an authorisation from the Authority to operate and the application must be submitted at least 90 days prior to the proposed operations. The application Form SM 116 with completion guidance is available on the CAA website *http://www.caa-mna.sm/*.]

The following operating /limitations requirements apply to RPA > 150 kg;

(a) Worldwide provided approval of the State in which it is being flown (including ferry);

(b) Segregated airspace only;

(c) [VLOS, BVLOS, RLOS or BRLOS;]

(d) Safety Management System (SMS);

(e) Pilot licences required for internal/external pilots in accordance with CAR LIC Subpart P (Also refer to CAP 16);

(f) Demonstrated competence of other involved personnel;

(g) Maintenance programme accepted by the Authority;

(h) Maintenance control manual accepted by the Authority;

(i) Operations Manual approved by the Authority.

1.3 OTHER CONSIDERATIONS

(a) Compliance with CAR OPS 4 is mandatory.

(b) The RPA shall hold a Certificate of Registration from San Marino.

(c) The RPAS (aircraft and control system) shall hold a Certificate of Airworthiness

(d) The operator shall hold an insurance policy covering 3rd party damage and injury to persons in accordance with EC 785/2004.

(e) The operational approval from the Authority is contained in an RPAS Operating Certificate with accompanying Operations Specifications.

(f) Approval from other authorities may be required for operations in San Marino.

(g) Approval is required from the State where the RPA will be flown/overflown.

1.4 ABBREVIATIONS

The following abbreviations are used in this CAP;

ACAS	airborne collision avoidance system
ADS-B	automatic dependent surveillance — broadcast
AFIS	aerodrome flight information service
AGL	above ground level
ATC	air traffic control
ATCO	air traffic control officer
ATM	air traffic management
ATS	air traffic services
BRLOS	beyond radio line-of-sight
BVLOS	beyond visual line-of-sight
C2	command and control
CA	collision avoidance
CDL	configuration deviation list
C of A	certificate of airworthiness
CNS	communication, navigation and surveillance
CPDLC	controller-pilot data link communications
DAA	detect and avoid
FCC	flight control computer
FMS	flight management system
HMI	human-machine interface
ICA	instructions for continuing airworthiness
IFR	instrument flight rules
IMC	instrument meteorological conditions
MCM	maintenance control manual
MMEL	master minimum equipment list
MTOM	maximum take-off mass
PBN	performance-based navigation
PIC	pilot-in-command
RCP	required communication performance
RF	radio frequency
RLOS	radio line-of-sight

ROC	RPAS operator certificate
RPA	remotely piloted aircraft
RPAS	remotely piloted aircraft system(s)
RPASP	Remotely Piloted Aircraft Systems Panel
RPS	remote pilot station(s)
RVSM	reduced vertical separation minimum
SATCOM	satellite communication
SMS	safety management system
TC	type certificate
TCDS	type certificate data sheet
Tsloss	time (sustained loss of link)
VFR	visual flight rules
VHF	very high frequency
VLOS	visual line-of-sight
VMC	visual meteorological conditions

1.5 APPLICATION PROCESS OVERVIEW

1.5.1 General

This Chapter on RPAS Operator Certification (ROC) provides guidance to a prospective applicant for an ROC in order to prepare for the ROC application process or for the amendment to an existing ROC when varying the ROC/Operations Specifications (e.g. introduction of new aircraft).

1.5.2 Charges

The charges payable by organisations/individuals to the Civil Aviation Authority (CAA) for the issue/renewal of approvals, licences and authorisations is available from the CAA on request. These charges cover the normal ROC process. However there could be additional charges for accident/incident investigation or if the applicant fails to meet his/her obligations and additional periodic inspections are required for operations and continued airworthiness.

1.5.3 Operations Not in the National Interest

Applicants are advised that some operations that are proposed, or conducted, under an ROC issued by San Marino may not be in the national interest of the government of San Marino and may therefore result in the application process being varied or suspended. The type of operation may include, but is not limited to;

(a) Sanctions imposed by one State against another;

(b) No-fly zones created by the United Nations or individual States;

(c) Quasi-legal activities, which could breach the laws of any State;

(d) Operations of a sensitive nature, which involve religious, political, security or other issues that have the potential to embarrass any State.

An applicant, or an operator, is encouraged to firstly research the implications of the proposed operation.

1.6 ROC PROCESS OVERVIEW

1.6.1 Purpose

This section describes the process of applying for and obtaining an RPAS Operator Certificate (ROC) to conduct aerial work operations under CAR OPS 4. The process for a variation to an existing ROC is identical.

The certification process may appear to be a complex undertaking, particularly to a “first-time” operator. This Chapter provides basic information applicable to the certification process. Applicants will be briefed in as much detail as necessary regarding the preparation of manuals and other required documents during meetings with CAA personnel at the Application meeting.

1.6.2 Background

To conduct aerial work operations using a RPA, an operator must comply with all CAA requirements to ensure operations are conducted with the highest degree of safety possible in the interest of citizens. The certification process is designed to ensure that prospective ROC holders understand and are capable of fulfilling this duty. When satisfactorily completed, the certification process must ensure that the operator is able to comply with CAA legislation, which is in accordance with the international best practices.

1.6.3 ROC Process Phases

There are 4 phases in the ROC operator certification process. Each phase is described in sufficient detail to provide a general understanding of the entire certification process. The 4 phases are:

(a) Phase 1 - Application

(b) Phase 2 - Document evaluation

(c) Phase 3 - Demonstration & Inspection

(d) Phase 4 - Certification (ROC issue)

Experience has shown that 90 days is normally required for the ROC application process once the application is submitted although this time frame may be reduced for an operator previously approved by an EASA Member State or one operating to EASA regulations.

Whilst the CAA will endeavour to process the application expeditiously, most delays incurred are generally due to the applicant’s failure to provide documents, provide access to the aircraft or facilities, or failure to respond to CAA requests in a timely manner.

CHAPTER 2

APPLICATION PHASE

2.1 APPLICATION SUBMISSION

2.1.1 General

An application must be made at least 90 days prior to the proposed operations. [Form SM 116 is designed as an application form for all RPA operations and must contain as much information as possible for the CAA to process the application.] All available supporting documentation must be submitted. It is essential that the operator's liaison person understands the CAR OPS 4 requirements and is familiar with the operation of the RPA.

Note: [The application Form SM 116 with accompanying guidance for completion of the form can be found on the CAA website http://www.caa-mna.sm/.]

The application form and supporting documentation and, unless otherwise advised, all contact during the ROC application must be made to;

Director General
Civil Aviation CAA
Via Consiglio dei Sessanta, 99 47891, Dogana
Republic of San Marino

TEL: +378 (0549) 882929

FAX: +378 (0549) 882928

EMAIL: registration@SMAR.aero

The CAA will normally designate one certification team member as the Project Manager. The Project Manager is the official CAA spokesperson and liaison officer throughout the certification process.

2.1.2 Application Meeting

Once the application is received by the CAA, a meeting will be scheduled. The purpose of the application meeting is to confirm the information provided by the applicant and to provide critical certification information to the applicant. It is recommended that the operator's senior management personnel attend the application meeting and be prepared to discuss plans and general aspects of the proposed operation.

Many problems can be avoided by discussing all aspects of the proposed operation and the specific requirements which must be met by the operator in order to be certified.

Minutes of the meeting will be made and distributed to all attendees. If the application meeting is acceptable, the documents and manuals will be retained by the CAA. These documents shall be evaluated thoroughly during subsequent phases of the certification process.

If the application is not accepted, the application will be returned with a written explanation of the reasons for its return

The interval between application and grant or variation of a ROC will depend primarily upon matters within the control of the operator as the CAA will work towards meeting its obligations in a timely manner. Nevertheless, if after a period of 6 months the application process has not been substantially progressed by the operator, the CAA will consider the refusal of the application. Fees paid will not be refunded.

2.2 DISCUSSION ISSUES

2.2.1 Schedule of events

A schedule of events must be submitted with the application that lists items, activities, programmes, aircraft and facility acquisitions that will be made ready for inspection by the CAA before certification. The dates must be logical in sequence and provide time for CAA review, inspection and approval of each item. The overall plan is to be kept under constant review to maintain control of the certification process. The Schedule of Events is prepared by the applicant and the schedule must include, but is not limited to, the dates when the following is planned to occur:

(a) Training including;

(i) pilot training;

(ii) CAA training (if required)

(b) When the required manuals will be available for assessment;

(c) When and where the RPAS components will be ready for C of A inspection;

(d) When and where facilities will be ready for inspection;

(e) When and where demonstration flights will begin;

(f) When and where operations will begin;

(g) Proposed assessment of the Accountable Manager and other key persons.

The Schedule of Events will enable the certification team to plan workloads so as to achieve certification by the required date. Once the CAA has accepted the Schedule of Events at the application meeting, every effort must be made to keep to the schedule, provided safety aspects are not compromised.

2.2.2 Manuals

[The following is a list of the manuals the applicant must prepare and submit with the application (Refer Form SM 116 with associated guidance and Chapter 3);]

(a) Operations Manual

(b) Maintenance Programme (Refer to CAP 12)

(c) Maintenance Control Manual (Refer to CAP 09)

(d) Safety Management System Manual (Refer to CAP 15)

2.2.3 Documents

[The following is a list of the documents the applicant must prepare and submit with the application (Refer Form SM 116 with associated guidance and Chapter 3);]

(a) Operational documents

(b) Aircraft documents (AFM, radio licences, noise certificate etc.)

(c) Purchase, Leases, Contracts or Letters of Intent documents

(d) Previous RPAS approvals (C of A, C of R etc.) and pilot licences.

(e) Other documents and publications the operator or CAA may consider relevant.

2.2.4 Management Structure and Key Staff Members

CAR OPS 4 requires the approval of an Accountable Manager and acceptance of the nomination of technical appointments such as Flight Operations, Crew Training, Ground Operations, Maintenance and Quality. The operator shall complete the Management Qualification Form SM 54 for the purpose of nominating the required personnel and attach it to the application. The forms shall be for each individual and accompanied by a CV detailing the required qualifications and experience.

2.2.5 Certification Issues

(a) Aircraft registration process (Refer to CAP 01)

(b) Aircraft C of A process (Refer to CAP 08)

(c) Radio Station Licence

(d) Noise Certificate

(e) Area of proposed operations and segregated airspace

(f) Pilot licensing (Refer to CAR LIC and CAR MED)

(g) Engineer licensing and authorisation (Refer to CAR LIC)

(h) CAA charges

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CHAPTER 3

DOCUMENT EVALUATION PHASE

3.1 GENERAL

The document evaluation requires the CAA to review all documents and forms submitted to ensure compliance. During this phase the CAA may require further information. After the application has been accepted, Inspectors will begin a thorough evaluation of all the manuals and documents required by regulations. The CAA will endeavour to complete these evaluations in accordance with the operator's schedule of events.

If a manual or document is incomplete or deficient, or if non-compliance with the regulations or procedures does not reflect a safe operating practice, the manual or document will be returned for corrective action. If the manuals and documents are satisfactory, an approval certificate will be issued.

The complexity of the information which must be addressed in the applicant's manuals and other documents depends on the complexity of the planned operation.

Note: Refer also to the Attachments for information that may be required for inclusion in the various manuals.

3.2 OPERATIONS MANUAL

3.2.1 General

The Operations Manual, which must be provided in separate parts, must set out the applicant's general policies, the duties and responsibilities of personnel, operational control policy and procedures, and the instructions and information necessary to permit flight and ground personnel to perform their duties with a high degree of safety.

The size, as well as the number of Chapters, of the Operations Manual will depend upon the size and complexity of the proposed operations. Operators are reminded that once the Operations Manual is approved an operator shall supply the CAA with intended amendments and revisions in advance of the effective date, which from experience would normally be a period of not less than 30 days depending upon CAA workload. This period takes into account the CAA review, operator approval, publication and dissemination.

Note: All amendments must be submitted to the CAA through the Accountable Manager.

When the amendment concerns any part of the Operations Manual which must be approved in accordance with CAR OPS 4, this approval shall be obtained before the amendment becomes effective. When immediate amendments or revisions are required in the interests of safety, they may be published and applied immediately in the form of a temporary revision to the Operations Manual, or by means of a Notice to crew or similar, and be incorporated in the Operations Manual, if appropriate, at the next formal revision.

The amendment process must be a controlled sequence of events with close coordination between the operator and the CAA. This will allow a proper review of the amended material to take place and any approval to be issued or amended. The use of the provision for immediate amendments or revisions must be limited to those occasions where they are the only means available of securing the interests of safety.

3.2.2 Structure of Manual

The Operations Manual must include the RPAS operating manual and the RPS manual in the following structure;

(a) **General**;

(1) administration of manual (amendment process etc.)

(2) organisation (structure, duties and responsibilities etc.)

(3) operational control and flight planning

(i) method for obtaining aeronautical data

(ii) adequacy of the fuel and oil records

(iii) adequacy of flight time, flight duty and rest period records

(iv) adequacy of the aircraft maintenance log book

(v) adequacy of the load manifest (if applicable)

(vi) adequacy of the operational plan

(vii) method for obtaining weather data

(viii) contents of the journey log book (tech log)

(ix) ground handling processes, subcontracting policies and practices for all ground handling operations

(b) **RPAS operating information**;

Aircraft performance operating procedures and limitations;

(1) AFM

(2) MEL, if applicable

(3) Normal Flight Operations Procedures

(4) Standard Operating Procedures

(5) Emergency Operations

(6) Coordination between internal external pilots and ATC etc.

(c) **Areas, routes and aerodromes**

(1) A list must be provided of the destination and alternate or emergency aerodromes designated for proposed operations and nominated areas of operations.

(2) The geographical area of operation can only be in segregated airspace and within the capabilities of the aircraft and equipment (navigation and safety).

(d) **Training**

All these following aspects must cover both initial and recurrent training.

(1) Conversion training course;

(2) Aircraft systems training;

(3) Simulator training;

(4) Aircraft flight training for internal/external pilots;

(5) Flight dispatch training;

(6) Technical staff training

(7) CAA staff training, if applicable;

3.3 RPAS OPERATOR'S MAINTENANCE CONTROL MANUAL (MCM)

3.3.1 General

The operator must provide, for the use and guidance of maintenance and operational personnel concerned, an MCM, acceptable to the State of Registry.

The MCM must clearly describe maintenance procedures including the procedures for completing and signing a maintenance release when maintenance is performed and completed.

The RPAS operator must provide copies of the MCM at each RPS and maintenance location. The RPAS operator must provide the State of the Operator and the State of Registry with a copy of the operator's MCM, together with all amendments and/or revisions to it and must incorporate in it such mandatory material as the State of the Operator or the State of Registry may require.

The design of the MCM must observe the Human Factors principles (see *Human Factors Training Manual* (Doc 9683)).

3.3.2 Maintenance records

The following maintenance records must be kept by the RPAS operator for a minimum period of 90 days after the unit to which they refer has been permanently withdrawn from service:

(a) the total time in service (hours, calendar time and cycles, as appropriate) of the RPA and all life-limited components;

(b) the current status of compliance with all mandatory continuing airworthiness information;

(c) appropriate details of modifications and repairs;

(d) the time in service (hours, calendar time and cycles, as appropriate) since the last overhaul of the RPA or its components subject to a mandatory overhaul life; and

(e) the current status of the RPA's compliance with the maintenance programme.

The detailed maintenance records must be kept for a minimum period of one year after the signing of the maintenance release to show that all requirements for the signing of a maintenance release have been met.

In cases where the State of Registry and State of the Operator are different, the RPAS operator must ensure that appropriate records for the RPA, RPS and launch/recovery equipment are available at each relevant location for inspection by the relevant authority.

3.3.3 Continuing airworthiness information

The RPAS operator must ensure that all RPAS are maintained and operated in accordance with the State of Registry requirements and are in a condition for safe operation at any time during their service life.

Reporting systems must be established and mandatory continuing airworthiness information complied with.

3.3.4 Modifications and repairs

The RPAS operator must ensure that all modifications and repairs carried out on the RPAS components are in compliance with airworthiness requirements acceptable to the Authority, as the State of Registry.

The RPAS operator must establish procedures to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained in accordance with CAR AIR and CAR 21.

3.3.5 RPAS maintenance and release to service

The RPAS operator must not operate the RPAS unless it is maintained and released to service by a maintenance organisation or maintenance engineer acceptable to the Authority.

In accordance with CAR OPS 4, a maintenance release must be completed and signed. In the case of RPAS, this may involve the use of separate log books for each RPA and RPS.

The RPAS operator must ensure that the maintenance of the RPAS is performed in accordance with the maintenance programme.

If an RPS or other essential component is located and maintained in a State other than the State of Registry, the RPAS operator must satisfy the State of Registry that the components are properly maintained. The Authority, as the State of Registry may require contractual arrangements, bilateral or multilateral agreements or national regulations to support such arrangements.

3.4 MAINTENANCE PROGRAMME

The RPAS operator must establish and provide, for the use and guidance of maintenance and operational personnel concerned, a maintenance programme, accepted by the Authority, as the State of Registry. The maintenance programme, which includes the maintenance schedule and any associated Reliability Programme, must be based on the manufacturer's recommendations and CAP 12.

The maintenance programme must contain, but is not limited to, the following:

(a) maintenance tasks and the intervals at which these are to be performed based on the RPA, RPS, C2, and other components of the RPAS;

(b) a continuing structural integrity programme (SIP);

(c) procedures for deviating from (a) and (b) above for tasks that do not have mandatory designations from the State of Design; and

(d) condition monitoring and reliability programme descriptions for RPA, RPS, launch/recovery equipment and other essential components.

3.5 SAFETY MANAGEMENT SYSTEM

3.5.1 General

In accordance with CAR OPS 4, RPAS operators must implement an SMS. The potential impact on the organisation's safety performance resulting from interaction of internal and external aviation system stakeholders must be taken into consideration when implementing an SMS. It is important to evaluate the risks associated with the RPAS operations being conducted, especially the potential impact on other service providers. The introduction of RPA into non-segregated airspace requires a thorough assessment of the safety performance of the RPAS operations. Based on this, an SMS of an RPAS operator must be:

(a) established in accordance with the SMS framework elements contained in CAP 15; and

(b) commensurate with the size of the service provider and the complexity of its aviation products or services.

3.5.2 SMS Manual

The SMS manual must contain details of the applicant's safety management system including:

(a) the safety policy; safety organisation; safety officer's responsibilities, safety assessments; occurrence reporting; hazard identification;

(b) risk assessment and risk management;

(c) event investigation and analysis; performance monitoring;

(d) safety promotion; and safety assurance.

Note: Operators are expected to create a separate SMS Manual. Guidance can be obtained from www.icao.int/fsix and from CAP 15.

3.6 DOCUMENTATION

3.6.1 Submitted Documentation

Documents of purchase, leases, contracts and/or letters of intent including:

(a) Aircraft

(b) Station facilities and services

(c) Weather information and services

(d) Communications facilities and services

(e) Maintenance facilities, services and contractual arrangements

(f) Aeronautical charts and related publications

(g) Airport analysis and obstruction data

(h) Training facilities and contract services

3.6.2 CAA Application Forms

(a) C of R (Form SM 01)

(b) C of A (Form SM 02)

(c) Acceptance of an Aircraft Maintenance Programme (Form SM 73)

(d) Domiciled Representative (Form SM 27)

(e) Remote Pilot Licence (Form SM 58A)

CHAPTER 4

DEMONSTRATION & INSPECTION PHASE

4.1 GENERAL

The CAR OPS 4 requires an operator to demonstrate his ability to comply with regulations and procedures of ensuring safe operating practices before beginning operations. These demonstrations include actual performance of activities and/or operations while being observed by CAA Inspectors. This includes on-site evaluations of aircraft maintenance, equipment and support facilities. During these demonstrations and inspections, the CAA evaluates the effectiveness of the policies, methods, procedures and instructions as described in manuals and other documents.

Emphasis is placed on the operator's management effectiveness during this phase. Deficiencies will be brought to the attention of the operator and corrective action must be taken before a certificate is issued.

Although the document evaluation and the demonstration and inspection phases have been discussed separately in this document, these phases overlap, or are accomplished simultaneously in actual practice. The following list provides examples of the types of items, equipment, facilities and operations evaluated during the technical demonstration phase.

(a) Conduct of training programmes (classroom, simulators, aircraft, flight and ground personnel training).

(b) RPS facilities (equipment, personnel, refuelling, technical data);

(c) Record keeping procedures (of training, flight and duty times, flight papers);

(d) Flight control (flight supervision and monitoring system or flight following system);

(e) Maintenance and inspection programmes (procedures, record keeping);

(f) Aircraft (conformity inspection, aircraft maintenance records, etc.);

(g) MELs and CDLs;

(h) Weight and balance programme;

(i) Demonstration flights, including actual flight(s) to demonstrate the operation is conducted safely and in compliance with all applicable CAR OPS 4 requirements.

4.3 **PERSONNEL MANAGEMENT**

4.2.1 Staff positions and requirements

Commensurate with the size, structure and complexity of the organisation, the RPAS operator must:

(a) appoint an accountable manager, who has the authority for ensuring that all activities can be financed and carried out in accordance with the applicable requirements. The accountable manager is responsible for establishing and maintaining an effective management system;

(b) nominate a person or group of persons with the responsibility for ensuring that the operator remains in compliance with the applicable regulations. Such person(s) must be acceptable to the CAA and ultimately responsible to the accountable manager;

(c) have sufficient qualified and competent personnel for the planned tasks and activities to be performed in accordance with the applicable requirements;

(d) maintain appropriate experience, qualification and training records to show compliance with (c); and

(e) ensure that all personnel are familiar with the rules and procedures applicable to the performance of their duties.

4.2.2 Competence of personnel

An RPAS operator must ensure its personnel are properly qualified and competent to perform their allocated tasks and discharge their responsibilities. Such personnel must have the necessary set of competencies and the related knowledge, skills and attitudes, such as:

(a) theoretical knowledge (“to know”);

(b) practical skill (“to know how”); and

(c) attitudes commensurate with the scope of their duties in relation to RPAS operations (“to be”).

The combination and integration of these three elements constitute the standards of competence that personnel must demonstrate as individuals and as team members.

An RPAS operator must establish initial and recurrent training to ensure continuing competence of its personnel. These programmes must be addressed to all personnel assigned to, or directly involved in, ground and flight operations and ensure that all personnel have demonstrated their competence in their particular duties and are aware of their responsibilities and the relationship of such duties to the operation as a whole.

4.2.3 Record-keeping

An RPAS operator must establish a system of record-keeping that allows adequate storage and reliable traceability of all activities developed, covering at a minimum:

(a) operator’s organisation;

(b) SMS;

(c) personnel training and competence verification;

(d) documentation of all management system key processes;

(e) maintenance records; and

(f) security management records.

Records must be stored in a manner that ensures protection from damage, alteration and theft.

4.3 CONTRACTED SERVICES

4.3.1 Contracted services other than for C2

Note: Refer also to Attachment 1 for C2 scenarios.

When contracting or purchasing services as part of its activity, the RPAS operator must ensure that such services or products conform to the applicable requirements.

An RPAS operator may contract services from other organisations which are certified and under oversight of the relevant aviation safety oversight authority (e.g. approved maintenance organisations). In these cases, the contractual agreements may only cover commercial and technical matters.

An RPAS operator may identify a need to contract RPS services from another RPAS operator in order to achieve operational and business benefits. This sharing of resources would give RPAS operators flexibility and increase the range within which they are able to conduct operations. In order to facilitate this arrangement, each State involved would need to allow such contractual agreements through bilateral or multi-lateral agreements or national/regional legislation. This could involve oversight of RPAS operators located in another State.

4.4 DOCUMENT REQUIREMENTS

4.4.1 Carriage of Documents

CAR OPS 4 requires that various documents be carried on board the RPA and these can be as electronic versions of the documents which are accessible to remote pilots, inspectors and maintenance personnel, whether at the RPA or the RPS.

4.4.2 Documents held by the RPAS operator

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

(a) ROC;

(b) operations specifications relevant to the RPA and RPS models, associated with the ROC;

(c) operations manual, including the RPAS operating manual and the RPS manual;

(d) RPA/RPAS flight manual;

(e) maintenance control manual (MCM);

(f) third party liability insurance certificate(s);

(g) certificate of registration of each RPA;

(h) C of A of each RPA;

(i) certificates of any additional RPAS components, if applicable;

(j) all radio station licence(s), if applicable;

(k) all noise certificates, if applicable;

(l) notification of special loads, if applicable; and

(m) cargo manifests, if applicable.

4.4.3 Documents at the RPS(s)

Documents, manuals and information, including, but not limited to the following, must be available at the RPS(s) planned to be used during the flight:

(a) operations manual including the MEL, CDL, RPAS operating manual and RPS manual;

(b) RPA/RPAS flight manual;

(c) operations specifications relevant to the RPA and RPS models associated with the ROC;

(d) journey log book for the RPA;

(e) MCM, maintenance log book and technical log for the RPA;

(f) MCM, maintenance log book and technical log for the RPS;

(g) details of the filed, current, ATS and operational flight plans, if applicable;

(h) current and suitable aeronautical charts for the route of flight and all routes along which it is reasonable to expect that the flight may be diverted, including departure, arrival and approach charts for all relevant aerodromes/heliports;

(i) information concerning search and rescue services for the area of the intended flight;

(j) notice to airmen (NOTAM) and aeronautical information service (AIS) briefing documentation;

(k) meteorological information;

(l) fuel requirements, fuel load and records;

(m) cargo manifests and information on dangerous goods, if applicable;

(n) mass and balance documentation; and

(o) any other documentation that may be pertinent to the flight or required by the State(s) involved in the operation.

Technical information regarding the RPAS (e.g. journey and maintenance log books, flight plan changes and fuel status) must be updated and all pertinent information conveyed to successive remote pilots. Electronic log books must be updated as soon as practicable during or immediately after the flight segment of each remote pilot.

The format (e.g. electronic) of the documents listed above must be acceptable to the Authority and to all other States involved in the operation.

4.4.4 Documents carried on board the RPA

The following documents must be available on board each RPA on international flights:

(a) ROC (certified true copy);

(b) certificate of registration of the RPA (certified true copy);

(c) C of A of the RPA (certified true copy);

(d) licences of each remote pilot involved in the current flight (certified true copies);

(e) journey log book;

(f) operations specifications;

(g) cargo manifests and information on dangerous goods, if applicable;

(h) noise certificate, if applicable; and

(i) aircraft radio station licence (certified true copy).

The format (e.g. electronic) of the documents listed above must be acceptable to the Authority and to all other States involved in the operation.

4.4.5 Documents at or in close proximity of the RPA ground operations area

Documents, manuals and information, including, but not limited to the following, must be available at or in close proximity of the RPA ground operations area(s):

(a) RPA flight manual, or pertinent subset thereof; and

(b) cargo manifests and information on dangerous goods, if applicable;

4.5 OPERATING FACILITIES

The RPAS operator must ensure that a flight will not be commenced unless it has been ascertained by every reasonable means available that the ground, space, air and/or water facilities available and directly required on such flight, for the safe operation of the RPAS, are adequate for the type of operation under which the flight is to be conducted and are adequately operated for this purpose.

An RPAS operator must ensure that any inadequacy of facilities observed in the course of operations is reported, including to the concerned ATS provider, if applicable, without undue delay.

4.6 RPAS OPERATOR RESPONSIBILITIES FOR CONTINUING AIRWORTHINESS

4.6.1 RPAS operator’s maintenance responsibilities

The RPAS operator is responsible for ensuring that all components of the RPAS are maintained in an airworthy condition. Furthermore, the RPAS operator must ensure that operational and emergency equipment necessary for the intended flight are serviceable.

The RPAS operator must establish and implement a maintenance programme in accordance with the manufacturer’s recommendation and accepted by the Authority, as the State of Registry.

An RPAS operator must not operate an RPAS unless it is maintained and released to service by an approved maintenance organisation or under an equivalent system, either of which must be acceptable to the Authority, as the State of Registry. When the Authority accepts an equivalent system under CAR AIR, the person signing the maintenance release must be licensed.

4.7 REMOTE FLIGHT CREW AND SUPPORT PERSONNEL

4.7.1 General

The terms “remote flight crew” and “remote flight crew member” have been developed as a means of referring to licensed remote pilots who are charged with duties essential to the operation of an RPAS during a flight duty period.

4.7.2 Composition and duties of the remote flight crew

The RPAS operator is responsible for compliance with the San Marino requirements and the safe conduct of all operations.

The RPAS operator is responsible for designating and authorising one remote pilot to act as remote PIC. In some cases, such as ultra-long duration flights where it is impractical for one person to be remote PIC continuously, the RPAS operator, if approved by the Authority, may establish appropriate policies and procedures for the transfer of remote PIC responsibilities.

In these cases, only one remote pilot may hold remote PIC responsibility at any given time. The RPAS operator is responsible for designating other members of the remote flight crew as necessary.

RPAS operators may consider the benefits of having all remote pilots involved in the intended operation included in the planning phase of the flight.

4.7.3 Remote PIC considerations

The RPAS operator is responsible for designating the remote PIC. This individual is responsible for the operation of the RPA in accordance with San Marino regulations (e.g. CAR OPS 0, CAR OPS 4) and other regulations and procedures of those States in which operations are conducted, except that the remote PIC may depart from these in circumstances that render such departure absolutely necessary in the interests of safety. The remote PIC will have final authority as to the disposition of the RPA while in command.

4.7.4 Transfer of remote PIC responsibility during flight

RPAS operations can be of very long duration and have the potential to be piloted from different locations, possibly from different States and one individual cannot, in practice, fulfil the remote PIC responsibilities for the duration of the flight. Therefore the transfer of remote PIC responsibilities, handovers between remote pilots, whether at collocated or widely spaced RPS, will need to explicitly identify whether or not the remote PIC responsibility is transferred coincident with the handover of the RPA.

4.7.5 Remote flight crew member training programmes

An RPAS operator must establish and maintain an RPAS training programme, approved by the Authority, which ensures that all remote flight crew members acquire and maintain the competencies to perform their assigned duties in terms of knowledge, skills and attitude. The training programme must consist of training in the RPS model(s) from which the remote pilot will fly the specific RPA type(s) and must include:

(a) knowledge and skills related to the RPA operational procedures for the intended area of operation and in the transport of dangerous goods;

(b) remote flight crew coordination and handover procedures, if applicable;

(c) abnormal and emergency situations or procedures (e.g. loss of C2 link, flight termination);

(d) methods to maintain situational awareness of the RPA's environment; and

(e) human performance aspects related to crew resource management, threat and error management (TEM) and automation or human-machine interface (HMI) which are unique to unmanned aviation.

Training must be given on a recurrent basis, as determined by the Authority and must include an assessment of competence.

4.7.6 Fatigue management

Remote pilots must be able to perform their duties at an adequate level of alertness. To ensure this, RPAS operators whose organisations include operation shifts and crew scheduling schemes must establish policies and procedures for flight and duty time, operation shift schedules and crew rest periods based on scientific principles. Such policies and procedures must be documented in the operations manual and may include:

(a) training and education on personal and operational fatigue-related risks and countermeasures;

(b) implementation of mitigations where necessary and monitoring of their effectiveness; and

(c) continued review of fatigue-related risks through safety management processes.

4.7.7 Support personnel

The RPAS operator, if utilising dispatch services, must ensure that the training and competency of the flight dispatchers is commensurate with the duties they are assigned.

The RPAS operator is responsible for designating any other support personnel necessary for the safe conduct of its operation. This may include RPA observers, ground station technicians and other ground support crew for launch and recovery, etc. The RPAS operator is responsible for ensuring that the training and competency of these individuals is commensurate with the duties they are assigned.

4.8 OPERATIONAL FLIGHT PLANNING

4.8.1 General

Operational flight planning must include provisions similar to those in manned operation. In addition, specific needs for RPAS such as the number of remote pilots and crew duty time planning for long endurance missions or the availability of RPS may be required. Such requirements may not be available at the time of departure but may be necessary for operation in a later phase of the flight. The RPAS operator must establish procedures to ensure a seamless operation throughout the duration of the flight, including remote pilots who can carry out the responsibilities for the different phases of the flight such as take-off, climb, cruise, approach and landing, all of which must be included in the operations manual.

4.8.2 Meteorological conditions — consistent with performance limitations

The remote pilot must review all available meteorological information pertaining to the operation and performance limitations of the RPAS. Particular attention must be given to such conditions as:

(a) surface visibility;

(b) wind direction/speed;

(c) hazardous meteorological conditions including cumulonimbus, icing and turbulence; and

(d) upper air temperature.

Flight into known or expected icing conditions must not be conducted unless the system is certificated and equipped for flight into those conditions, with the icing protection systems operational in accordance with the MEL, and the remote pilot is current in, and qualified for, cold weather operations.

4.8.3 Impacts on radio frequencies (RFs)

Electromagnetic (EM) interference (e.g. solar flares, volcanic ash, ionospheric activity) may affect performance of C2 links and GPS reception and must be considered by the remote pilot prior to, and during, flight.

The remote pilot must consider the available information regarding potential EM interference and its impact on the RPAS and flight completion. Additional considerations must be given to possible intentional or inadvertent electronic interference.

Operations in areas of high RF transmission/interference (e.g. radar sites, high tension wires) must be avoided unless engineering testing has confirmed that operations in these areas will not impact safe operation of the RPAS.

4.9 OPERATIONS CONSIDERATIONS

4.9.1 Visual line-of-sight operations (VLOS)

A VLOS operation is one in which the remote pilot or RPA observer maintains direct, unaided, visual contact with the RPA.

For VLOS, the visual contact has to be direct, meaning that the remote pilot or RPA observer must maintain a continuous unobstructed view of the RPA, allowing the remote pilot and/or RPA observer to monitor the RPA's flight path in relation to other aircraft, persons, obstacles (e.g. vehicles, vessels, structures, terrain), for the purpose of maintaining separation and avoiding collisions. The direct visual contact must be ensured without visual aids (e.g. telescope, binoculars, electro-optical reproduced/enhanced vision) other than corrective lenses. VLOS operations must be operated in such meteorological conditions that the remote pilot or RPA observer is able to avoid conflicting traffic and other safety risks related to the hazards present in the operating environment.

The flight planning must ensure the remote pilot and/or RPA observer will have sufficient ceiling and visibility and terrain/obstacle clearance to maintain continuous visual contact with the RPA with conditions forecast to continue throughout the duration of the flight. Additionally, the conditions must allow for visual detection of other aircraft in the vicinity.

VLOS operations, in which the RPA is operated at relatively short ranges from the remote pilot or RPA observer and at relatively low altitudes, typically employ a hand-held RPS with limited displays.

The term "relative" is used to indicate that the acceptable ranges and altitudes are linked to the conspicuity of the RPA and possible intruders (e.g. other aircraft, including RPA) in the operating environment which is dependent on their colour, size, speed, lighting).

The pilot requires real-time communication capability with any RPA observers and, if a handover will occur, with the other remote pilot(s). In some situations, the remote pilot will also need real-time communications with the local ATC unit.

If the remote pilot cannot visually monitor the RPA and is relying on RPA observers, numerous additional factors need to be considered including:

(a) remote pilot and RPA observer training and competence;

(b) communication delays between RPA observer and remote pilot;

(c) simultaneous communication from multiple RPA observers or conflicting instructions;

(d) communication failure procedures between the RPA observer and remote pilot;

(e) remote pilot's ability to determine the optimum CA manoeuvre when not in visual contact with the RPA or the conflicting traffic; and

(f) remote pilot response time.

Predetermined manoeuvers and phraseology for use by RPA observers and remote pilots to change the flight trajectory may contribute to reduce exposure to conflicting traffic or obstacles and to restore normal flight after carrying out a plan to avoid or mitigate each threat. These predetermined manoeuvers might include direction, rate and extent of turn, climb/descent to a specific altitude, etc.

4.9.2 VLOS operations at night

The remote pilot and/or RPA observer will have an additional challenge at night to judge distance, relative distance and trajectory. VLOS operations must not be conducted at night unless adequate means to mitigate the different possible threats have been established and can be met.

4.9.3 Beyond VLOS operations

To conduct flights beyond VLOS of the remote pilot or RPA observer, a means to DAA traffic and all other hazards such as hazardous meteorological conditions, terrain and obstacles must be available to the remote pilot.

Prior to conducting a controlled BVLOS operation, coordination must be effected with the ATC unit(s) involved regarding:

(a) any operational performance limitations or restrictions unique to the RPA (e.g. unable to perform standard rate turns);

(b) any pre-programmed lost C2 link flight profile and/or flight termination procedures; and

(c) direct telephone communication between the RPS and the ATC unit(s) for contingency use, unless otherwise approved by the ATC unit(s) involved.

Communication between the RPS and the ATC unit(s) must be as required for the class of airspace in which operations occur and must utilise standard ATC communications equipment and procedures, unless otherwise approved by the ATC unit(s) involved.

C2 link transaction time must be minimised so as not to inhibit the remote pilot's ability to interface with the RPA compared to that of a manned aircraft.

The nature of the C2 link (whether RLOS or BRLOS) will also influence the design of the RPAS. From an operational perspective, the main difference between an RLOS operation and a BRLOS operation of a BVLOS RPAS will be the delays associated with control and display information and the design features selected to accommodate the available C2 link capacity.

BRLOS C2 links in general are expected to have lower data capacity (due to cost and bandwidth limitations) and higher message delays than RLOS C2 links. BVLOS RPS will be designed to match the performance of the type of C2 link (BRLOS/RLOS) with which they will be used.

Note: The more time critical the control function, the higher the level of RPA automation that is required to maintain normal safe flight.

BVLOS operations conducted under VFR must only be considered when the following conditions are met:

(a) the Authority and the State in whose airspace the operation occurs have approved the operation;

(b) the RPA remains in VMC throughout the flight; and

(c) a DAA capability or other mitigation is used to assure the RPA remains well clear of all other traffic; or

(d) the area is void of other traffic; or

(e) the operation occurs in specifically delimited or segregated airspace.

4.9.4 Populated areas

Operations over heavily populated areas or over open air assemblies of people may require special considerations and must consider the following:

(a) altitudes for safe operation;

(b) consequences of uncontrolled landing;

(c) obstructions;

(d) proximity to airports/emergency landing fields;

(e) local restrictions regarding RPAS operations over heavily populated areas; and

(f) the emergency termination of an RPA flight.

4.10 AERODROME OPERATIONS

4.10.1 Take-off

RPAS may be operated from established aerodromes or from almost any other location depending on operational requirements and system configuration, design and performance.

4.10.2 Take-off/launch from aerodromes

For operations from established aerodromes, the remote pilot must consider the following:

(a) regulations pertaining to RPAS operations on or near an aerodrome;

(b) complexity and density of aircraft operations; and traffic);

(c) ground operations (e.g. taxiway width, condition and other ground traffic)

(d) C2 link continuity;

(e) payload considerations;

(f) wake turbulence;

(g) performance and capability related to take-off distance/run available and minimum obstruction climb requirements, departure procedures and any flight restricting conditions associated with operations to or from the aerodrome; and

(h) availability of emergency recovery areas.

4.10.3 Take-off/launch from other than aerodromes

For operations from other than established aerodromes, the remote pilot must consider the following;

(a) take-off/launch area and condition;

(b) location and height of all obstructions that could hinder launch and recovery;

(c) performance and capability related to obstacle clearance, departure procedures (if applicable) and any flight-restricting conditions;

(d) availability of emergency recovery areas;

(e) ATC communications, if required;

(f) C2 link continuity;

(g) payload considerations; and

(h) density and proximity of overflight traffic.

4.10.4 Landing/recovery

RPAS may land at aerodromes or at almost any other location depending on operational requirements and system configuration, design and performance.

For operations at aerodromes, the remote pilot must consider the following:

(a) regulations pertaining to RPAS operations on or near an aerodrome;

(b) complexity and density of aircraft operations;

(c) performance and capability related to landing distance available and obstacle clearance, arrival procedures and any flight-restricting conditions;

(d) wake turbulence;

(e) ground operations (e.g. taxiway width, condition, other ground traffic);

(f) C2 link continuity;

(g) payload considerations; and

(h) availability of emergency recovery areas.

4.10.5 Landing/recovery at other than aerodromes

For operations at other than aerodromes, the remote pilot must consider the following:

(a) landing/recovery area and condition;

(b) location and height of all obstructions that could hinder landing or recovery (e.g. cables, towers, trees);

(c) performance and capability related to obstacle clearance, arrival procedures (if applicable) and any flight-restricting conditions;

(d) availability of emergency recovery areas;

(e) ATC communications, if required;

(f) C2 link continuity;

(g) payload considerations; and

(h) density and proximity of overflight traffic.

4.10.6 Recovery equipment preparation/set-up/inspection

Set-up, positioning and operation of recovery equipment, if applicable, must be as recommended by the manufacturer and, if located at an aerodrome, must be coordinated with the aerodrome operator. The condition and operability of all recovery hardware, direction and positioning of the recovery crew, and ensuring persons not associated with recovery or landing of the RPA are well clear of the operational area, must be assured. Similarly, the set-up, positioning and operation of recovery equipment must not adversely affect aerodrome operations.

4.10.7 RPA operations in proximity of aerodromes, other than for take-off and landing purposes

These operations may include control of birds at or in proximity to aerodromes or inspection of facilities. In order to avoid conflict with other aerodrome users, these types of operations must be regulated to ensure safety of ground vehicles and other aircraft.

4.10.8 Diversion to alternate aerodromes

Pre-flight planning must include consideration of alternate aerodromes/recovery sites, as appropriate, in the event of an emergency or meteorological-related contingency. Adequate fuel/energy reserves must be included in pre-flight preparation such that the RPA can deviate from a landing/recovery at the planned location, proceed safely to the alternate aerodrome/recovery site, and execute an approach and landing. Before selecting an alternate recovery/landing location, the remote pilot must consider, at a minimum, the adequacy of fuel/energy reserves, the reliability of C2 links with the RPA, ATC communications capability as necessary and meteorological conditions at the alternate.

4.11 RPS HANDOVER

4.11.1 General

Handover of the RPA from one RPS to another is used for many reasons, including to extend the operational range or to permit precision control such as for a terminal area or for maintenance reasons. RPS handovers may happen in two common scenarios:

(a) handover of piloting control to a collocated, but not coupled, RPS. This handover may be to a second remote pilot or, in the event of an RPS malfunction, the remote pilot moving to a standby RPS; or

(b) handover of piloting control to an RPS at another location.

Note 1: A remote pilot relieved by another at the same RPS is considered to be similar in nature to a relief pilot/crew taking over on board an aircraft, rather than a handover.

Note 2: A remote pilot transferring piloting control to another within a dual seat RPS is considered to be similar in nature to exchanging control in a manned aircraft, rather than a handover.

4.11.2 Handover coordination between RPS

All handovers must be planned and coordinated as per the procedures in the operations and/or flight manual. Handover considerations must include:

(a) confirmation of the availability of a reliable voice communication link between the transferring and receiving remote pilots in the RPS to support coordination of the handover (it is recommended that this communication is not relayed through the RPA);

(b) status of the receiving RPS (e.g. its readiness and availability, its software configuration and compatibility with the RPA to be handed over);

(c) compatibility of the C2 link (e.g. IP address, frequency);

(d) coordination between the respective remote pilots; and

(e) ATC coordination (e.g. emergency contact telephone number), as necessary.

Before transferring an RPA, a handover briefing must be conducted between the transferring and receiving remote pilots to ensure the status of the RPA is understood. This briefing must be conducted in adequate time before the actual handover and must include, at a minimum:

(a) confirmation by the receiving remote pilot that the RPA is within the accepting RPS C2 link range;

(b) current status of the RPAS and location of the RPA;

(c) faults/system failures with the RPAS;

(d) status of fuel/energy and other consumables;

(e) C2 link configuration; and

(f) changes or limitations to the intended flight or RPA performance.

The receiving remote pilot must be satisfied with all of the above before accepting responsibility for the safe continuation of the flight.

4.11.3 Remote relief pilot briefings at a single RPS

Unlike manned aviation, remote pilots may be assigned shift work that commences or ends while the aircraft is airborne. In these cases, as one remote pilot relieves the other at the same RPS, a relief briefing will be necessary, which must include, at a minimum:

(a) current status of the RPAS and location of the RPA;

(b) meteorological conditions;

(c) aerodrome/recovery site conditions;

(d) faults/system failures with the RPAS;

(e) status of fuel/energy and other consumables;

(f) C2 link configuration; and

(g) changes or limitations to the intended flight or RPA performance.

The receiving remote pilot must be satisfied with all of the above before accepting responsibility for the safe continuation of the flight.

4.12 EMERGENCIES AND CONTINGENCIES

4.12.1 Emergency landing/ditching locations

RPAS flight planning must include provisions for emergency landing of the RPA in locations that minimise the safety risks to people or property on the ground. Remote pilots, unlike pilots of manned aircraft in visual conditions, have little chance to observe actual details on the ground in the vicinity of their aircraft during an emergency. They must therefore rely to a much greater extent on preplanning emergency scenarios that may occur along their intended route of flight.

When selecting emergency landing locations, the remote pilot must consider the following conditions:

(a) terrain, ground obstructions, population density, open air assemblies of people; and

(b) landing/ditching areas including accessibility for recovery or fire suppression.

4.12.2 Loss of C2 link

Flight planning must include provisions for loss of the C2 link and must be in accordance with guidance contained in the flight manual and/or operations manual. Procedures for the loss of the C2 link for RPA conducting controlled flights must be pre-approved by the ATC units involved in each portion of the flight planned route, if so stipulated by the ANSP(s). Remote pilots must notify the ATC unit immediately upon the procedures being activated for any flight under ATC control or any flight that may affect other ATC controlled flights, manned or unmanned.

Additional information on procedures for the loss of C2 link is contained in Attachment 1.

4.12.3 Interception operations

RPAS operators must comply with CAR OPS 0 regarding intercept operations. It is not envisaged that these requirements will be modified in the near term to accommodate RPA. Consequently, State authorities must consider implications for both RPA and intercept aircraft during an intercept manoeuvre.

4.13 REMOTE FLIGHT CREW

4.13.1 Duties of the remote pilot-in-command (PIC)

Each remote PIC is responsible for the operation and safety of the RPA and RPS for the respective segment of flight assigned by the RPAS operator. Transfer of remote PIC responsibilities, if applicable, must be effected in accordance with procedures established by the RPAS operator and approved by the Authority. These procedures must include a record identifying when the transfer occurred and the remote pilots involved. The remote PIC is responsible for terminating the flight, in the event such an action is deemed necessary.

The remote PIC must be assigned responsibility by the RPAS operator for ensuring that any handover from one RPS to another is completed in accordance with the procedures contained in the operations manual and/or flight manual, as applicable.

The remote PIC(s) must be responsible for updating all documents for the respective segment of the flight (e.g. the journey log book, maintenance logs).

4.13.2 Remote flight crew members at duty stations

All remote flight crew members required to be on duty must remain at their RPS as necessary for the safe operation of the RPAS, except when their absence is necessary for the performance of duties in connection with the operation of the system or for physiological needs. In a single remote pilot operation, a relief remote pilot must relieve the remote pilot if the latter needs to be absent from the RPS for any reason.

4.14 ACCIDENTS AND SERIOUS INCIDENTS

4.14.1 Flight and ground recorder records

CAR ACC - Aircraft Accident and Incident Investigation requires that accidents and incidents involving unmanned aircraft over 150 kg be investigated.

Adequate recording of RPAS operations will be required to support accident and incident investigations as well as for flight data analysis. Due to the uniqueness of RPAS and the large variation in system size, provisions for recording system requirements in terms of scale and complexity need to be determined relative to the type of operation in which the RPAS will be involved.

Procedures to support handover of piloting control from one RPS to another must include definition of any specific data or communications that need to be recorded to ensure that the event can be properly reconstructed.

4.14.2 Downlinking RPA recorded data

Recording of all data on the RPA and RPS may be required to ensure data collection is not affected by a C2 link loss. During extra-long duration missions, the RPA flight recorder may have a storage capacity that is less than the anticipated duration of the flight.

To prevent overwriting valuable recorded data, it may be prudent to downlink the recorded data periodically or continuously before reaching the maximum storage capacity on board the RPA.

4.14.3 Accident and incident investigation

Adequate recording of RPAS flight command, trajectory and systems will be essential in determining events leading up to an accident or incident. Investigations where an RPAS was involved in an international operation could involve multiple States with the location of wreckage and the RPS locations in different States. The State of Occurrence, or if the investigation is delegated to another State or regional organisation, the State responsible for investigating, must have access to all the data as per the provisions of ICAO Annex 13, including data from the RPS. Other States involved will be able to participate in the investigation by appointing accredited representatives. Access to data available in the other States will be arranged according to the above-mentioned provisions of Annex 13.

An RPAS operator must ensure, to the extent possible, that all related RPAS data is preserved in the event the RPA becomes involved in an accident or incident and, if necessary, the associated flight recorders and their retention in safe custody, pending the accident or incident investigation.

For accident investigation and flight data recovery purposes, the accident site of an RPA may need to be established within a 6 NM radius. In this case, the RPA may need to be fitted with a system that can automatically transmit or broadcast positional information. Depending on the size of the RPA, this may be accomplished by means of a triggered emergency data transmission/broadcast method which includes positional information, a locator transmitter or an automatic deployable flight recorder.

The choice of equipment type and placement on the RPA will need to ensure the transmission/broadcast activation in the event of an accident. For RPA operating over water or land, including areas especially difficult for search and rescue, placement of the transmitter unit will be a vital factor in ensuring optimal crash and fire protection.

The placement of the control and switching devices (activation monitors) of automatic fixed emergency locator transmitters (ELTs) and their associated operational procedures will have to take into consideration the need for rapid detection of inadvertent activation.

4.15 SECURITY REQUIREMENTS

Security is a vital issue for RPA with aspects that are both similar and unique when compared with manned aircraft. However, due to the fixed and exposed nature of the RPS (consideration must be given to the potential vulnerability of the premises against unlawful interference.

Similarly, the RPA must be stored and prepared for flight in a manner that will prevent and detect tampering and ensure the integrity of vital components.

Identification technologies such as the use of biometrics for access control systems may offer a high degree of security for the RPS. Furthermore, distinction in access control level may be considered between the RPS and the premises wherein it resides.

Remote pilots must be subjected, at a minimum, to the same background check standards as persons granted unescorted access to security restricted areas of airports.

The C2 link provides functions as vital as traditional wiring, control cables and other essential systems. These links may utilise diverse hardware and software that may be provided and managed by third parties. Safety and security of these links and services are equally important as those for the RPA and RPS. They must be free from hacking, spoofing and other forms of interference or malicious hijack.

4.16 SAFE TRANSPORT OF DANGEROUS GOODS BY AIR

CAR DG addresses cargo restrictions, specifically regarding the carriage of munitions or implements of war and other dangerous goods. The broad provisions of regulation are amplified by the detailed specifications of the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) and its supplement, *Supplement to the Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284SU).

Most of the dangerous goods carriage requirements are considered applicable to RPA as written. While there are references to crew, these relate to the crew being informed about the dangerous goods or informing other parties. Again, RPAS operators would be expected to comply with the requirements.

The transportation of goods requires training, procedures and approval by the Authority.

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CHAPTER 5

CERTIFICATION PHASE

5.1 GENERAL

After the document evaluation and the demonstration and inspection phases have been completed satisfactorily, the CAA will prepare the RPAS Operator Certificate (ROC) and its corresponding operation specifications and limitations, which contain authorisations, exemptions, limitations and provisions specific to an operator's operation. The certificate holder is responsible for continued compliance with all CAA legislation and the operation specifications and limitations.

The process for amending operation specifications and limitations is similar to the certification process. In some cases it may be a less complex procedure depending on the subject of the amendment. The CAA is responsible for conducting periodic inspections of the certificate holder's operation to ensure continued compliance and safe operating practices. It must be noted that operating competence cannot be adequately judged until a sufficient period of demonstration of such competence is completed.

5.2 C of R/C of A

To be registered in San Marino the RPA must, whereas the RPS may, have type design approval for international operations and hold a Certificate of Airworthiness/Permit to Fly. It is envisaged that RPA will be required to have a type design approval in the form of a type certificate (TC) or restricted type certificate which would be issued to an RPA TC holder when it has demonstrated, and the State of Design has confirmed, compliance to an appropriate and agreed type certification basis.

Note: At present the agreed type certificate basis is USAR (Unmanned Systems Airworthiness Requirements) developed by NATO to STANAG 4671.

The distributed nature of RPAS also requires that the design approval scope expands from the RPA itself to include the RPS(s) (possibly of various types), the C2 link(s), as appropriate, and any other components of the system to enable safe flight from take-off to landing.

The type design approval must include instructions for continuing airworthiness (ICA) and operational documentation (e.g. flight manual). Any limitation associated with the type design that affects the function and operation of the RPAS may require specific restrictions, operating limitations and supplemental operational controls or provisions to achieve an acceptable level of safety for operation in international airspace.

In operation, the distributed nature of the RPAS implies that provisions to ensure the continued validity of an individual RPA C of A will need to address the RPS and specify other constituent components. The compliance demonstrations therefore also need to ensure that all components used during a flight are acceptable under the conditions of the C of A, including any instructions for ICA, maintenance and configuration control.

The C of A may be valid for up to 24 months in accordance with CAR 21.183.

5.3 RPAS OPERATOR CERTIFICATE (ROC)

5.3.1 General

The ROC grants the RPAS operator authority to conduct operations in accordance with the conditions and limitations detailed in the operations specifications attached to the ROC.

The issuance of an ROC by the State of the Operator is dependent upon the RPAS operator demonstrating an adequate organisation, method of control and supervision of flight operations, training programme as well as ground handling and maintenance arrangements consistent with the nature and extent of the operations specified and commensurate with the size, structure and complexity of the organisation.

The Authority has established a system for both the certification and the continued surveillance of the RPAS operator to ensure that the required standards of operations are maintained.

In addition to the normal insurance requirements regarding aircraft and third party etc., operators are reminded that they must comply with the provisions of European EC 785/2004 regarding insurance for operations worldwide and not just into Europe.

5.3.2 Amendments to the ROC

Any change to ROC (e.g. addition or change to RPAS models or any changes to the original ROC Operations Specifications must be applied for giving at least 30 days' notice. Addition of aircraft or change to operating area may require CAA inspection.

5.3.3 Renewal of ROC

[An application for a subsequent issue of an ROC must be submitted on Form SM 127 at least 30 days before the expiry of the current ROC. A fee for the renewal of a ROC is required. The ROC will be valid for up to 24 months and a re-certification will be conducted by the CAA.]

5.3.4 Oversight

The CAA will conduct oversight as follows;

(a) Organisation;

- An inspection of Returned Flight paperwork, Flight and Duty Time and Training Records and SMS within 6 months of the ROC renewal. The inspection will also examine the Safety and Quality activities. This will normally take place in the operator's offices or in San Marino.

(b) Operations;

- An inspection of the Company's operations involving a facilities and base operations check within 6 months of the ROC renewal.

(c) Airworthiness;

- An annual review of the Company's maintenance arrangements may be required.

- C of A inspection of the RPA and RPS if required (otherwise every two years).

(d) Training;

- A two yearly inspection of training arrangements, where applicable.

5.4 TYPICAL DOCUMENTS REQUIRED FOR ROC APPLICATION

	APPLICATION PHASE	TO BE ACTIONED BY	COMPLETED
1	[ROC application complete and correct (Form SM 116)]		
2	Schedule of events		
3	Postholder & management application(s) (Form SM 54)		
4	Legal documents/contracts/letters of intent/lease		
5	Operations Manual		
6	Dispatch Manual *(if applicable)*		
7	Aircraft Operating Manual, checklists & QRH		
8	Quality Manual *(if applicable)*		
9	Aircraft Flight Manual		
10	MEL (Refer Form SM 03) *(if applicable)*		
11	MCM		
12	Maintenance Manuals		
13	Maintenance programme		
14	Weight & Balance documentation		
15	Type certificate data sheet		
16	Noise certificate		
17	List of applicable Airworthiness Directives (AD)		
18	List of repetitive AD and compliance dates		
19	List of incorporated Service Bulletins		
20	List of incorporated STCs		
21	Summary of Life limited components		
22	Compass swing report		
23	Technical log book(s)		
24	Tech log/Journey log		
25	Insurance certificate		
26	Safety Management System (SMS) Manual		
27	Radio Station Licence		
28	Details of maintenance, training and dispatch facilities,		
29	Details of area of operation		
30	Details of Designated Airspace/AWO/RVSM requirements etc.		
31	Other supporting documentation		

Note: The CAA may accept a delay in the submission of some of the above information.

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ATTACHMENT 1

COMMAND AND CONTROL (C2) LINK

1.1 GENERAL

This chapter is sourced from ICAO Doc. 10019 and addresses the C2 link: the information flows and performance requirements, including quality of service, related to the transfer of data and information between the RPS and the RPA. Information contained in this Attachment may be required to be incorporated in the Operations Manual.

The C2 link typically supports the following communication tasks:

(a) control uplink to RPA: data to modify behaviour and state of the RPA;

(b) control downlink from RPA: data to indicate the position and status of the RPA;

(c) DAA uplink: sensor selection/control and, if applicable, auto response state select (on/off) and override (remote pilot option to cancel the manoeuvres);

(d) DAA downlink: sensor data and processed sensor information (related to traffic, weather, terrain, airport visual data, etc.), conflict alert and terrain/obstacle alert and manoeuvre advisories (MA) and, if applicable, DAA automatic response (initiation and description), etc.;

(e) data to support RPS handover, uplink and downlink; and

(f) data to support flight data recording requirements, uplink and downlink.

In addition, the C2 link must support a range of data link health monitoring functions, including a heartbeat, or positive and negative acknowledgements of messages exchanged in either direction. These could be used to provide data link status information to the remote pilot.

The C2 link technical solution offered by a manufacturer or RPAS operator must comply with availability requirements and may be implemented by a single data link or multiple redundant data links. It is anticipated that any payload data link requirements will normally need to be provided by an independent data link which does not use aeronautical protected spectrum.

In addition, ATC voice and data communication tasks may be relayed between the RPA and the RPS on the same C2 link. Specific requirements for ATC communications are addressed in Attachment 4.

(a) ATC voice communication relay (ATC to remote pilot via RPA);

(b) ATC voice communication relay (remote pilot to ATC via RPA);

(c) ATC data link relay (ATC to remote pilot via RPA); and

(d) ATC data link relay (remote pilot to ATC via RPA).

1.2 SCOPE OF PLANNED SARPS FOR C2 LINK

The C2 link provides the connection between the remote pilot and the RPA controls and may be considered functionally equivalent to, for example, the control wires or data bus between the cockpit and the control surfaces possibly via the FCC. The RPA must therefore use data links that can be assured to meet communication transaction time, continuity, availability and integrity levels appropriate for the airspace and operation. SARPs related to these parameters will be needed.

There will be multiple types of RPA and RPS on the market. Some types of operation may, from time to time, lead to an RPA from one manufacturer being controlled by an RPS provided by another manufacturer. The type certification must verify that all combinations of RPA and RPS that will become involved in such operations can coexist, interwork, i.e. exchange, C2 protocol syntax, and interoperate, i.e. act correctly on C2 protocol semantics,

1.3 C2 LINK ARCHITECTURE AND REQUIREMENTS

1.3.1 Introduction

C2 link architectures to support RPAS operations are usually classified as RLOS or BRLOS, which reflect both the type of architecture and the timeframe within which transmissions are completed.

RLOS. RLOS refers to the situation in which the transmitter(s) and receiver(s) are within mutual radio link coverage and thus able to communicate directly or through a ground network provided that the remote transmitter has direct RLOS to the RPA, and transmissions are completed in a comparable timeframe (see Figure 1-1). The timeframe within which transmissions must be completed for RLOS is not currently defined.

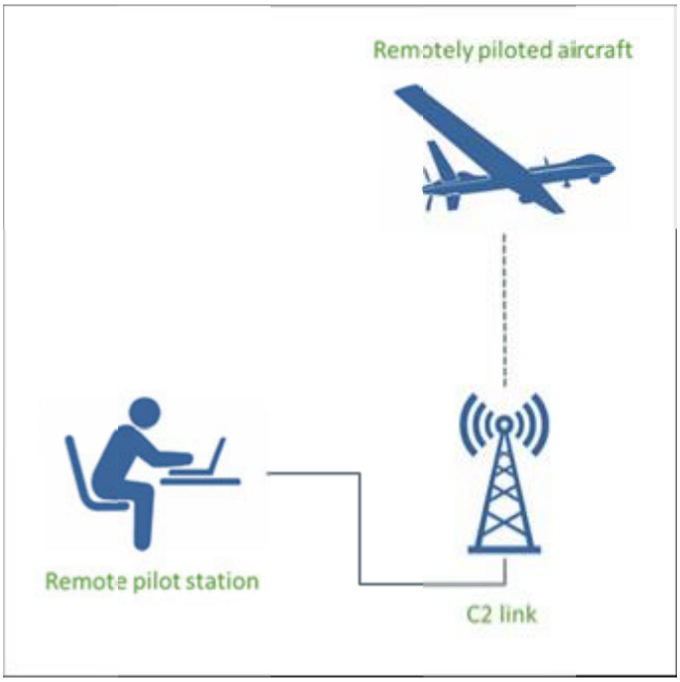

Figure 1-1. RLOS — RPS and RPA direct access

BRLOS. BRLOS refers to any configuration in which the transmitters and receivers are not in RLOS. BRLOS thus includes all satellite systems and possibly any system where an RPS communicates with one or more ground stations via a terrestrial network which cannot complete transmissions in a timeframe comparable to that of an RLOS system (see Figure 1-2).

Any system, RLOS or BRLOS, must meet required communications performance parameters for latency and availability established for the airspace and/or operation.

The BRLOS label provides no information about the network between the RPS and the satellite as shown in Figure 1-2. In the nominal case, there is a single satellite relay. Alternatively, a double satellite hop might be needed if it is required to go through a central gateway and if there is no ground link between the RPS and this central gateway. While the propagation delay of the satellite link is fully predictable, the total end-to-end link delay will depend on other factors as well, such as any ground-ground links in the path between the RPA and the RPS.

The key challenges of BRLOS, such as increased signal delay and the involvement of an external communications service provider, may also be present in some terrestrial networks, therefore putting them in the category of BRLOS.

It must be noted that there is no agreed term for situations where a satellite link is used as part of the "ground network" (described in RLOS) if the final link to the RPA is from a ground relay station located at a significant distance from the RPS.

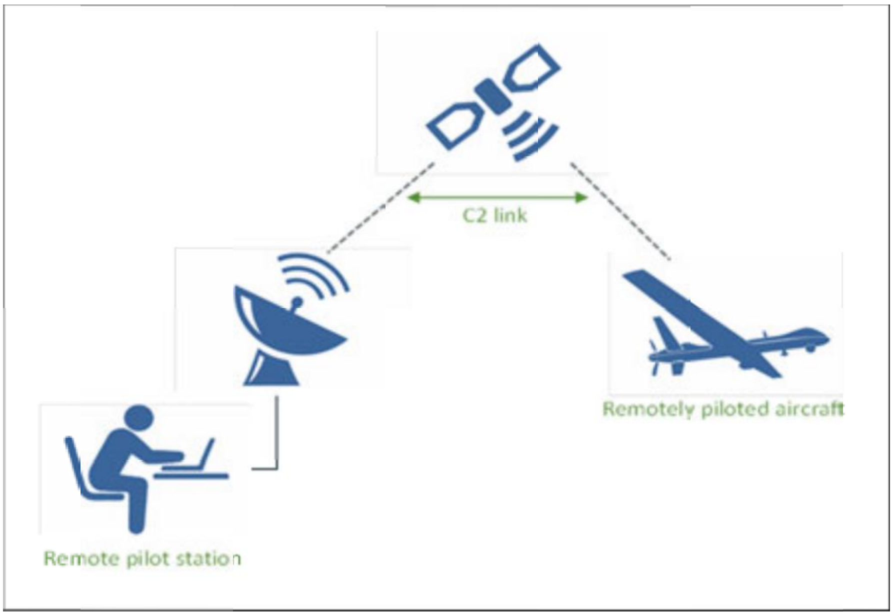

Figure 1-2. Example of BRLOS — RPS and RPA via satellite access

1.3.2 C2 link architectures

RLOS C2 link.

(a) collocated RPS and transceiver;

(b) single remote transceiver:

(1) linked to RPS via private network (RPAS operator controlled); and

(2) linked to RPS via a C2 service provider network;

(c) multiple remote transceivers:

(1) linked to RPS via private network (RPAS operator controlled); and

(2) linked to RPS via a C2 service provider network.

***BRLOS C2 link*.** Satellite or airborne relay:

(a) collocated RPS and satellite/airborne relay transceiver:

(1) private (RPAS operator controlled) satellite network:

(i) single satellite/airborne relay;

(ii) multiple satellite/airborne relay;

(2) C2 service provider satellite network:

(i) single satellite/airborne relay;

(ii) multiple satellite/airborne relay;

(b) remote satellite/airborne relay transceiver:

(1) private (RPAS operator controlled) satellite/airborne relay network:

(i) single satellite/airborne relay;

(ii) multiple satellite/airborne relay;

(2) C2 service provider satellite/airborne relay network:

(i) single satellite/airborne relay: and

(ii) multiple satellite/airborne relay.

Additional capability can be provided using:

(a) link architecture using dual simultaneous de-correlated links (e.g. using both RLOS and BRLOS or either dual RLOS or dual BRLOS with different frequency to increase link availability/quality of service); or

(b) link architecture using dual redundant active/standby de-correlated links (using both RLOS and BRLOS or either dual RLOS or dual BRLOS with different frequency to increase link availability/quality of service).

Note: While in principle, all of the above options could be used to support VLOS operations it is likely that most VLOS activities will use an RLOS option, with a collocated RPS and antenna, typically in a handheld configuration.

1.3.3 C2 link spectrum

The C2 link between the RPA and the RPS plays a major role in maintaining safety and regularity of flight of the RPA and the safety and efficiency of operation of proximate users of the airspace. Protecting the spectrum this link uses from harmful interference which could affect the availability, continuity and integrity of the information being transmitted between the remote pilot and the RPA is therefore a high priority.

The spectrum most protected from harmful interference that is available for this type of application is identified as route (R) service spectrum by the International Telecommunication Union (ITU). This class of spectrum is typically not shared with other non-safety of life services, is subject to the most rigorous technical analysis for harmful interference before new services are introduced into the spectrum or spectrum adjacent to these (R) service bands and is protected by international agreement so that effective action can be taken against anyone causing harmful interference.

In 2007 work began in the ITU to perform the necessary studies to identify spectrum for the RPAS C2 link. In accordance with ITU Radio Regulation, as of 2012 the following bands are potential candidates for RPAS C2 links:

(a) 960–1 164 MHz for RLOS;

(b) 1 545–1 555/1 646.5–1 656.5 MHz and 1 610–1 626.5 MHz for BRLOS; and

(c) 030– 5 091 MHz for RLOS and BRLOS.

Note: Other frequency bands, with suitable technical and regulatory provisions, may also be potential candidates for RPAS C2 links.

1.3.4 C2 link required communication performance (C2 link RCP)

The C2 link RCP concept is derived from *Manual on Required Communication Performance (RCP)* (Doc 9869) providing confidence that the operational communications supporting the RPAS functions that depend on the C2 link will be conducted in an acceptably safe manner.

The RCP values for the C2 link will need to be derived by the manufacturer specifically for the RPAS control and monitoring requirements including DAA.

The capability of the RPA, RPS, their control interfaces and any communications system connecting them, including the C2 link, as implemented by a manufacturer/operator, must comply with the RCP type parameters for the specific type of operation and phase of flight. The specific C2 link RCP values will depend on the design and performance characteristics of the RPA and RPS as determined by the manufacturer.

These parameters include

(a) *communication transaction time*: the maximum time for the completion of the operational communication transaction after which the initiator must revert to an alternative procedure;

(b) *continuity*: the probability that an operational communication transaction can be completed within the communication transaction time;

(c) *availability:* the probability that an operational communication transaction can be initiated when needed; and

(d) *integrity:* the probability of one or more undetected errors in a completed communication transaction.

If ATC voice and C2 messages are transmitted on the same data link, then the worst case combination of availability, continuity and transaction time must not reduce the minimum availability or continuity nor exceed the maximum transaction time of the most demanding RCP type.

The availability of the C2 link will be affected by the type of architecture used, the relative positions of the transmitter(s) and receiver(s) and the presence, or not, of rain or other forms of interference. Figure 1-3 shows example levels of availability that may be expected in several scenarios.

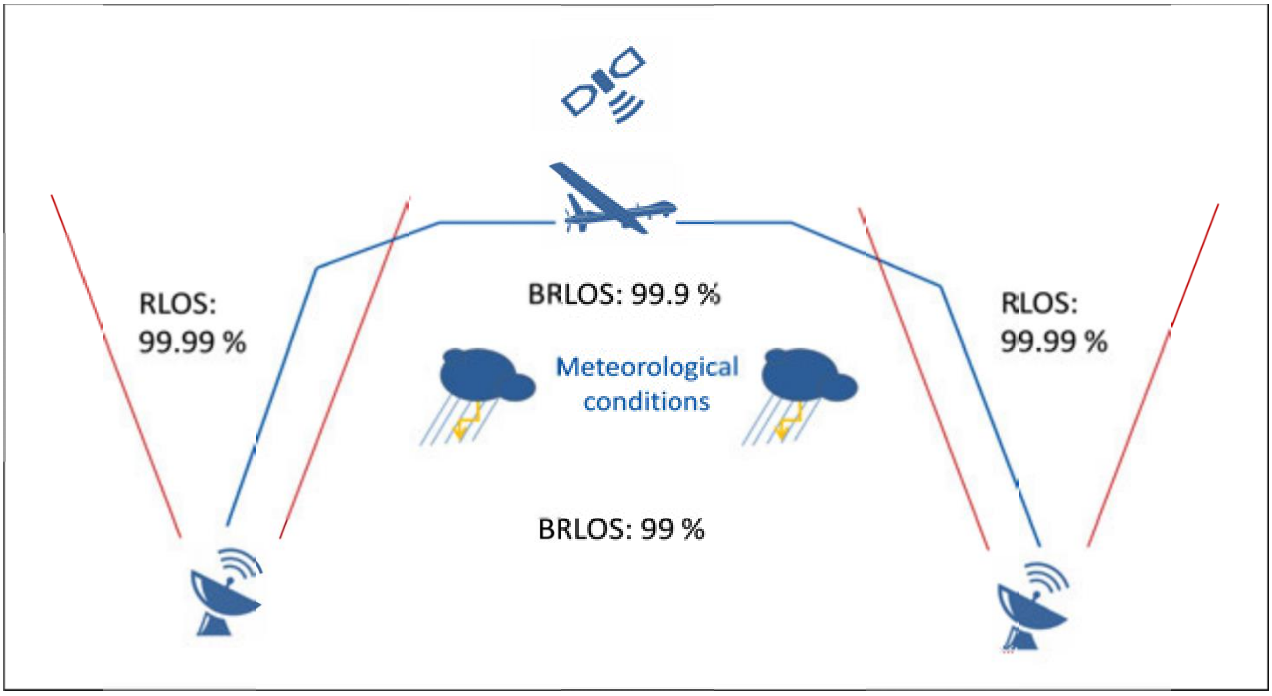

Figure 1-3. Example availability of the C2 Link

1.3.5 Implications of C2 link RCP value

The required C2 link performance parameters will be defined by the manufacturer/operator and agreed with the relevant regulator. The required performance of the link depends on the capability of the RPA and its control interface.

RPAS system design and operating procedures must be such that either:

(a) the loss of the C2 link will not lead directly to injury to people or damage to property; or

(b) the probability of loss of the C2 link due to all possible causes must be lower than the allowed probability of injury to people or damage to property.

1.3.6 Certification and operational approval of C2 link component and service providers

Regulatory oversight of the C2 link performance will be required to verify that the minimum standards are maintained. However, at the current time there is insufficient operational service history and certification experience with the RPAS C2 link to determine minimum standards. More detailed guidance and related SARPs can be expected as such operational service history and certification experience is gained.

When all the components of the link are under the direct control of the TC holder or RPAS operator, the components of the communication system will be certified by the civil aviation authority as part of the system. The type certification may be limited to certain types of operation and combinations of RPA, RPS and communication systems.

When some of the components are controlled by a C2 service provider, the C2 service provider will either need to be under safety oversight of a recognised civil aviation authority, or the safety aspects of the C2 link must be under the SMS of the RPAS operator who has contracted the service. In both cases, the C2 service provider must be acceptable to the State of Registry. This will be necessary to ensure that the end-to-end performance of the C2 link application, as required by the applicable RCP type, is achieved and maintained.

Communications services provided to support C2 and ATC/remote pilot voice services must meet the RCP criteria. The performance requirements of the communications services procured from a C2 service provider are defined by service level specifications (SLS) in agreement with the appropriate State authority. The SLS address the RCP parameters that are part of a service level agreement (SLA) entered into between the RPAS operator and the C2 service provider.

1.3.7 C2 link information flow

C2 link information flow requirements include update rate and support of specific data types. Information flows and related details will be RPA/RPS specific. The precise list of parameters and their format must be defined by the manufacturer/operator and agreed by the Authority.

1.4 C2 LINK MANAGEMENT PROCEDURES

1.4.1 Frequency/bandwidth

There will be a need to dynamically assign specific frequencies as required on a daily/hourly basis. The frequency assignment for the C2 link will need to accommodate the requirements for a specific area and the requirements of flights which transit from one area to another. This may become a particular challenge in areas where large numbers of RPAS operations are taking place. Without some form of regional assignment there is a risk of harmful interference.

1.4.2 Link discrimination

The use of a centralized network for C2 link communication provision may be a long-term solution to the challenge of dynamic frequency or channel assignment. This will eventually need international harmonization.

To provide unique link discrimination, a means must be provided to ensure that data transmitted via the C2 link are “coded” in a unique manner (e.g. the ICAO 24-bit address) in order to ensure that the RPA communicates only with the appropriate RPS.

1.4.3 Link and avionic system performance requirements

An RPAS C2 link allows the remote pilot to manage the flight. The required performance of the C2 link is dependent on the level of automation provided by the FCC or FMS.

The required performance of the C2 link is also dependent on the capability of on-board systems. For example, if the systems are capable of ensuring the safe flight of the RPA in the event of a short duration loss of the C2 link, the required performance may be lower.

These considerations will determine C2 link performance requirements and in turn the need for link redundancy.

1.4.4 Considerations for redundant C2 link

Configuration options include, “cold standby”, “hot standby” and “dual operation”.

(a) *cold standby*: where one link is working and carrying all the message traffic, the other link is powered down. In the event the first link is lost, before the standby link can be used, it needs to power up and initiate the link connection/log-in procedure to establish a connection to the other end of the link (e.g. at the RPS or RPA). This may involve a sign-in protocol with any third party network provider. The time delay associated with this procedure must be sufficiently short to avoid the need to trigger the lost C2 link procedure;

(b) *hot standby*: where both links are powered and connected and immediately available, although only one is being used to transfer C2 link data at any time. (The standby may be transferring low rate data to keep the link immediately ready to take over.); and

(c) *dual operation*: where all C2 link data messages are sent on both links simultaneously and the flight computer chooses the message from the link with the best integrity. This mode of operation minimises the probability that there will be an interruption in C2 link data flow in the event of a single link interruption or failure.

It is recommended that the two links employ different frequencies/technologies (e.g. terrestrial radio line-of- sight and satellite-based BRLOS) as this will provide significantly greater protection against possible loss of the C2 link. The remote pilot must be provided with a continuous indication of the operational status of all C2 links.

Note: There may be a case for having more than two links.

1.5 C2 LINK PROTECTION REQUIREMENTS

1.5.1 Non-malicious/unintended interference

The data link(s) must be robust enough to survive the modest levels of interference that will be present from time to time.

Due to the risk of interference of the C2 link, it is recommended that there be a means to test or confirm that no harmful RF interference is present prior to and during flight; this requirement also applies to VLOS operations.

1.5.2 Security threats/malicious interference

The requirements for protection against malicious interference of the data link need to be harmonized based on an assessment by the Authority.

The protection of the C2 link by encryption using security keys incurs a logistical overhead that requires careful management.

1.6 CHARACTERISTICS OF LOSS OF THE C2 LINK AND ASSOCIATED PROCEDURES

1.6.1 Background

The C2 link provides the connection between the remote pilot and the RPA controls and this control information is routed via one or more radio links, potentially via extensive communication networks, which may involve satellites. It is anticipated that, due to the nature of radio waves and the EM environment, at least for the foreseeable future, occasional degradation or even loss of the C2 link may occur. This is likely even when redundant data link architectures are provided.

In order to allow RPA to fly without undue restrictions, the RPA total system design must be such that loss of the C2 link, while it may restrict the operation of the RPA, must not result in a hazardous or catastrophic event (e.g. collision with another aircraft or uncontrolled collision with the ground or obstacle).

C2 link loss is considered to be any situation in which the RPA can no longer be controlled by the remote pilot due to the degradation or failure of the communication channel between the RPS and RPA. The degradation or failure may be temporary or permanent and can result from a wide range of factors. RPA or RPS faults, such as failure of flight control systems, are not considered as a loss of C2 link.

Whilst it is possible to suffer a unidirectional loss of communication, either uplink to the RPA or downlink from it to the RPS, this is less likely with a data link than with a voice link and must still be considered a lost C2 link situation. Depending on the communications architecture, C2 link loss may not be coincident with the failure of voice communications between the remote pilot and ATC. Three basic states can be envisaged:

(a) the C2 link works within the values specified in the RCP — the remote pilot is able to intervene as required;

(b) the C2 link works outside the limits of the RCP to the extent that control instructions are received without error but with a delay greater than the RCP allows — the remote pilot control is restricted, but providing the delay or unavailability persists for less than the sustained loss of link (Tsloss) functionality seconds, normal flight can be maintained. The value of Tsloss is dependent on the categories of control and potentially the phase of flight and the local airspace environment; and

(c) the C2 link is lost or is degraded to the extent that control instructions are delayed by more than Tsloss. Normal flight can no longer be assumed to be safe as the remote pilot cannot intervene; the RPA design and operational contingency procedures must be sufficient to ensure a safe and predicable landing (or flight termination).

1.6.2 Decoupling C2 link and CA

If the RPA is equipped with an automatic CA function, the function must be able to operate correctly in the event of a C2 link loss. In this case, the required C2 link RCP would be independent of the required integrity and availability of the CA function. However, in a lost C2 link situation, the potential for remote pilot initiated traffic avoidance/separation manoeuvres or manual CA capability will not be available. This may need to be considered when determining the required availability and integrity of any automatic CA function.

1.6.3 Differentiation between loss of C2 link and failure of ATC voice communications

Loss of the C2 link must not be equated with a failure of voice communications with ATC. When voice communications with ATC fail, and depending on the communications architecture of the RPAS, the RPA will likely still be under the remote pilot's command, e.g. the remote pilot may still be able to manage the flight of the RPA. However, when there is a loss of the C2 link, the remote pilot cannot intervene in the flight's trajectory, and the RPA will be limited to performing automated actions. It is recommended that States harmonize the procedures including the actions pre- programmed into each RPA to best ensure that the safety of the air navigation system is maintained if the C2 link is lost.

Different procedures may be required for C2 link loss and ATC voice communications failure events; it will be necessary for ATC to be able to distinguish between these situations. In airspace where SSR transponder carriage is required, this can best be achieved by use of a dedicated SSR code. ADS-B emergency/urgency modes may also be used.

1.6.4 Possible causes of C2 link loss

There are a range of possible causes of RPS to RPA C2 link loss which are linked to architecture, environment as well as equipment characteristics. These include:

(a) screening terrain, buildings and (at low altitude) vegetation, other ground clutter and ocean wave effects;

(b) natural interference (meteorological conditions and space weather);

(c) unintentional interference by human activities (e.g. television broadcast);

(d) malicious or intentional interference (e.g. jamming) by humans;

(e) out of range (often linked to flying too low);

(f) equipment failure on the RPA;

(g) equipment failure in the RPS;

(h) equipment failures in the network (e.g. satellite);

(i) human error in the RPS (e.g. frequency setting, switches);

(j) aircraft manoeuvres (attitude-induced antenna screening, velocities and acceleration effects); and

(k) loss of the link resulting from a failed RPS/remote pilot handover operation.

Some of these effects may persist for short periods of time (less than 1 second) while others may endure for several minutes or may be permanent. In general, information on cause of the loss of a C2 link will not be available, although with appropriate monitoring systems the remote pilot may be able to infer the likely cause.

The following are not considered lost C2 link situations (although they will need to be considered in an overall safety assessment):

(a) erroneous messages on the C2 link resulting from undetected RPS faults;

(b) erroneous messages on the C2 link resulting from undetected RPA faults;

(c) failure of one link in a dual redundant C2 link implementation — this must trigger an appropriate reversionary procedure (but not the lost C2 link procedure). The remote pilot must be provided with suitable status indications;

(d) system failures in the RPA or RPS which result in the RPA no longer being able to maintain controlled flight; and

(e) short-term planned interruption of the C2 link during handovers.

1.6.5 Criteria for identification of lost C2 link condition

Degradations in the C2 link transaction time and availability from whatever cause will, if severe enough, result in a lost C2 link condition. The lost C2 link procedure must be initiated once the C2 link cannot be used to control the RPA (regardless of whether the remote pilot is attempting to use the link at the time).

Partial degradation of the performance of the C2 link (typically characterized by an increased delay in the end-to-end transmission of a control instruction), which still allows safe control of the RPA, must not trigger the lost C2 link procedure. However, it will be up to the RPAS TC holder to agree with the certifying authorities on the maximum level of degradation that can be allowed before the lost C2 link procedure is initiated.

Temporary interruptions to C2 link transmissions can occur at times due to normal variations in the strength of the received signal. The duration of these interruptions can span from very small fractions of a second to minutes or even longer. Short-term interruptions must not have any significant effect on the flight and may not even be noticed by the remote pilot. It is clearly impractical for a lost C2 link procedure to be initiated for such events.

While the C2 link is not available, the RPA is flying in a state where it is “not under the command” of the remote pilot, and there will be a time period beyond which continued flight in this manner may not be considered acceptable. It is therefore important to determine the point at which a C2 link must be declared as being lost, (e.g. by display of a lost C2 link SSR code) at which point the lost C2 link procedure is initiated. This time period may need to be standardized; it must be long enough to minimise nuisance alerts but also be short enough to ensure that the safe operation of other airspace users is not compromised.

From an airworthiness perspective, it will be up to the RPAS TC holder to agree with the certifying authorities on the maximum duration of interruptions which can be allowed before the lost C2 link procedure is initiated. From an ATC voice communication perspective, if relayed via the C2 link, the acceptable duration of interruption may be different and will need to be agreed by the competent authority responsible for operational approvals.

The supporting C2 link monitor functions (in the RPA and RPS) must automatically detect the agreed level of degradation. The maximum allowed degradation will usually depend on the airspace and the type of operation as well as the control interface available or in use. Operations near busy aerodromes and manual landings will be more critical than during cruise flight in class A, B or C airspace. The monitor must, as a minimum, detect total C2 link unavailability and end-to-end message delays of Tsloss.

The hazards associated with loss of the C2 link during particular phases of flight (e.g. the final stages of a manually controlled approach) will need to be assessed and mitigated by the RPA manufacturer. The C2 link RCP may, as a result, be more demanding for particular flight phases and may preclude the use of some communication networks.

The RPA and the RPS will need to continuously monitor the C2 link for degraded operation.

Note 1: The indication of the C2 link status to the remote pilot must be updated at a sufficient rate to ensure that C2 link RCP (for the phase flight) can be correctly monitored.

Note 2: The lost C2 link procedure provides no protection against undetected errors in a completed communication transaction. The probability of undetected errors must be sufficiently low that when combined with the severity of any possible outcome, the resulting probability of a catastrophic event is acceptable.

1.6.6 Intermittent link degradation

Short-term degradation of C2 link performance of less than Tsloss must not result in the initiation of the lost C2 link message to ATC (e.g. SSR code, if equipped); however, such dropouts may indicate a reduction in the overall quality of the C2 link. Repeated, intermittent degradation of the C2 link, even if only for a short duration, must be assessed by the remote pilot with regard to the acceptability of continuing the planned flight.

Such conditions may require the remote pilot to initiate the lost C2 link procedure, even while some partial link availability exists in order to maintain a safe, predicable and ATC-compliant flight.

1.6.7 Selection and notification of alternate aerodromes in the event of a lost C2 link condition

For long distance flights, there may be several alternate aerodromes identified for use in the event of a lost C2 link. Selection of the alternate to be used will depend not only on the RPA's position but also on the meteorological conditions at the aerodromes. The remote pilot is responsible for selecting the alternates. During the flight, based on position and latest meteorological information, the remote pilot must update the current alternate aerodrome in the RPA FMS so that in the event of a lost C2 link, the RPA's expected route will be predictable.

Once a lost C2 link condition occurs, the remote pilot is responsible for informing ATC which of the available lost C2 link alternate flight options will be executed by the RPA. Therefore, it is likely that the criteria for selecting lost C2 link alternate flight options will need to be agreed by ATC on a case-by-case basis until ATC has confidence in the process. It may be possible to use the Mode S data link to provide the information to ATC.

1.6.8 Discussion of lost C2 link contingency options

There are five basic contingency options to be considered by the RPAS operator, State authorities and ANSPs for action following a loss of the C2 link. Decisions regarding the option to be taken may be different depending on the segment of flight where the failure occurs, the type of RPA and its risk to other airspace users, as well as persons and property on the ground. In all cases, the contingency option(s) must be pre-programmed, although generally not hardwired, into the RPA for automatic activation when specified conditions are met.

(a) *continue original flight plan:* this may be appropriate if the planned flight is short and the planned destination is a low density aerodrome or landing site or if the planned flight occurs in low density airspace. However in general, this option could result in the RPA flying "not under command" for long duration (or even days), crossing numerous national borders, and ultimately attempting to approach and land at a congested aerodrome under meteorological conditions (wind direction and speed and visibility) different from those expected when the flight commenced. As a minimum this would imply a high integrity flight management function.

(b) *land at nearest appropriate designated landing site*: this ensures that the duration of the RPA flight when not under command is minimised and that the landing site used has agreed to approach and landing by RPA that are not under command. (The nearest appropriate diversion/alternate aerodrome or landing site may, depending on the characteristics of the flight, be the planned destination or departure aerodrome or departure site);

(c) *direct return to departure aerodrome or departure site*: this has the same issues as option a) in that the RPA may be many hours flying time from the departure aerodrome or departure site, which may no longer be able to accept an automatic not under command approach. As indicated in option b), in some situations the departure aerodrome may be the nearest appropriate designated landing site;

(d) *flight termination*: in general, immediate termination of the flight must be avoided as it presents a risk to people and property on the ground, a risk to other airspace users as it descends and can result in hull loss. However, this option may be specified by regulators in certain situations; and

(e) *climb to altitude to attempt to regain the C2 link*: this may not be acceptable in controlled airspace if the ATC unit is not provided sufficient time to clear other aircraft from the area, thus posing a significant risk to other airspace users. While this could be undertaken as an agreed contingency plan (e.g. fly to a known point and then climb 5 000 feet in an effort to recapture the C2 link), there are many scenarios where this would not be effective and an alternative procedure would have to be initiated.

Given the above, it is expected that option (b) is preferred for most RPAS operations.

1.7 RECOVERY OF THE C2 LINK

1.7.1 When flying under an ATC clearance

If the C2 link is recovered after the lost C2 link procedure was initiated, the remote pilot must coordinate with ATC prior to taking any action to alter the trajectory of the RPA. A revised ATC clearance must be obtained which could allow the original flight plan to be resumed.

Note: In event of loss of the C2 link, it must be assumed that RVSM and performance-based navigation (PBN) are no longer available as these performance requirements can only be maintained if actual performance is continuously monitored by the remote pilot(s).

1.7.2 Flights not under ATC control

In the event of C2 link recovery, the remote pilot is responsible for deciding on the appropriate course of action, taking into account the overall situation, the likely reliability of the C2 link and the risk to other airspace users. The general principles of remaining predictable to other airspace users and minimising the time of flight while not under command must be adhered to.

1.8 C2 LINK INFORMATION FLOW

C2 link information flow requirements include update rate and support of specific data types. Examples of typical information flows and given in (a) to (c); the details are RPA/RPS specific. The precise list of parameters and their format are for the manufacturer/operator to define and agree with the Authority.

(a) uplink information flows (RPS to RPA):

(1) aircraft and flight management control commands such as inputs to control surfaces and throttle(s); motion or flight status inputs into an FCC, and waypoint data into an FCC:

(i) stick and throttle signals (if used or provided for reversionary operations);

(ii) heading, altitude, speed, climb and descent rate inputs (if used);

(iii) waypoint data;

(iv) pressure altitude;

(v) ATC RF changes (sector handover);

(vi) SSR transponder code changes;

(vii) detect and avoid (DAA) control parameters;

(viii) fuel and other aircraft system management required for the specific aircraft;

(2) additionally, for long duration flights, updates of information may be required such as flight plan, navigation database, NOTAMs and meteorological information for alternate aerodromes or landing sites, RPS handover:

(i) flight plan update;

(ii) navigation database — updates in flight may be necessary for long duration flights;

(iii) NOTAMS — updates in flight may be necessary for long duration flights;

(iv) meteorological updates for alternate aerodromes;

(v) RPS handover information, including aircraft status, could include flight plan and accepting RPS status (if the handover information exchange is conducted over the aircraft relay);

(vi) when an airborne network is used, data are necessary to support its operation;

(b) downlink information flows (RPA to RPS):

(1) information on flight status, including engine, navigation, C2 link, DAA, etc. With the lack of sensory information such as attitude and motion, attitude information is important. Requirements for communication transaction time and update rate must be assessed depending on categories of control;

Note: Under VLOS operation, the high rate downlink may not be required.

(i) system status: data link(s), engine(s), fuel quantity/electric power, hydraulics, etc., as required, and if used, communication relay network status;

(2) situational awareness:

(i) navigation status including position and sufficient information to allow RVSM and RNP status to be monitored, if applicable;

(ii) DAA information sufficient to recognise and interpret;

(A) aerodrome markings;

(B) visual signals (interception);

(C) terrain proximity;

(D) severe meteorological conditions including turbulence, icing, etc.;

(E) wake turbulence;

(F) distance from cloud (to enable determination of flight conditions);

(G) flight visibility (to enable determination of flight conditions), traffic awareness and, under VFR, "visual" separation, RWC and collision avoidance (CA).

Note: The downlink of raw imaging sensor data is unlikely to be feasible due to bandwidth limitations. It is likely that sensor data will need to be processed on board before being transmitted to the remote pilot.

(3) data recording:

(i) the specific requirements for data recording will depend on the classification of the RPA;

(ii) the C2 link must support the downlink of all the parameters that will be required to be recorded on the ground, at the appropriate rate;

(iii) some data will be required to be recorded on board the aircraft;

(iv) as a result, a trade-off between data link bandwidth/on-board recording capacity and data availability in the event of C2 link loss/non-recoverable aircraft, needs to be undertaken;

(c) special information flows:

(1) specific information flows to support RPS handover including:

(i) exchange of relevant documents (e.g. flight plans, RPAS operating manual, RPA flight manual, journey log book, maintenance log book(s));

(ii) information exchanges between the two RPS and the RPA in order to manage the RPS handover;

(2) use of C2 link for applications not directly related to the control of the aircraft;

(i) criteria need to be agreed for determining the acceptability and the potential amount of additional data that is acceptable on the C2 link;

(3) in order to ensure safe operation, the update rate of the information provided on the link must, as a minimum, be sufficient to support:

(i) management of the flight including situational awareness;

(ii) information to compensate for the loss of pilot sensory inputs (noise, vibration etc.), if required; and

(iii) data recording and handover support.

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ATTACHMENT 2

ATC COMMUNICATIONS

2.1 OVERVIEW

Information contained in this Attachment may be required to be incorporated in the Operations Manual. The general requirements for ATC communications, to and from the remote pilot, are the same as for manned aviation operating in the same airspace. In addition to very high frequency (VHF) voice, this may also include the requirement to support ATC data link. However, because the remote pilot is not on board the aircraft, a range of alternative communication architectures are possible which are outlined in 2.2 to 2.4.

Whichever architecture is employed, the ATC communications function will be expected to meet the RCP specified for the airspace in which the RPA is operating. In the case that ATC communications are relayed via the RPA, a reversion/backup means of communication with ATC may be required in order to mitigate any failure of the RPA relay function.

If approved by the ATC unit(s) involved, this could include a telephone backup. Where connections to ATC are discussed, the ATC “system” is assumed to include any already approved communications service providers as appropriate.

2.2 ATC VOICE AND DATA LINK COMMUNICATIONS ARCHITECTURE OPTIONS

The communications links between ATC and remote pilot, RPS and RPA may be implemented by any network service that meets the required communications performance, e.g. a private network or a service provided by a third party. The various options for providing voice and data communications between ATC units and the remote pilot are divided in two main groups:

(a) via the RPA, which is transparent to ATC and requires no additional infrastructure or equipment in the ATC unit. This approach also has the advantage that it is compatible with existing ATC operations across the globe. However, it may require more communications bandwidth on the C2 link to support the ATC voice and data relay between the RPA and the remote pilot; or

(b) via a new broadcast, private or networked communications link, directly between the ATC unit and the remote pilot.

Note 1: All of these communications options can apply to either VLOS or BVLOS operations.

Note 2: Where all the new elements of the communications system are under the direct control of the RPAS operator, the regulatory approval of the system may be simpler than if a third party commercial network is used.

2.3 VOICE AND DATA TO/FROM THE RPS, RELAYED VIA THE RPA

RLOS operations may be conducted using the RPA as a relay point for ATC voice and data communications.

In this case, the C2 link may be used to support the segment between the RPA and the RPS. This RLOS option requires at least one VHF radio on board the RPA and assumes that the C2 link has the bandwidth to support the ATC voice and, if required, data communications, e.g. CPDLC (see Figure 2-1).

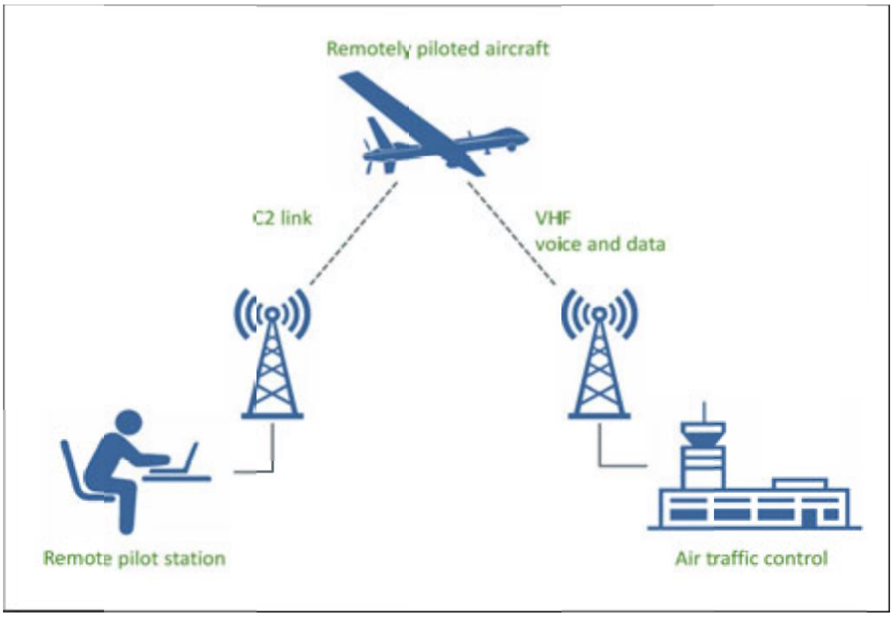

Figure 2-1. Radio line-of-sight

The standard minimum equipment requirement for manned aircraft (for operation where a radio is required) is for two VHF radios to be carried. However, this may be revised for RPAS if an additional independent communications channel between the ATC unit and the remote pilot is available or required. This will enable ATC/remote pilot communication in the event that the primary communications route fails. Such a failure may be caused by VHF equipment failure or by failure of the C2 link used as the relay.

In this scenario, VHF voice messages from the ATC unit to the remote pilot are received by the RPA, digitized and relayed to the RPS via the C2 link. Remote pilot voice messages to the ATC unit are digitized in the RPS, sent to the RPA via the C2 link, converted to analogue voice and transmitted via the VHF radio (see Figure 2-2).

It is important to note that there may be a data communications network between the ATC unit and the VHF antenna used to broadcast the message to the RPA. The link between the RPA and RPS may also include a network operated by a communications service provider and potentially involve routing via multiple satellites. These networks can introduce additional delays which need to be included in the assessment of overall communication transaction time (see Figure 2-3).

A particular feature of the ATC communications BRLOS relay approach, as with any situation where ATC communications is routed through the RPA, is that it is universal and must operate seamlessly anywhere in the world, without changes to local infrastructure being required. Although this provides a long-range capability from a single RPS, it may be more difficult to achieve the necessary RCP (transaction time, continuity, availability and integrity) compared to the short-range RLOS situation.

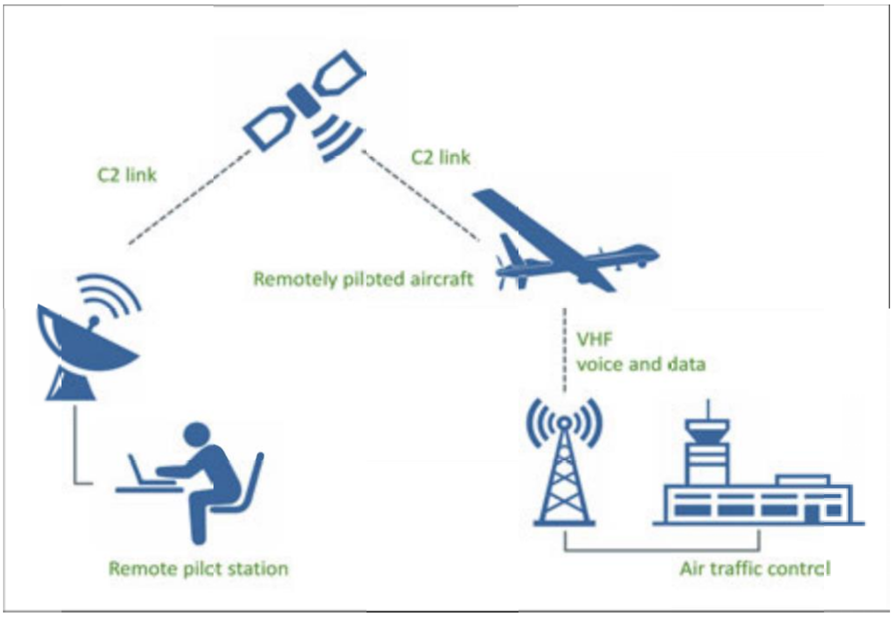

Figure 2-2. Beyond RLOS (BRLOS) via a relay (typically via satellite)

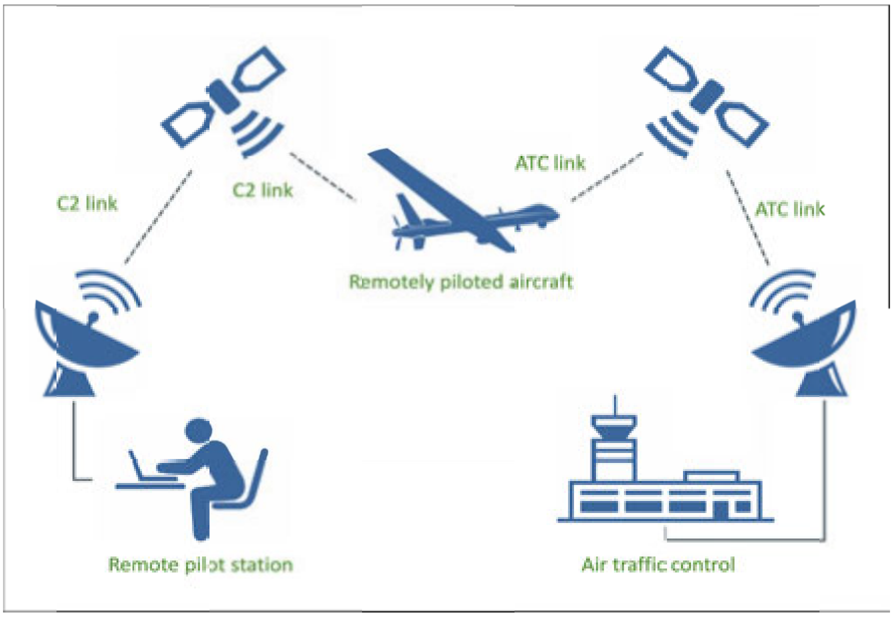

Figure 2-3. Oceanic/remote area operations, ATC voice and data via satellite

Existing third party networks contracted by relevant ATC authorities are already approved to the required ATC RCP levels; however, because of the additional transmission path from the RPA to the RPS, these levels may need to be reviewed.

2.4 ATC VOICE AND DATA TO/FROM THE RPS WITHOUT A RELAY VIA THE RPA

These options do not require a VHF radio on the RPA and use direct or indirect (through a service provider network) communications pathway between the ATC unit and the remote pilot. A key requirement of this approach is that the solution is transparent to the controller (i.e. the controller's procedures and actions remain the same as for the management of manned aircraft). Although new equipment would be required at the ATC unit, no additional operational requirements relating to the communications architecture must be apparent to the ATCO.

Whenever possible, the party-line effect provided by VHF voice must be maintained to ensure that all voice communications between the remote pilot and ATC are broadcast on the sector frequency for other airspace users to hear, and all voice communications on the sector frequency must be available to the remote pilot. This assists the remote pilot in building and maintaining situational awareness in the airspace.

There are a number of possible architectures:

(a) ATC voice on the sector frequency received directly from a VHF radio in the RPS (see Figure 2-4):

(1) this is the simplest alternative to using the RPA as a relay and can be suitable for short range operations. The RPS is connected to a VHF radio antenna located within range of the ATC unit antennas for the airspace in which the RPA is intended to be flown. The link between the RPS and its antenna could be a short, direct line or be routed for longer ranges via a network. This is likely to be very effective where the RPA is routinely operated in one location. Additional RPS antennas will be required to support operation in larger ATC airspaces;

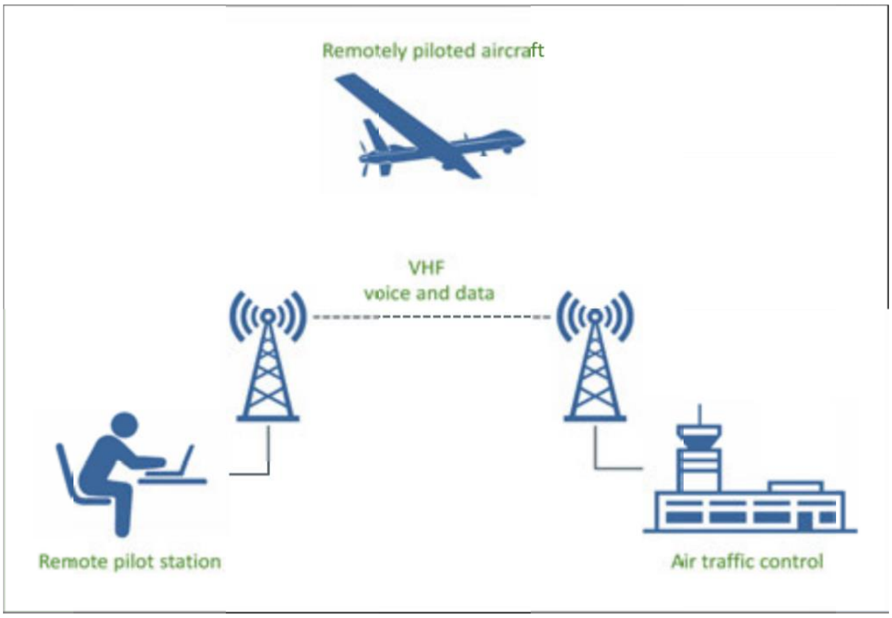

Figure 2-4. VHF ground to ground radio link

(b) ATC voice and data to/from the RPS via a dedicated/private connection (see Figure 2-5):

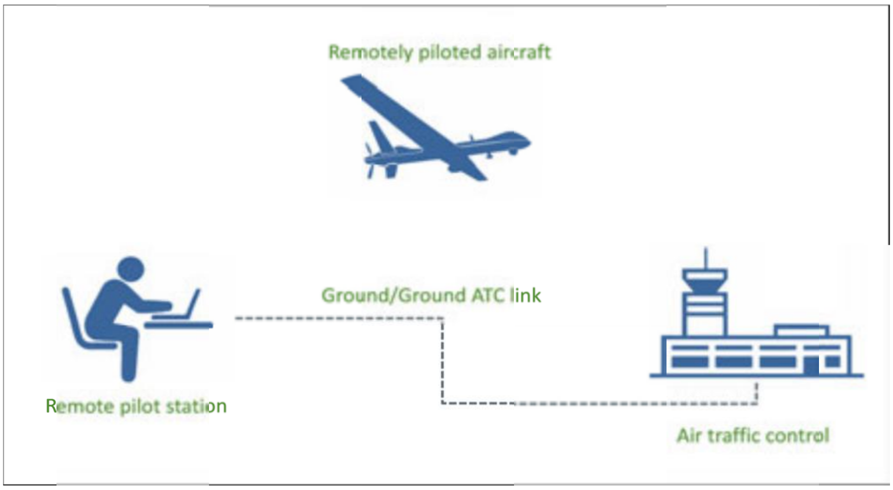

Figure 2-5. Ground only network

(1) this requires a direct interface into the ATC unit's voice control system such that when the ATCO communicates on a frequency, the information is captured, digitized (along with any CPDLC messages) and relayed to the RPS via a dedicated connection, with a similar arrangement for communications from the RPS to the ATC unit. Systems or procedures must be provided to ensure that the voice input from the RPA does not have higher priority than normal VHF transmissions;

(2) a key advantage of this option is that the location of the RPS is not constrained and, providing the logic in the ATC unit will support it, the RPA can operate anywhere in the full volume of airspace supported by the ATC unit;

(3) a simple phone link (hand-held receiver) may not be acceptable as the primary communications between RPS and ATC. The overall integrity and availability of the link used may need to be approved by the appropriate aviation authority;

(4) as for all alternate architectures, the remote pilot will be expected to have an appropriate alternative method of communicating with the ATCO in case the primary link fails. The ATCO must also have a means of contacting the remote pilot when necessary (e.g. the phone number of the RPS provided prior to the flight);

(c) ATC voice and data to/from RPS via a communications service provider network (see Figure 2-6):

(1) This approach is the same as the previous option except that it involves a third party communications service provider. In practice this option, rather than the previous one, is likely to be more generally employed, except in situations where the local ATC service provider provides, under its own responsibility, ground links for the RPAS operator to tap into;

(2) this will again require specific equipment to be installed in the ATC unit and while it would be effective within the airspace covered by a specific unit, it would not easily support crossing ATC sectors, especially if these were planned at short notice;

(3) some reversionary/backup capability is still likely to be required; however, possibly only dual redundant terminals in the RPS, if the communications network has sufficient integrity (e.g. based on multiple communications paths);

(4) the key challenge with this option is regulatory oversight of the communications service provider, especially if this is under contract with the RPAS operator rather than with the ANSP. However, the oversight/approval challenge for the ATC communications link will typically be less than that for the C2 link, given the expected higher RCP for C2 link than for ATC communications; and

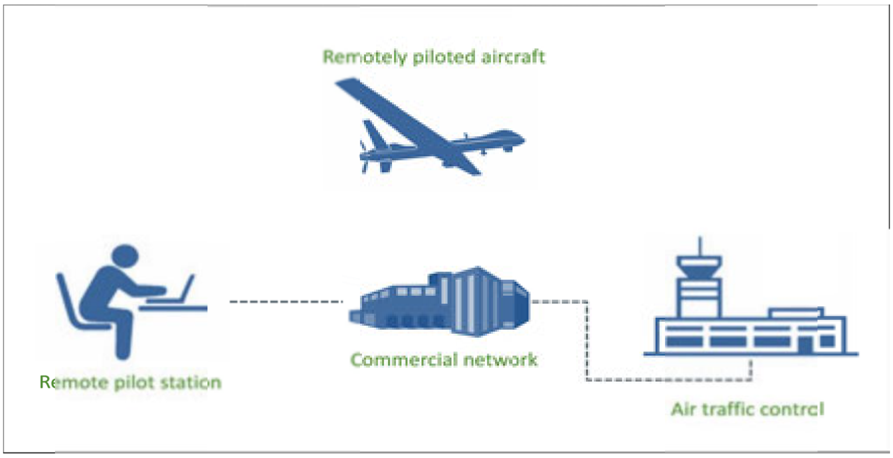

Figure 2-6. Ground link via communications service provider

(5) one feature of communications service provider networks is that they may involve a range of technology and links to provide the service, which could involve the use of the internet and or satellite networks (see Figure 2-7). Certification of such systems is expected to be very difficult and procedures for appropriate regulatory oversight are still to be developed. One specific concern may be the use of different routes (e.g. terrestrial or satellite) based on the logic internal to the service provider's system. Guaranteeing a particular RCP may be difficult with such a system.

2.5 SPECIFIC COMMUNICATION REQUIREMENTS FOR OPERATIONS IN VLOS

Most VLOS operations will be operated either below the altitude where ATC communications is required or in situations where ATC prior approval and operating constraints have been agreed, making routine ATC communications unnecessary. However, ATC may still require a method to contact the remote pilot in an emergency, and the remote pilot must know how to contact the local ATC unit if the need arises. In both cases this would normally be achieved by telephone.

In exceptional circumstances for particular operations (e.g. low level surveillance of an active airfield), direct communication between the ATC unit and the remote pilot may be required. In these cases, any of the architectures outlined above for BVLOS operations could be used although ground/ground VHF voice is likely to be the most appropriate).

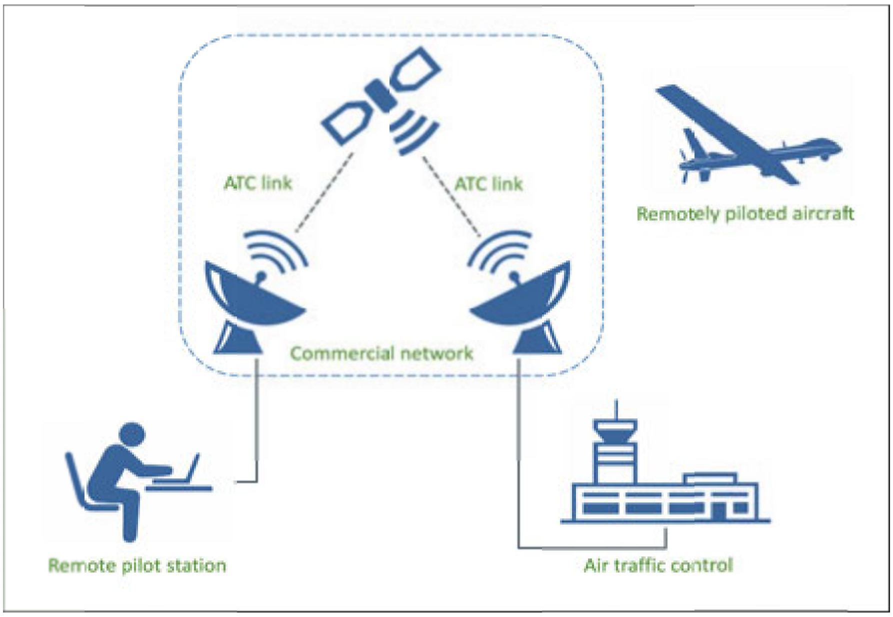

Figure 2-7. Including satellite network

More frequently, it may be appropriate for the remote pilot of a VLOS RPA to broadcast a short range (i.e. low power) periodic message to other unspecified airspace users to warn them of the ongoing operation. This would normally be on the recommendation of the local regulators.

2.6 ATC COMMUNICATIONS — REQUIRED COMMUNICATION PERFORMANCE (RCP)

In order to provide a means for assessing the performance requirements of ATC communications in support of RPAS operations, the principles of the RCP concept described in Doc 9869 must be employed. This is based upon "operationally significant" benchmarks which, when attained, provide confidence that the ATC communications will safely support the RPAS operations. The values for a specific C2 link RCP will depend on:

(a) the requirements of the specific airspace;

(b) the phase of flight; and

(c) The degree of automatic operation of the RPAS.

An assessment of RCP has been made for ATC communications data links, and it is expected, taking into account the implications that the various RPAS link architecture options may have on communication transaction time, continuity, availability and integrity of the total system, to accommodate RPAS ATC communications within the current requirements.

The ATC RCP provides the end-to-end performance requirement based on the assumption that the pilot is in the aircraft. For RPAS, the additional relay of the message via the C2 link to the remote pilot (if used) must be included in the assessment of the RCP.

2.7 MINIMUM COMMUNICATIONS AIRBORNE EQUIPMENT

Aircraft must meet the minimum number of short- or long-range radio equipage requirements to be carried on board, as established by the competent authorities.

These rules imply that, in principle, different technologies could be used to satisfy the requirement on- board manned aeroplanes (e.g. one set of satellite communication (SATCOM) and one set high frequency (HF) could be approved in regions where both services are available for routine communications along oceanic routes).

In the case of RPAS, since the remote pilot and the RPS are not installed in the RPA, the competent authorities may consider whether alternative ATC VHF radio equipage requirements may be utilised. For example, one radio on board and a second alternative communications path between the RPS and the ATS unit(s) could provide the necessary redundancy.

In principle, installed equipment must be operational when commencing a flight. However, experience has demonstrated that temporary unserviceability may, in some cases, be tolerated. In such cases, the MMEL must be complied with. The MMEL contains a list of equipment which can be tolerated as unserviceable at commencement of flight and for how long. The MMEL is approved by the authority designated by the State of Design. The MMEL for RPAS relating to communications equipment will likely be related to the specific communications architecture adopted. Requirements for C2 link and ATC communications will need to be specified separately although depending on the architecture, they will not, necessarily, be independent.

Remote aircraft operators may be required to establish a minimum equipment list (MEL), based upon, but no less restrictive than, the relevant MMEL. The MEL is approved by the Authority as the State of Registry. If changes to the MEL to allow dispatch are desired, the operator must obtain operational approval or at least notify the change to the Authority as the State of Registry.

ATTACHMENT 3

REMOTE PILOT STATION (RPS)

3.1 OVERVIEW

The RPS is defined as "… the component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft." As a general principle, the RPS functions in the same manner as the cockpit/flight deck of a manned aircraft and must therefore offer the remote pilot an equivalent capability to command/manage the flight.

While the basic functions are similar to those of a manned cockpit/flight deck, the specific shape, size, contents and layout of any RPS will vary due to aspects such as:

(a) the type of operation conducted (VLOS or BVLOS);

(b) the complexity of the RPAS;

(c) the type of control interface used;

(d) the number of remote pilots required to operate the RPA; and

(e) the location of the RPS — fixed position on the ground or within another vehicle/platform (e.g. ship or aircraft).

This Attachment outlines specific factors that must be taken into account when considering the design and operational use of an RPS. It covers both the technical and the operational aspects (e.g. displays and controls). In addition, due to the likelihood that a significant proportion of RPAS operations will be involved in aerial work, often of long duration, it will be important to ensure that the separation of any piloting and payload (e.g. sensors) operations/displays/controls is appropriately considered, particularly if the remote pilot is intended to become involved in any aspect of the payload operation. Information contained in this Attachment may be required to be incorporated in the Operations Manual.

3.2 FUNCTIONAL OVERVIEW

The RPS provides the means for the remote pilots of the RPAS to monitor and control the operation of the RPA both on the ground and in the air. However, the interface between the remote pilot/RPS and the RPA is via a C2 link. The RPAS must therefore be designed to provide the remote pilot with the tools necessary to effectively manage the flight. This may result in controls, displays and alarms that are different from those of manned aircraft with consequences for remote flight crew procedures, training and licensing as well as the airworthiness requirement of the components. Notwithstanding these potential differences, the fundamental requirements of the remote pilot/RPS interface remain the same as for manned aircraft and can be summarized as follows:

(a) the design of the controls and control systems must be such as to minimise the possibility of mechanical jamming, inadvertent operations and unintentional engagement of control surface locking devices;

(b) the design of the RPS must be such as to minimise the possibility of incorrect or restricted operation of the controls by the remote flight crew due to fatigue, confusion or interference. Consideration must be given at least to the following:

(1) layout and identification of controls and instruments;

(2) rapid identification of emergency situations;

(3) sense of controls; and

(4) ventilation, heating and noise;

(c) means must be provided which will either automatically prevent or enable the remote pilot to deal with emergencies resulting from foreseeable failures of equipment and systems, the failure of which would endanger the aircraft; and

(d) markings and placards on instruments, equipment, controls, etc., must include such limitations or information as necessary for the direct attention of the remote pilot during flight;

Additionally, for BVLOS RPS:

(e) adequate information on the environment in which the RPA is operating to provide the remote pilot sufficient situational awareness to enable the safe operation of the RPA. These displays must include those necessary to support the DAA functions.

Controls and displays provided within the RPS must meet appropriate human performance principles/requirements.

RPS systems and displays will not necessarily be required to comply with manned aircraft flight deck level environmental standards; however, they will have to meet appropriate reliability, integrity and environmental requirements, as determined by the Authority.

Performance of the C2 link will likely limit the controls and displays available to the remote pilot. In particular, certain traditional controls such as the stick and throttle may not be provided in the RPS. Manufacturers will have to demonstrate that the controls and displays that are provided are sufficient to safely and effectively pilot the RPA in normal operation as well as in the event of system failures.

The design and approval of automatic systems on the RPA which replace a control function in the RPS, must take into account that the remote pilot may not be able to compensate for failures of these systems.

Information on the quality of the C2 link must be available to the remote pilot, particularly if the quality of service is degrading to a level at which remedial action must be taken. RPS components exposed to the elements must be secured, typically the antenna and other masts, as these can suffer damage due to lightning and severe winds.

3.3 RPS CONSIDERATIONS FOR DIFFERENT OPERATIONAL CONFIGURATIONS

3.3.1 BVLOS Category A — direct control

Category A control provides the greatest level of remote pilot control of the RPA, allowing inputs equivalent to a control stick, rudder pedals and throttle to actuate flight control surfaces and power settings, or via autopilot. The transaction time and update rate for primary flight data (e.g. speed, altitude, heading, attitude, vertical speed and yaw) to be received from the RPA and displayed to the remote pilot must be able to support the operational requirements. Likewise, the transaction time and update rate for remote pilot inputs to be received and processed by the RPA must be able to support the operational requirements. This direct control places the greatest demands on the C2 link capability and performance.

3.3.2 BVLOS Category B — autopilot control

Category B control provides less control of the RPA, still allowing speed, altitude, heading and vertical speed to be controlled, although changes are only effected through autopilot entries. The transaction time and update rate for flight data to be received from the RPA and displayed to the remote pilot are less stringent than for Category A RPS; however, they must be able to support the operational requirements. Likewise, the transaction time and update rate for remote pilot inputs to be received and processed by the RPA, while less stringent than for Category A RPS, must also be able to support the operational requirements. This autopilot control places less stringent demands on the C2 link capability and performance than direct control.

RPA flown from a Category B RPS may have less ability to manoeuvre rapidly or abnormally due to autopilot design characteristics (e.g. fixed bank angle) and transaction times. It may be possible to mitigate this limitation and come closer to the flexibility of a stick and throttle interface by including emergency command options within the autopilot interface.

3.3.3 BVLOS Category C — waypoint control

Category C control provides limited control by the remote pilot of the RPA during flight. The flight planned route can only be altered through waypoint entries and/or deletions into the programmed flight plan.

The transaction time and update rate for flight data to be received from the RPA and displayed to the remote pilot are less stringent than for Category B RPS; however, they must be able to support the operational requirements. Likewise, the transaction time and update rate for remote pilot inputs to be received and processed by the RPA, while less stringent than for Category B RPS, must also be able to support the operational requirements. This waypoint control places limited demands on the C2 link capability and performance.

This level of control, while supporting the management of pre-planned flights, limits the ability of the remote pilot to respond promptly to ATC instructions with accuracy (e.g. it is not possible to directly enter a specific heading to be flown). Although the requirement may be met by insertion of a new waypoint approximately on the required track, this takes time for the remote pilot to estimate and enter, adding to the delay. This performance constraint is likely to restrict routine operation in busy airspace where ATC vectoring is used.

Note: While VLOS operation assumes the remote pilot has direct control of the RPA attitude and speed, the use of automation, including waypoint control, may also be possible. This "indirect control" inevitably isolates the remote pilot from the RPA to some extent and potentially reduces the remote pilot's ability to react in a timely manner.

3.3.4 VLOS control for take-off and/or landing with handover to BVLOS

When VLOS control is used during take-off or landing, with handover to BVLOS control for the en-route segment, for example, when automatic take-off or landing is not available or approved by the aerodrome operator, the following points must be considered:

(a) operational requirements may necessitate use of an RPA observer or additional remote pilot to maintain visual contact with the RPA; and

(b) VLOS operation of a BVLOS RPA may require use of a different RPS than for the en-route segment.

3.4 DISPLAY AND CONTROL REQUIREMENTS FOR BVLOS CAPABLE RPS

3.4.1 General requirements

The RPS must be equipped with controls and displays which will enable the remote pilot to control the flight path of the RPA, carry out any required manoeuvres and deal with emergencies while observing operating limitations.

HMI must allow the remote pilot to operate the RPA by monitoring normal flight characteristics, status, navigation information and DAA functions. Additionally, there must be warning of RPA failures, potential losses or degradation of the C2 link and relevant meteorological effects on the aircraft. When designing such functions, consideration must be taken of the update rate of the information being supplied and also the potential robustness of the control interfaces. All of these functions contribute to the remote pilot's situational awareness.

All warnings and alerts currently provided for manned aircraft must be considered for inclusion in the RPS.

Any payload-related displays or controls must be designed and positioned so as not to distract the remote pilot from the primary task of maintaining safe flight.

3.4.2 Remote pilot access control

The RPS is equivalent to the flight deck of a manned aircraft. Security of the station and the remote pilot are therefore of paramount concern to overall air navigation system safety. Access to an RPS must be restricted commensurate with the size and capability of the RPAS. RPS logon and logoff functions are critical security features to reduce unapproved access to the RPAS.

The logon provides identified control over the RPAS and the logoff ends such control; failure in either process may enable an unauthorised individual to gain control over the RPA. RPS logon must include identification and authentication of the remote pilot.

Handovers between non-collocated RPS may necessitate additional verifications and controls to assure the process is not interfered with by unauthorised individuals.

3.5 RPS CAPABLE OF OPERATING RPA OF ONE OR MORE TYPES

3.5.1 General

An RPS can be designed to control one or more types of RPA. However, an individual RPS must not have piloting control of more than one RPA at a given time. The following sections identify some of the possible capabilities that might be considered within a future RPS classification scheme.

3.5.2 VLOS RPS

Since VLOS operations require remote pilots or RPA observers to maintain visual contact with the RPA, it is likely that VLOS RPS will only support a limited set of displays to minimise a “head down” operation.

If a VLOS RPS is used to control multiple types of RPA, common control and display interfaces will be needed to minimise remote pilot workload and confusion. This may therefore limit the types of RPA that may be effectively controlled by the RPS.

3.5.3 BVLOS capable RPS

RPAS operators may identify a business case for utilising a BVLOS capable RPS to handle many types of RPA in order to satisfy different operations economically. In order for this scenario to be feasible, the RPS will have to be approved for use with each model of RPA and documented on the TCDS by the TC holder.

If a BVLOS capable RPS is used to control multiple types of RPA, common control and display interfaces will be needed to minimise remote pilot workload and confusion. This may, therefore, limit the types of RPA that may be effectively controlled by the RPS. Furthermore, the remote pilot must have clear indication of the model of RPA currently being controlled.

3.6 HUMAN PERFORMANCE IMPLICATIONS

3.6.1 General

The human performance implications of the lack of sensory information resulting from the remote pilot not being on board the aircraft must be considered and, where necessary, adequately substituted. This may involve the use of non-visual cues, such as vibration or audio alerts. At this time, the range of information to be provided to the remote pilot through sensors or displays has not been determined. However, the following items, including substitute means based on hazard cause analysis of the sensory information, must be considered as a minimum:

(a) visual sensory information (e.g. light and flash);

(b) auditory sensory information (noise environment including engine and airframe noise);

(c) proprioceptive sensory information (e.g. vibration and acceleration);

(d) olfactory sensory information (smell);

(e) tactile sensory information (e.g. heat and vibration); and

(f) other sensory information (e.g. heat and pressure).

3.6.2 Mobile RPS

When RPS are located on mobile platforms, such as aircraft or ships, the human performance issues of being located on a moving platform, such as conflicting inputs from equipment-based sources versus from sensory sources (e.g. instruments indicating the RPA is turning right while the RPS platform is turning left), must be addressed.

3.6.3 Controls and switches

The wide range of RPS types may make a common standard remote pilot interface impractical. Varying levels of automation result in many different levels of control and control interfaces being proposed. Remote pilots will have to adapt to the RPS in use, executing tasks in different ways and adjusting to the level of automation provided. These differences will have human performance implications for the remote pilot. This implies that:

(a) adequate, potentially continuous, display of essential information and access to all secondary information that may contribute to the remote pilot's decision-making process is required;

(b) the data provided must be clear and unambiguous;

(c) control of aircraft systems and functions must:

(1) be intuitive;

(2) induce direct RPA response;

(3) provide appropriate feedback; and

(4) respond within an acceptable time; and

(d) the controls and switches must not be open to inadvertent operation.

3.7 DISPLAY OF INFORMATION FOR DAA

3.7.1 General

Providing RPAS capabilities to replace visual capabilities traditionally performed by pilots of manned aircraft may require the use of sensors and RPS displays. The following capabilities include those required to support DAA, as noted, and other capabilities that may be required to enhance the efficiency and flexibility of RPAS operations:

(1) obtaining information provided by aerodrome signs, markings and lighting;

(2) obtaining information provided by visual signals (e.g. interception);

(3) identifying and avoiding terrain and obstacles;

(4) identifying and avoiding hazardous meteorological conditions;

(5) maintaining at least the minimum applicable distances from cloud when operating under VFR;

(6) remaining well clear of other aircraft or vehicles; and

(7) avoiding collisions.

With such a wide range of differing requirements, and also the means by which these can be achieved, it is likely that numerous different systems and sensors will be required to gather, process and display all the information to the remote pilot.

Additional information may have to be displayed to the remote pilot to support efficient airfield operations between RPA and other aircraft. This information must include positional information with respect to airport features (e.g. runway centre line, aerodrome signs, marking and lighting). Information on the relative position and movement of other aircraft or surface vehicles is also essential. CAR OPS 0 requires pilots to be able to recognise visual interception signals from other aircraft, such as intercept aircraft wing rocking, flashing lights or landing gear lowering; RPA will need to be able to obtain this information through visual or alternate means.

The remote pilot must be provided with the means to identify proximity to terrain and obstacles unless the approved use of autoflight systems and planned flight trajectories mitigates the risk from these hazards. The information could be provided by a moving map with terrain overlay enhanced with alerts indicating rapid descent rate and close proximity to the ground. Such systems are well established for manned aircraft and typically use standard digital elevation models for the terrain information. However, as the remote pilot is not on board the aircraft, the necessary information, e.g. horizontal position, barometric altitude, height above ground, would need to be downlinked to the RPS at a suitable rate for the situation to be displayed and alerts generated.

Pilots in manned aircraft, when operating under VFR, need to be able to recognise and assess the in-flight visibility and estimate horizontal and vertical distances from clouds. Meeting this same requirement for remote pilots is expected to necessitate new technology and appropriate displays if operating under VFR and BVLOS. It can be assumed that the data will be captured on the aircraft using suitable sensors and downlinked to the RPS.

3.7.2 Traffic display

The RPS must have the ability to display the location of all other traffic in the vicinity. In addition to the display, audible and visual alerts must be provided to warn the remote pilot of any significant traffic.

Human performance issues must be assessed to determine the optimum methods to support the remote pilot's requirement to RWC of traffic and avoid collisions. Remote pilots must be trained to interpret the display of traffic and all guidance and alerting required to DAA other aircraft.

ATTACHMENT 4

INTEGRATION OF RPAS OPERATIONS INTO ATM

4.1 OVERVIEW

This Attachment provides information regarding the safe introduction of RPAS operations into the air navigation management system. The scope of this section will be limited to the following areas:

(a) the recommendation of best practices and procedures that can be used for the safe integration of RPAS, taking into consideration the current technological limitations; and

(b) operations in non-segregated airspace, controlled and uncontrolled.

Note: At present integrated operations are not permitted.

4.2 INTEGRATION PRINCIPLES

4.2.1 General

The integration of RPA in non-segregated airspace will be a gradual process that builds upon technological advances and development of associated procedures. The process begins with limited access to airspace, and while some RPA may eventually be able to seamlessly integrate with manned flights, many may not.

RPAS operations must conform to the existing airspace requirements. These airspace requirements include, but are not limited to, communication, navigation and surveillance requirements, separation from traffic and distances from clouds.

Controlled airspace. In order for RPA to be integrated into non-segregated controlled airspace, the RPA must be able to comply with existing ATM procedures. In the event that full compliance is not possible, new ATM procedures must be considered by the aviation authorities and/or ANSPs in consultation with the RPAS operator and representatives of other airspace user groups. Any new ATM procedures must be kept as consistent as possible with those for manned flights to minimise disruption of the ATM system.

Uncontrolled airspace. In order for RPA to be integrated into non-segregated uncontrolled airspace, the RPA will need to be able to interact with other airspace users, without impacting the safety or efficiency of existing flight operations.

4.2.2 Airspace requirements

The operational and equipage requirements of RPA will be governed, as per manned aviation, by the class of airspace in which they will be operating. Airspace class definitions are defined in CAR OPS 0.

4.2.3 Take-off and landing phases

RPAS may be operated in either VMC or IMC, and the associated VFR and IFR restrictions applicable to manned aircraft will apply. These operations may also be conducted within VLOS or BVLOS depending on the capability of the RPAS involved. Of particular note is the requirement for the RPAS operator to be able to determine the meteorological conditions in which the RPA is operating during these phases, in order to ensure the RPA is indeed operating in accordance with applicable flight rules.

4.2.4 En-route phase

The operational, equipage and performance requirements imposed on the RPAS will again depend upon the class of airspace through which the RPA will be transiting and any additional requirements prescribed for the airspace or operation (e.g. RVSM, PBN, 8.33 KHz channel spacing capable radio equipment).

4.2.5 VFR

The remote pilot or RPAS operator must be able to assess the meteorological conditions throughout the flight. In the event the RPA, on a VFR flight, encounters IMC, appropriate action must be taken.

4.2.6 IFR

RPAS must be equipped with suitable instruments and with navigation equipment appropriate to the route to be flown.

4.2.7 Communication, navigation and surveillance (CNS)

Functionality and performance requirements for RPA must ideally be equivalent to those established for manned aircraft and appropriate to the airspace within which the RPA is operated and where ATS is being provided. The performance and equipage requirements will be determined by factors associated with the operating environment which may include classes of airspace, proximity to heavily populated areas, terrain, etc.

4.2.8 Transponder operations

RPA, in the majority of cases, will need to comply with existing transponder operating rules in the same way as manned aircraft and as required by the class of airspace within which they are operating. As with current manned operations; however, there may be circumstances that will call for a deviation from existing practices due to the context within which a particular RPA will be operating, such as low-level operations within areas where manned aircraft are not operating.

While it is impossible to identify all potential circumstances where this would be acceptable, these exceptions must be considered in the same way as a request from a manned aircraft to operate without a transponder.

4.2.9 RPAS unique procedures

The lost C2 link procedure, unique to RPAS, necessitates a specific approach with respect to transponder operation. A lost C2 link is not necessarily an emergency situation that would warrant setting the Mode A code to 7700 or the ADS-B emergency mode, however use of code 7600 or specific ADS-B emergency mode indicating voice communication failure may be equally inappropriate. A new non-discrete code may be warranted for use by RPA to indicate loss of the C2 link.

It is expected that RPA will use Mode A code 7700 or equivalent ADS-B emergency mode for those emergencies that are common to manned aircraft (e.g. engine failure), but consideration must also be given to those circumstances that are unique to RPA (e.g. flight termination). The procedures addressing coordination with ATC relating to transition from one code to another need to be clearly identified to ensure a common understanding and expectations of how the RPA will operate in a given situation.

4.3 FLIGHT RULES

4.3.1 Right-of-way

As with manned aircraft, RPA are obliged to comply with the CAR OPS 0 right-of-way rules and RWC of other aircraft (manned or unmanned). They must avoid passing over, under or in front of other aircraft, unless it passes well clear and takes into account the effect of aircraft wake turbulence. Owing to the relatively small size and low conspicuity of some RPA, it may be difficult for pilots of manned aircraft and other remote pilots to visually acquire the RPA.

4.3.2 RPAS performance requirements

The performance characteristics of the RPAS will require additional consideration when planning their integration within the ATM system, as their performance characteristics will affect how ATS providers manage their integration with conventional traffic. For example, high-altitude, long-endurance (HALE) RPA that typically operate at lower speeds in climb to and descent from high flight levels, pass through levels at which manned aircraft are cruising at high speeds. This speed differential may pose separation challenges in a mixed environment.

Control instruction response times (e.g. the length of time between ATC issuing an instruction, the remote pilot complying with the instruction and the RPA responding to the inputs) may affect the controller’s ability to support RPA operations if an inordinate amount of resources are allocated to a single aircraft. This can also be a result of other performance characteristics such as climb, descent or turn rate that may differ substantially from those of conventional aircraft. Thus, it will be essential that the ATCO be aware of and anticipate these potential underperformances and plan accordingly. Conventional instructions such as “expedite” and “immediate” may not be practical in many cases.

ATCO must have a general knowledge of RPA performance characteristics and be familiar with specific characteristics of RPA operating in the airspace. The following performance characteristics must be considered:

(a) speed;

(b) climb, descent or turn rates;

(c) wake turbulence;

(d) endurance;

(e) latency; and

(f) effect of bank angle on C2 and ATC communications link capability and reliability.

4.3.3 ATM procedures

The absence of an on-board pilot will necessitate some unique procedures in the integration of RPA into non-segregated airspace. To the greatest extent practicable, procedures must be identical to those developed for manned aircraft.

Some of the issues that will need to be addressed to integrate RPA flights include the following:

(a) flight planning:

 (1) RPA type designators;

 (2) phraseology (to be used with/by ATC);

(b) VFR flight:

 (1) separation standards;

 (2) right-of-way rules;

(c) IFR flight:

 (1) separation standards;

 (2) right-of-way rules;

(d) contingency and emergency procedures:

 (1) C2 link failure;

 (2) ATC communications failure with remote pilot; and

 (3) intercept procedures/compliance with air defence.

4.3.4 Flight plan

RPAS operators will need to file flight plans in accordance with CAR OPS 0. Aircraft type designators will need to be established and documented and until this is done, “ZZZZ” must be entered in item 9 of the flight plan form and the RPA type specified in item 18.

4.3.5 Non-standard method of communication

For small RPA, due to RLOS challenges, the remote pilot may need to communicate with ATC through means other than the published VHF/HF radio frequency (RF) for the airspace in which the RPA will be operating. Prior to approving use of a non-standard method of communication, the ANSP must assess the implications on the overall traffic situation for the airspace and on the ATCO’s ability to effectively manage different methods of communication.

4.3.6 RPA sensitive to hazardous meteorological conditions

Small RPA may be more sensitive to hazardous meteorological conditions due to their low MTOM and, more specifically, the wing/power loading of the aircraft.

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ATTACHMENT 5

USE OF AERODROMES

5.1 OVERVIEW

This Attachment discusses issues related to integration of RPAS operations at aerodromes open to public use.

Note: RPAs are presently for use in segregated airspace and not authorised for operations at aerodromes open to public use.

5.2 GENERAL

Integration of RPA into aerodrome operations will require the remote pilot to identify, in real-time, the physical layout of the aerodrome and associated equipment, such as aerodrome lighting and markings, so as to manoeuvre the aircraft safely and correctly, regardless of the location of the RPS. To achieve this goal, advances in technology and procedures will be required, e.g. surveillance, detection and other systems or methods, internal or external to the RPA, capable of providing sufficient awareness and resolution to allow the remote pilot to safely operate the RPA without causing undue disruption to other traffic.

5.3 APPLICATION OF AERODROME SPECIFICATIONS TO RPA

ICAO Annex 14 — *Aerodromes* sets forth the specifications for aerodromes and requires that States certify aerodromes used for international operations in accordance with the specifications contained in the Annex as well as other relevant ICAO provisions through an appropriate regulatory framework. Annex 14 also requires that States' regulatory framework include the establishment of criteria and procedures for certification and recommends that States certify aerodromes open to public use.

States will need to determine whether RPA can be safely integrated without presenting new hazards to, or placing new burdens on, manned aircraft. They will also need to evaluate the applicability of applying aerodrome specifications to RPA operations.

Note: San Marino does not have international aerodromes.

5.4 AERODROME INTEGRATION ISSUES

Several unique characteristics of RPA that may affect aerodrome operations and must be considered by States, aerodrome operators, RPAS operators and manufacturers include:

(a) the RPA's ability to detect aerodrome signs and markings;

(b) the RPA's ability to avoid collisions while manoeuvring;

(c) the RPA's ability to follow ATC instructions in the air or on the manoeuvring area (e.g. "follow green Cessna 172" or "cross behind the Air France A320");

(d) applicability of instrument approach minima to RPA operations;

(e) necessity of RPA observers at aerodromes to assist the remote pilot with CA requirements;

(f) implications for aerodrome certification requirements of RPA;

(g) infrastructure, such as approach aids, ground handling vehicles, landing aids, launch/recovery aids;

(h) rescue and fire-fighting requirements for RPA (and RPS, if applicable);

(i) integration of RPA with manned aircraft in the vicinity of, and on the movement area of, an aerodrome; and

(j) aerodrome implications for RPAS specific equipment.

5.5 CONTROLLED AERODROME ENVIRONMENT

For RPA integration into controlled aerodromes where ATC services are provided for safe, orderly and expeditious flow of aircraft and vehicular movement, the RPAS needs to have the ability to communicate and manoeuvre in a similar manner to manned aircraft.

Remote pilots operating at controlled aerodromes must maintain two-way communication with ATC and acknowledge and comply with ATC instructions in the air and on the surface. Remote pilots must be able to comply with all instructions during all phases of operations associated with aerodrome operations, e.g. take-off, approach and landing and manoeuvring on aprons, taxiways and runways.

RPA will need to be able to comply with airport markings, signage lighting and signals, and respond, as appropriate, to maintain safety as conditions on the aerodrome surface change. Avoidance of people, aircraft, vehicles, buildings and obstacles on or near the designated surface movement areas will be required as well as avoidance of restricted or other areas not intended for aircraft.

5.6 AERODROME FLIGHT INFORMATION SERVICE (AFIS)

For RPA integration into uncontrolled AFIS aerodromes used for international general aviation, the RPA must be able to operate in the same manner as manned aircraft. Remote pilots must be able to communicate with the AFIS officer in a timely and effective manner in order to pass and receive safety related traffic information. Requirements for remote pilots to identify and comply with airport markings and signage and to safely and efficiently manoeuvre among other aircraft and other airport users will be the same as the requirements for operations at controlled aerodromes.