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Unmanned aircraft systems —

Part 2:
UAS components

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

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

The use of unmanned aircraft systems (UAS) or drones, for commercial and recreational purposes has grown in popularity over the last several years. There are many application markets growing rapidly, such as motion pictures and film, security, inspections as well as many uses by organizations to increase public safety. It has been a challenge for operators to use these aircraft due to the lack of regulation and lack of common manufacturing methods a regulator would recognize as safe.

The purpose of this document is to shape a general architecture for the quality and safety of the manufacture of UAS. By addressing the UAS components separately, the document enables manufacturers to focus on the applicable design requirements in order to better promote international trade and basis for future development while enhancing the safety of UAS operations.

Unmanned aircraft systems —

Part 2:
UAS components

1 Scope

This document specifies requirements for ensuring the quality and safety of the design and manufacture of unmanned aircraft systems (UAS) that include unmanned aircraft (UA), remote pilot stations (RPS), datalinks, payloads, and associated support equipment.

This document includes information regarding the unmanned aircraft, any associated remote pilot station (RPS)(s), the command and control links (C2 Link), any other required data links (e.g. payload, traffic management information, vehicle identification) and any other system elements as can be required. This document does not cover passenger carrying UAS or technical requirements for the design and manufacturing for UAS components.

This document does not include equipment considerations unique to compliance with UA traffic management systems.

The document is applicable to the reasonable expected use of a UAS.

This document is applicable:

a) to UAS designed for use where a State aviation authority has determined a Certificate of Airworthiness (C of A) is not required;

b) where a C of A is required, to complement technical standards published by the aviation authority for the purposes of building the certification basis; or

c) as an alternative means of compliance if acceptable to the aviation authority.

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 6858, *Aircraft — Ground support electrical supplies — General requirements*

ISO 21384-1, *Unmanned Aircraft Systems – Part 1: General specification*

IEC 62133 (all parts), *Battery Standards*

IEC 62368-1, *Audio/video, information and communication technology equipment - Part 1: Safety requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21384-1 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
airframe
mechanical structure of an aircraft which typically includes the fuselage, wings and undercarriage and excludes the *propulsion system* (3.8)

3.2
avionics
electronics as applied to aviation which include *propulsion system* (3.8) controls, FCS, navigation, communications, flight recorders, lighting systems, threat detection, fuel systems, electro-optic/ infrared (EO/IR) systems, weather radar, performance monitors, and systems that carry out various mission and flight management tasks

3.3
C2 Link
data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight

3.4
controlled airspace
airspace of defined dimensions within which air traffic control service (ATS) is provided in accordance with the airspace classification

Note 1 to entry: Controlled airspace is a generic term which covers ATS airspace classes A, B, C, D and E.

3.5
flight plan
specified information provided to ATS units, relative to an intended flight or portion of a flight of an aircraft

3.6
ground speed
horizontal speed of a UA relative to the ground

3.7
maintenance
performance of tasks required to ensure the *reliability* (3.9) of an aircraft, including any one or combination of overhaul, inspection, replacement, defect rectification, and the embodiment of a modification or repair

3.8
propulsion system
engines and motors using components such as propellers and turbine engines that are necessary for propulsion generation and affect the control or safety of flight.

3.9
reliability
ability of a system or component to function under stated conditions for a specified period of time

3.10
vulnerability
flaw or defect, if exploited, could result in a security or safety compromise

4 Abbreviated terms

C2 Link	command and control link
CA	collision avoidance
C of A	certificate of airworthiness
COTS	commercial off the shelf
C-UAS	counter-UAS
DoD	Department of Defence
E3	electromagnetic environmental effects
EMC	electromagnetic compatibility
EME	electromagnetic environment
EMI	electromagnetic interference
EMSEC	emanations security
EO/IR	electro-optical/infrared
ESC	electronic speed controller
EUROCAE	European Organisation for Civil Aviation Equipment
FCS	flight control system
GNSS	Global Navigation Satellite System
HERF	hazardous electromagnetic radiation to fuel
HERO	hazardous electromagnetic radiation to ordnance
HITL	human in the loop
HUMS	health and usage monitoring systems
ICAO	International Civil Aviation Organization
IMU	inertial measurement unit
RPS	remote pilot station
RTK	real time kinematic
SDLC	software development life cycle
UA	unmanned aircraft
UAS	unmanned aircraft system
UPS	uninterruptable power supply
UV	ultra-violet

VLOS	visual line of sight
VTOL	vertical take-off and landing
WGS	world geodetic system

5 General design requirements for UAS

5.1 General

The systems related to the design of a UAS consist of the:

a) unmanned aircraft;

b) communication systems;

c) mission payloads;

d) RPS;

e) support equipment.

5.2 Function and reliability

5.2.1 Design

The following minimum concepts shall be incorporated in the design to ensure the functionality and reliability of the UAS, wherever possible:

a) simplify the design criteria to reduce the product complexity;

b) identify the components critical to flight safety;

c) ensure the functionality and reliability of the UAS throughout the operational flight envelope, applying safety margins and redundancy for components critical to flight safety;

d) minimise stress to the components and mechanical parts;

e) establish thermal design criteria throughout the components selection, circuit design and structural design to enable reliability over a wide temperature range;

f) conduct an electromagnetic interference (EMI) or electromagnetic compatibility (EMC) evaluation and design mitigations for harmful effects of electromagnetic radiation from the operational environment as well as those produced by other components of the UAS;

NOTE Additional information on electromagnetic environmental effects can be found in Annex B.

g) adopt software reliability design and analysis tools;

h) apply environmental protection in the design and materials to limit the environmental effects on components critical to flight safety;

i) apply protections designed to avoid damage to the UAS during the packaging, handling, transportation and storage;

j) establish specific design approach and references to evaluate gust loads, whenever UA configuration leads to extremely severe loads;

k) establish manoeuvre safe operation provisions or limitations, in case of manual commands or semi-automatic commands, to ensure operational flight loads limit to be respected;

l) adopt software reliability design, including cybersecurity requirements, and analysis tools.

5.2.2 Components

The manufacturer shall document the following minimum component reliability for components identified as "critical" in 5.2.1 b):

a) mission time between fatal failures;

b) mean time between failures or failure rate;

c) mean time between maintenance;

d) cumulative failure rate.

5.3 Maintainability and supportability

5.3.1 Design

The UAS design shall ensure:

a) the interchangeability and standardization of parts;

b) that detachable parts cannot be incorrectly assembled;

c) that replaceable parts are readily accessible for maintenance;

d) that diagnostic testing points are readily accessible;

e) there is a method to track parts and components to identify, monitor and promptly act on present or future failures within the UAS;

f) that the maintenance and support requirements document is presented in a clear, consistent and unambiguous manner.

5.3.2 Documentation

The manufacturer shall document the maintenance requirements for components identified as "critical" in 5.2.1 b) and make them available to the operator. The following factors shall be included:

a) mean repair time or repair rate;

b) mean maintenance time;

c) propulsion system replacement time;

d) maintenance schedules and instructions;

e) repair and replace instructions;

f) troubleshooting information;

g) structural inspection intervals and procedures for the UA;

h) servicing information;

i) assembly and disassembly instructions (where applicable);

k) pre-flight and/or post-flight structural integrity checks for UA which are required to be assembled before being operated.