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FOREWORD

Civil aviation has to this point been based on the notion of a pilot operating the aircraft from within the aircraft itself and more often than not with passengers on board. Removing the pilot from the aircraft raises important technical and operational issues, the extent of which is being actively studied by the aviation community. Many of these issues will be identified in this circular.

Unmanned aircraft systems (UAS) are a new component of the aviation system, one which ICAO, States and the aerospace industry are working to understand, define and ultimately integrate. These systems are based on cutting-edge developments in aerospace technologies, offering advancements which may open new and improved civil/commercial applications as well as improvements to the safety and efficiency of all civil aviation. The safe integration of UAS into non-segregated airspace will be a long-term activity with many stakeholders adding their expertise on such diverse topics as licensing and medical qualification of UAS crew, technologies for detect and avoid systems, frequency spectrum (including its protection from unintentional or unlawful interference), separation standards from other aircraft, and development of a robust regulatory framework.

The goal of ICAO in addressing unmanned aviation is to provide the fundamental international regulatory framework through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material, to underpin routine operation of UAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations. This circular is the first step in reaching that goal.

ICAO anticipates that information and data pertaining to UAS will evolve rapidly as States and the aerospace industry advance their work. This circular therefore serves as a first snapshot of the subject.

Comments

Comments from States on this circular, particularly with respect to its application and usefulness, would be appreciated. These comments will be taken into account in the preparation of subsequent material and should be addressed to:

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ABBREVIATIONS/ACRONYMS

ACAS	Airborne collision avoidance system
ADS-B	Automatic dependent surveillance — broadcast
AM(R)S	Aeronautical mobile (route) service
AMS(R)S	Aeronautical mobile satellite (route) service
ARNS	Aeronautical radio navigation service
ARNSS	Aeronautical radio navigation satellite service
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
C2	Command and control
C3	Command, control and communications
CAA	Civil Aviation Authority
CPDLC	Controller-pilot data link communications
EASA	European Aviation Safety Agency
EUROCAE	European Organisation for Civil Aviation Equipment
HF	High frequency
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
ITU	International Telecommunication Union
PANS	Procedures for Air Navigation Services
QOS	Quality of service
RPA	Remotely-piloted aircraft
RPAS	Remotely-piloted aircraft system
RTCA	RTCA, Inc.
SAR	Search and rescue
SARPs	Standards and Recommended Practices
SATCOM	Satellite communication
SMS	Safety management system(s)
SSP	State safety programme
UA	Unmanned aircraft
UAS	Unmanned aircraft system(s)
UAV	Unmanned aerial vehicle (obsolete term)
UOC	UAS operator certificate
VDL	VHF digital link
VFR	Visual flight rules
VHF	Very high frequency
VLOS	Visual line-of-sight
VMC	Visual meteorological conditions
WRC	World Radiocommunication Conference

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GLOSSARY

Explanation of Terms

*Note.— The terms contained herein are used in the context of this circular. Except where indicated, they have no official status within ICAO. Where a formally recognized ICAO definition is included herein for convenience, this is noted with an *. Where a term is used differently from a formally recognized ICAO definition, this is noted with an **.*

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

Aircraft — category*. Classification of aircraft according to specified basic characteristics, e.g. aeroplane, helicopter, glider, free balloon.

Autonomous aircraft. An unmanned aircraft that does not allow pilot intervention in the management of the flight.

Autonomous operation. An operation during which a remotely-piloted aircraft is operating without pilot intervention in the management of the flight.

Command and control link. The data link between the remotely-piloted aircraft and the remote pilot station for the purposes of managing the flight.

Commercial operation. An aircraft operation conducted for business purposes (mapping, security surveillance, wildlife survey, aerial application, etc.) other than commercial air transport, for remuneration or hire.

Crew member*. A person assigned by an operator to duty on an aircraft during a flight duty period.

Detect and avoid. The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action to comply with the applicable rules of flight.

Flight crew member*. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight recorder.** Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation. In the case of remotely-piloted aircraft, it also includes any type of recorder installed in a remote pilot station for the purpose of complementing accident/incident investigation.

Flight time — aeroplanes*. The total time from the moment an aeroplane first moves for the purpose of taking off until the moment it finally comes to rest at the end of the flight.

Flight time — helicopters*. The total time from the moment a helicopter's rotor blades start turning until the moment the helicopter finally comes to rest at the end of the flight, and the rotor blades are stopped.

Flying pilot. A person who operates the flying controls of an aircraft and is responsible for the flight trajectory of the aircraft.

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

Instrument flight time*. Time during which a pilot is piloting an aircraft solely by reference to instruments and without external reference points.

Lost link. The loss of command and control link contact with the remotely-piloted aircraft such that the remote pilot can no longer manage the aircraft's flight.

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

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

Pilot (to)*. To manipulate the flight controls of an aircraft during flight time.

Pilot-in-command*. The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

Radio line-of-sight. A direct electronic point-to-point contact between a transmitter and a receiver.

Remote crew member. A licensed crew member charged with duties essential to the operation of a remotely-piloted aircraft, during flight time.

Remote pilot. The person who manipulates the flight controls of a remotely-piloted aircraft during flight time.

Remote pilot station. The station at which the remote pilot manages the flight of an unmanned aircraft.

Remotely-piloted. Control of an aircraft from a pilot station which is not on board the aircraft.

Remotely-piloted aircraft. An aircraft where the flying pilot is not on board the aircraft.

Note.— This is a subcategory of unmanned aircraft.

Remotely-piloted aircraft system. A set of configurable elements consisting of a remotely-piloted aircraft, its associated remote pilot station(s), the required command and control links and any other system elements as may be required, at any point during flight operation.

RPA observer. A remote crew member who, by visual observation of the remotely-piloted aircraft, assists the remote pilot in the safe conduct of the flight.

Segregated airspace. Airspace of specified dimensions allocated for exclusive use to a specific user(s).

Unmanned aircraft. An aircraft which is intended to operate with no pilot on board.

Unmanned aircraft system. An aircraft and its associated elements which are operated with no pilot on board.

Visual line-of-sight operation. An operation in which the remote crew maintains direct visual contact with the aircraft to manage its flight and meet separation and collision avoidance responsibilities.

REFERENCES

ICAO DOCUMENTS

Annex 1 — *Personnel Licensing*

Annex 2 — *Rules of the Air*

Annex 3 — *Meteorological Service for International Air Navigation*

Annex 6 — *Operation of Aircraft*

Part I — *International Commercial Air Transport — Aeroplanes*

Annex 7 — *Aircraft Nationality and Registration Marks*

Annex 8 — *Airworthiness of Aircraft*

Annex 10 — *Aeronautical Telecommunications*

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

Volume IV — *Surveillance and Collision Avoidance Systems*

Annex 11 — *Air Traffic Services*

Annex 13 — *Aircraft Accident and Incident Investigation*

Annex 14 — *Aerodromes*

Volume I — *Aerodrome Design and Operations*

Annex 16 — *Environmental Protection*

Volume I — *Aircraft Noise*

Volume II — *Aircraft Engine Emissions*

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

Doc 4444 *Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM)*

Doc 7300 *Convention on International Civil Aviation*, signed at Chicago on 7 December 1944 and amended by the ICAO Assembly

Doc 8643 *Aircraft Type Designators*

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

Doc 9854 *Global Air Traffic Management Operational Concept*

Doc 9863 *Airborne Collision Avoidance System (ACAS) Manual*

Doc 9869 *Manual on Required Communication Performance (RCP)*

OTHER DOCUMENTS

RTCA, DO-304, *Guidance Material and Considerations for Unmanned Aircraft Systems*

Issued 03-22-07 • Prepared by SC-203

This document addresses all Unmanned Aircraft Systems (UAS) and UAS operations being considered for realistic implementation in the United States National Airspace System (NAS) in the foreseeable future. It is intended to educate the community and used to facilitate future discussions on UAS standards. It provides the aviation community with a definition of UAS, a description of the operational environment, and a top-level functional breakdown. The guidance material provides a framework for developing standards through RTCA Special Committee 203.

EASA, Policy Statement – Airworthiness Certification Policy of Unmanned Aircraft Systems (UAS)
Doc E.Y013-01 • Issued 25-08-2009

This policy establishes general principles for type-certification (including environmental protection) of an unmanned aircraft system. The policy represents a first step in the development of a comprehensive civil UAS regulation. This policy statement is an interim solution to aid acceptance and standardization of UAS certification procedures in Europe.

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Chapter 1

INTRODUCTION

BACKGROUND

1.1 On 12 April 2005, during the first meeting of its 169th Session, the Air Navigation Commission requested the Secretary General to consult selected States and international organizations with respect to: present and foreseen international civil unmanned aerial vehicle (UAV) activities in civil airspace; procedures to obviate danger to civil aircraft posed by UAVs operated as State aircraft; and procedures that might be in place for the issuance of special operating authorizations for international civil UAV operations.

First informal ICAO meeting on UAVs

1.2 Subsequent to the above, the first ICAO exploratory meeting on UAVs was held in Montreal on 23 and 24 May 2006. Its objective was to determine the potential role of ICAO in UAV regulatory development work. The meeting agreed that although there would eventually be a wide range of technical and performance specifications and standards, only a portion of those would need to become ICAO SARPs. It was also determined that ICAO was not the most suitable body to lead the effort to develop such specifications. However, it was agreed that there was a need for harmonization of terms, strategies and principles with respect to the regulatory framework and that ICAO should act as a focal point.

Second informal ICAO meeting on UAVs

1.3 The second informal ICAO meeting (Palm Coast, Florida, January 2007) concluded that work on technical specifications for UAV operations was well underway within both RTCA and EUROCAE and was being adequately coordinated through a joint committee of their two working groups. The main issue for ICAO was, therefore, related to the need to ensure safety and uniformity in international civil aviation operations. In this context, it was agreed that there was no specific need for new ICAO SARPs at that early stage. However, there was a need to harmonize notions, concepts and terms. The meeting agreed that ICAO should coordinate the development of a strategic guidance document that would guide the regulatory evolution. Even though non-binding, the guidance document would be used as the basis for development of regulations by the various States and organizations. As regulatory material developed by States and organizations gained maturity, such material could be proposed for inclusion in the ICAO guidance document. The document would then serve as the basis for achieving consensus in the later development of SARPs.

1.4 The meeting felt strongly that the eventual development of SARPs should be undertaken in a well-coordinated manner. Because this was a newly emerging technology it was felt that there was a unique opportunity to ensure harmonization and uniformity at an early stage and that all ICAO efforts should be based on a strategic approach and should support the emerging work of other regulatory bodies. The meeting had also suggested that from this point onwards, the subject should be referred to as unmanned aircraft systems (UAS), in line with RTCA and EUROCAE agreements.

1.5 Finally, it was concluded that ICAO should serve as a focal point for global interoperability and harmonization, to develop a regulatory concept, to coordinate the development of UAS SARPs, to contribute to the development of technical specifications by other bodies, and to identify communication requirements for UAS activity.

PURPOSE OF THE CIRCULAR

1.6 The purpose of this circular is to:

- a) apprise States of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes;
- b) consider the fundamental differences from manned aviation that such integration will involve; and
- c) encourage States to help with the development of ICAO policy on UAS by providing information on their own experiences associated with these aircraft.

1.7 Unmanned aircraft (UA) are, indeed, aircraft; therefore, existing SARPs apply to a very great extent. The complete integration of UAS at aerodromes and in the various airspace classes will, however, necessitate the development of UAS-specific SARPs to supplement those already existing.

DOCUMENT STRUCTURE

1.8 UAS issues span all of aviation, and as such, it is an ongoing challenge to determine the most effective and efficient means of addressing the broad scope of topics. This document is organized to reflect the three traditional areas of aviation: operations, equipment and personnel. This systems approach will facilitate a comprehensive view of the issues, as well as better align the discussions with the appropriate disciplines.

Chapter 2

ICAO REGULATORY FRAMEWORK

PILOTLESS AIRCRAFT

Article 8 of the *Convention on International Civil Aviation*, signed at Chicago on 7 December 1944 and amended by the ICAO Assembly (Doc 7300) (hereinafter referred to as “the Chicago Convention”) stipulates that:

No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization....

2.1 The *Global Air Traffic Management Operational Concept* (Doc 9854) states “An unmanned aerial vehicle is a pilotless aircraft, in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous.” This understanding of UAVs was endorsed by the 35th Session of the ICAO Assembly.

2.2 The regulatory framework under development by ICAO is being shaped within the context of the above statement. All UA, whether remotely-piloted, fully autonomous or a combination thereof, are subject to the provisions of Article 8. Only the remotely-piloted aircraft (RPA), however, will be able to integrate into the international civil aviation system in the foreseeable future. The functions and responsibilities of the remote pilot are essential to the safe and predictable operation of the aircraft as it interacts with other civil aircraft and the air traffic management (ATM) system. Fully autonomous aircraft operations are not being considered in this effort, nor are unmanned free balloons nor other types of aircraft which cannot be managed on a real-time basis during flight.

2.3 Integrating remotely-piloted UA into non-segregated airspace and at aerodromes can likely be achieved in the medium-term. The premise behind the regulatory framework and the means by which contracting States will be able to grant special authorizations is that these UAS will meet the identified minimum requirements needed to operate safely alongside manned aircraft. The remotely-located pilot with the fundamental responsibilities of pilot-in-command is a critical element in reaching this status. It is possible that States may be able to accommodate UA which are not remotely-piloted through use of special provisions or in segregated airspace; however this accommodation is not equivalent to integration.

MODEL AIRCRAFT

2.4 In the broadest sense, the introduction of UAS does not change any existing distinctions between model aircraft and aircraft. Model aircraft, generally recognized as intended for recreational purposes only, fall outside the provisions of the Chicago Convention, being exclusively the subject of relevant national regulations, if any.