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Uncrewed aircraft systems —

Part 3: Operational procedures

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 16, *Uncrewed aircraft systems*.

This third edition cancels and replaces the second edition (ISO 21384-3:2023), which has been technically revised.

The main changes are as follows:

— harmonization with the three risk-based categories of UAS operations described in Reference [24];

— introduction of new personnel tasks in 9.6 in relation to fleet manager (FM) and visual observers (VO).

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document outlines requirements for uncrewed aircraft (UA) operational procedures which, when applied together with any other current and future standard on uncrewed aircraft systems (UAS), form a robust UA safety and quality standard.

This document refers to the three risk-based categories of UAS operations introduced by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS)[21] enshrined by ICAO in Reference [24]. Assigning a UAS operation to a category (or subcategory in jurisdictions where they exist) typically considers the maximum take-off mass (MTOM), the maximum dimensions of the airframe, the type of operations (i.e. VLOS, EVLOS or BVLOS), the risk for third parties on the ground normally driven by the density of population and the risk for third parties in the air, which is also influenced by the airspace classes defined in Reference [25].

The principles of these three risk-based categories are summarized in Table 1 and can be applied also in jurisdictions where the three risk-based categories are not implemented, but the taxonomy is based, for example, on aircraft MTOM and type of operations.

Table 1 — Main features of the three risk-based categories of UAS operations

Category	Open	Specific	Certified
MTOM	In most jurisdictions 25 kg	Unlimited	Unlimited
Risk for third parties on the ground and in the air	Low risk	Medium risk or regulated lower risk	High risk (i.e. comparable to commercial aircraft operations with pilot on board)
Purpose	Recreational Governmental non-military Professional non-commercial Commercial including aerial work or transport of freight	Governmental non-military Professional non-commercial Commercial including aerial work, transport of freight, spraying, releasing substances or objects, one pilot to several aircraft, autonomous operations without pilot	Governmental non-military Professional non-commercial Commercial including aerial work, transport of freight, spraying, releasing substances or objects, but also transporting people on-board for commercial or non-commercial air transport
Type of operations	VLOS	VLOS EVLOS BVLOS	VLOS EVLOS BVLOS International IFR
Registration	Required with possible minor exceptions Depending on the jurisdiction, registration can be required for the UA or for the UAS operator or for both In no jurisdiction registration of the RPS is required	Always required, but depending on jurisdiction as in the open category	Required In most jurisdictions only for the UA
Remote (electronic) identification	Required with possible minor exceptions	Required	Required possibly using conventional aviation equipment (e.g. ADS-B)
Risk assessment by UAS operator	Not required	Required	Required as proactive, predictive and inter-organizational safety management by operator
NOTE The registration process is different from the operational authorization process; and the latter is a regulatory safety approval, different from the administrative approval by the geozone manager, if applicable and from the airspace authorization issued by traffic management services.			

Table 1 *(continued)*

Category	Open	Specific	Certified
Means of evidence of applied mitigations	Not required	Required	Required and including certificates by aviation authorities
Conditions and limitations	Established by regulations	Established case-by-case based on the risk assessment	Established case-by-case based on the risk assessment
Airworthiness of UA	Demonstrated through Declaration of Conformity signed by UAS manufacturer	Demonstrated through Declaration of Conformity signed by UAS manufacturer or, for higher risk, by design verification (DV) or type certificate (TC) and individual certificate of airworthiness (CofA)	TC and individual CofA
UAS pilot licence (UPL)	Required but issuance often delegated to a recognized entity	Required but issuance often delegated to a recognized entity	Required. It may have different denominations, different from UPL and depending on the type of operation in the certified category [e.g. remote pilot licence (RPL) for international RPAS operations under IFR in conformance with ICAO standards].
Operational authorization for one or a series of UA flights	Not applicable	Possible	Not applicable
UAS operator certificate	Not applicable	Voluntary	Mandatory in several jurisdictions
Authorization by geozone manager to enter specific areas	Possible	Possible	Possible
Airspace authorization to enter controlled airspace	The process for airspace authorization is normally not applicable, but in some jurisdictions geozones are established to permit access to some portions of controlled airspace also to the open category	Possible under specified conditions	Required
International (i.e. entering the sovereign airspace of State(s) different from the take-off State)	Not applicable, unless enabled by agreements among States by regionally applicable legislation	Not applicable, unless enabled by agreements among States by regionally applicable legislation	Possible on the basis of the Chicago Convention
Flights above high seas without entering sovereign airspace of a second State	Possible	Possible	Possible

NOTE The registration process is different from the operational authorization process; and the latter is a regulatory safety approval, different from the administrative approval by the geozone manager, if applicable and from the airspace authorization issued by traffic management services.

This document is structured in a way to provide a logical pathway from core principles to specific requirements, applicable in jurisdictions where the three risk-based categories are implemented or elsewhere.

Uncrewed aircraft systems —

Part 3: Operational procedures

1 Scope

This document specifies the requirements for safe commercial operations of uncrewed aircraft system (UAS), including the external safety-critical service providing command and control (C2) Link.

This document applies to all commercial UAS regardless of size, application or location and represents the international best practice for the safe commercial operation of any UAS.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 21384-4, *Uncrewed aircraft systems — Part 4: Vocabulary*

ISO 23629-12:2022, *UAS traffic management (UTM) — Part 12: Requirements for UTM service providers*

ISO 23665, *Uncrewed aircraft systems — Training for personnel involved in UAS operations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21384-4 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
C2 Link communications service provider
C2CSP
entity which provides a portion of or all of the *C2 Link* (3.4) service for operation of an UAS

Note 1 to entry: The definition is adapted from Reference [16].

3.2
designated operational coverage
DOC
volume where the C2 Link *QoSD* (3.10) meets the *C2 Link* (3.4) specified performances and supports the corresponding intended UAS operations

Note 1 to entry: The definition is adapted from Reference [16].

3.3
collision avoidance
third layer of conflict management which activates when the separation mode has been compromised

Note 1 to entry: The definition is adapted from Reference [17].

3.4
C2 Link
command and control link service
telecommunication service provided for the purpose of supporting command and control of the aircraft

Note 1 to entry: The definition is adapted from Reference [16].

Note 2 to entry: The C2 Link is not a tangible product, therefore it cannot be subject to product verification procedures.

3.5
crew resource management
CRM
utilization of all resources available to the crew to manage human error

3.6
DAA system
detect and avoid system
system that supports the remote pilot to see, sense or detect conflicting traffic or other hazards and take the appropriate action

3.7
external service
service and related provider, necessary for the safety of the UA flight or safety of UAS operations, encompassing:

a) *command and control link communication service provider (C2CSP)* (3.1);

b) other operation support services, whose purpose is to support a single flight but not to manage traffic;

c) UTM services;

d) services at vertiports

Note 1 to entry: The definition is adapted from Reference [20].

Note 2 to entry: Additional information on external services is provided in Annex B.

Note 3 to entry: Only the safety critical C2CSP is covered in this document.

Note 4 to entry: UTM services and non-safety-critical operation support services are covered in ISO 23629-12.

3.8
fleet manager
person designated by the operator to execute specific functions associated with the operational control system of the UAS operator

Note 1 to entry: The terms UAS operator or operator are equivalent in this document and they refer to the organization employing the remote pilots and other personnel, as defined in ISO 21384-4.

3.9
quality of service
QoS
totality of the characteristics of an entity that bear on its ability to satisfy stated and implied needs

Note 1 to entry: The definition is adapted from Reference [16].

3.10
quality of service delivered
QoSD
statement of the *QoS* (3.9) achieved or delivered to the UAS operator by the *C2 Link communications service provider (C2CSP)* (3.1)

Note 1 to entry: The definition is adapted from Reference [16].

3.11
quality of service experienced
QoSE
statement expressing the *QoS* (3.9) that remote pilots believe they have experienced

Note 1 to entry: The definition is adapted from Reference [16].

3.12
quality of service required
QoSR
statement of the *QoS* (3.9) requirements of the UAS operator to the *C2 Link communications service provider (C2CSP)* (3.1)

Note 1 to entry: The definition is adapted from Reference [16].

3.13
remain-well-clear
ability to detect, analyse and manoeuvre in order to ensure that a UA is not being operated in such proximity to other aircraft as to create a collision hazard

3.14
remote pilot in command
RPIC
pilot designated by the operator as being in command and charged with the safe conduct of a flight

3.15
safety assurance
set of activities providing for system monitoring, measuring, assessment, and corrective action to assure the effectiveness of risk controls

3.16
safety management system
SMS
systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures

Note 1 to entry: The definition is adapted from Reference [12].

3.17
safety promotion
set of activities providing guidance for training and communication to promote safety as a core value in the organization

3.18
safety risk management
SRM
set of activities using task analysis, hazard identification, risk analysis, and risk assessment to develop risk controls

3.19
separation provision
second layer of conflict management and tactical process of keeping aircraft away from hazards by at least the appropriate separation minima which is only used when *strategic conflict management* (3.21) (i.e. airspace organization and management, demand and capacity balancing and traffic synchronization) cannot be used efficiently

Note 1 to entry: The definition is adapted from Reference [17].

3.20
service level agreement
SLA
enforceable agreement between the *C2 Link communications service provider (C2CSP)* (3.1) and the UAS operator covering the safety, performance, coverage and security of the *C2 Link* (3.4) provision as required for the RPAS operator's intended operations

Note 1 to entry: The definition is adapted from Reference [16].

3.21
strategic conflict management
first layer of conflict management that is achieved through the airspace organization and management, demand and capacity balancing and traffic synchronization components

Note 1 to entry: The definition is adapted from Reference [17].

3.22
uncrewed aircraft accident
occurrence associated with the operation of an uncrewed aircraft which takes place between the time the aircraft is ready to move with the purpose of flight until it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of direct contact with any part or exposure to any emission of the UA or other component of the UAS, including parts which have become detached from the aircraft; or

b) the aircraft sustains damage or structural failure which prevents safe operation

3.23
uncrewed aircraft incident
occurrence, other than an *uncrewed aircraft accident* (3.22), associated with the operation of an aircraft which affects or can affect the safety of operation, including the loss of uncrewed aircraft

3.24
VLL
very low level
airspace below the minimum heights for VFR traffic as established by the competent authority

4 Abbreviated terms

ADS-B	automatic dependant surveillance - broadcast
AIS	aeronautical information service
ANSP	air navigation service provider
ATC	air traffic control
ATS	air traffic service
BVLOS	beyond visual line-of-sight

CofA	certificate of airworthiness
COMO	compliance monitoring officer
DAL	design assurance level
DG	dangerous goods
DV	design verification
ERP	emergency response plan
EVLOS	extended visual line-of-sight
FD	flight dispatcher
FM	fleet manager
FOO	flight operations officer
FW	firmware
FOD	foreign object debris
GNSS	global navigation satellite system
HAIKU	Human AI teaming Knowledge and Understanding
IFR	instrument flight rules
ISMS	information security management system
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
MCM	maintenance control manual
MEL	minimum equipment list
NOTAM	notice to airmen
OEM	original equipment manufacturer
PIC	pilot in command
RF	radio frequency
RPS	remote pilot station
SAFO	safety officer
SECO	security officer
SW	software
TC	type certificate
UA	uncrewed aircraft
UAS	uncrewed aircraft system
UTM	UAS traffic management

VLL very low level

VLOS visual line-of-sight

VO visual observer

5 Safety and security

5.1 General

UAS operators and providers of external services shall be aware of their responsibilities for safety and security, including information security, regardless of the type or size of UAS operated or category of operation.

Comprehensive SMS and ISMS, which are process-oriented approaches to managing safety and security throughout an organization, can be required as specified in 5.2 and 5.3.

NOTE 1 Safety management systems for occupational health and safety of the personnel are defined in ISO 45001.

NOTE 2 Information security management systems are described in ISO/IEC 27001.

NOTE 3 Aviation safety management, as defined in Reference [12], has instead the purpose of protecting the safety of third parties, in the air or on the ground, during UAS operations.

5.2 Safety

5.2.1 Safety policy

A safety policy shall be defined for UAS operators and providers of external services to accomplish their goals. Human error in UA operation and supporting system management can be controlled by a safety policy.

The policy shall be complemented by procedures and organizational structures for safety risk management, safety assurance and safety promotion.

5.2.2 Requirements for operators conducting UAS operations in open category

All operators conducting UAS operations in VLOS in the open category or equivalent shall:

a) appoint a person as COMO;

b) appoint a person as SAFO;

c) designate the COMO and the SAFO based on professional qualities and expert knowledge of laws, regulations and practices on safety of uncrewed aviation and the ability to fulfil tasks respectively referred to in 5.2.5 and 5.2.6;

d) train and qualify personnel on safety matters related to intended operations;

e) establish procedures for prescriptive safety including as a minimum:

   1) monitor and assess changes to regulations which can affect operations;

   2) establish evidence that all applicable regulations are complied with;

f) establish procedures to support reactive safety through:

   1) maintain records of any operational activity for at least three months (can be longer if required by regulations or because the State authority competent for the matter has opened an accident or incident investigation);

2) provide in a timely manner any information required by the authority;

g) establish procedures for proactive safety including as a minimum:

1) the possibility for staff, customers, subcontractors or other partner SPs to report any relevant and perceived safety occurrence;

2) mandatory reporting of safety occurrences to the competent authority, based on applicable regulations;

3) voluntary reporting to the competent authority of any additional and relevant observed safety occurrence, in a manner that would allow a further safety analysis by the authority, if deemed appropriate by the latter;

4) collection of received or originated safety occurrence reports;

5) timely feedback to originators of the report;

6) storage of received or originated safety occurrence reports;

7) protection of related information, in particular identity of the author of the report, in accordance with Annex A;

8) dissemination of safety information to involved personnel and affected stakeholders;

9) taking decisions, implementing and monitoring effect of corrective actions originated by received reports;

NOTE 1 The COMO or SAFO can be or not be employees of the UAS operator.

NOTE 2 A single COMO or single SAFO can perform such a function on behalf of several organizations, providing that no conflict of interest arises.

NOTE 3 A single physical person can perform both the function of COMO and of SAFO.

5.2.3 Additional requirements for operators conducting UAS operations in specific category

In addition to 5.2.1 and 5.2.2, all operators conducting UAS operations in the specific category or equivalent shall:

a) address the structure, responsibilities, processes and procedures that promote and establish an environment and culture of continuing improvement and enhancement of safety;

b) not change configuration of the systems used for respective operations or the procedures thereof, without prior evaluation of the related hazards, considering safety, security and privacy, and emerging risks, complemented by verified implementation of the mitigations stemming from the evaluation;

c) control system configuration and operational procedures and manage changes, demonstrate and document their compliance with applicable regulations, monitor actual application of such procedures and maintain related records for at least two years;

d) establish procedures for predictive safety including as a minimum, safety assessment of any change affecting operations; such safety assessment should include:

1) identification of the scope of the change;

2) verification that the foreseen change is compliant with applicable regulations;

3) identification of related hazards;

4) determination of the safety criteria applicable to the change;

5) risk analysis in relation to the harmful effects or improvements in safety related to the change;