
**Unmanned aircraft systems —
Part 2:
UAS components**

*Aéronefs sans pilote —
Partie 2: Composants des UAS*

**iTeh Standards
(<https://standards.iteh.ai>)
Document Preview**

[ISO 21384-2:2021](https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021)
<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>



Reference number
ISO 21384-2:2021(E)

© ISO 2021

iTeh Standards

(<https://standards.iteh.ai>)

Document Preview

[ISO 21384-2:2021](#)

<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	vii
Introduction	viii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	2
5 General design requirements for UAS	4
5.1 General	4
5.2 Function and reliability	4
5.2.1 Design	4
5.2.2 Components	5
5.3 Maintainability and supportability	5
5.3.1 Design	5
5.3.2 Documentation	5
5.3.3 Support	6
5.4 Fatigue durability	6
5.5 Aircraft identification features	6
5.6 Transportation, storage and packaging	6
6 Aircraft structures	7
6.1 Overview	7
6.2 Damage tolerance assessment	7
6.3 UA construction	7
6.4 Moving parts	8
6.5 Attached parts	8
7 Propulsion	8
7.1 Propulsion risk management	8
7.2 Engines and motors	8
7.2.1 General requirements	8
7.2.2 Mounting and installation	8
7.2.3 Combustion engines	9
7.2.4 Electric motors	9
7.2.5 Electronic speed controller (ESC) requirements	9
7.3 Thrust mechanisms	9
7.3.1 Propellers and rotors	9
7.3.2 Turbine and fans	10
8 Electrical systems	10
8.1 General	10
8.2 Electrical safety	10
8.3 Airborne electrical systems	10
8.4 Ground electrical systems	10
8.4.1 UAS electrical components on the ground	10
8.4.2 RPS power system	11
8.4.3 Labelling	11
9 Energy sources	11
9.1 Batteries	11
9.1.1 General	11
9.1.2 Protective measures	11
9.1.3 Precautions	11
9.2 Combustible fuels	11
9.3 Fuel cells	12
9.3.1 General requirements	12

9.3.2	General safety requirements.....	12
9.3.3	Protective measures.....	12
10	Equipment.....	12
10.1	Avionic equipment (general).....	12
10.2	Flight control system (FCS).....	13
10.2.1	General requirement.....	13
10.2.2	Flight control hardware.....	13
10.2.3	Flight control software.....	14
10.2.4	Course accuracy.....	14
10.2.5	Airspeed.....	14
10.3	Flight control actuators.....	15
10.4	Diagnostics.....	15
10.5	Navigation systems.....	15
10.5.1	General.....	15
10.5.2	Global Navigation Satellite System (GNSS) receiver.....	15
10.5.3	Real time kinematic (RTK) augmentation.....	15
10.5.4	Inertial measurement unit (IMU).....	16
10.5.5	Magnetic compass.....	16
10.6	Attitude sensors.....	16
10.6.1	Altimeter.....	16
10.6.2	Airspeed sensor.....	16
10.6.3	Optical sensor.....	17
10.7	Hardware and software redundancy.....	17
10.8	Failure modes.....	17
11	C2 Link.....	18
11.1	Performance and design.....	18
11.2	Antenna module design.....	18
11.3	Operations.....	18
11.4	Monitoring.....	19
11.5	Protocol.....	19
11.6	Data features.....	19
11.6.1	General.....	19
11.6.2	UA status data standards/iso/0061/390-7/ccb-4579-9502-2c/122b055cc/iso-21384-2:2021	19
11.6.3	Delay requirements.....	19
11.7	Reliability requirements.....	19
11.8	Security requirements.....	20
12	Remote pilot station.....	20
12.1	General.....	20
12.2	Features.....	20
12.2.1	General.....	20
12.2.2	Data monitoring systems requirements.....	20
12.3	Design requirements.....	20
12.3.1	System.....	20
12.3.2	Structure.....	21
12.3.3	Human factors engineering and ergonomics design.....	21
12.4	Functional requirements.....	21
12.4.1	Mission planning.....	21
12.4.2	Data link control.....	21
12.4.3	Flight Control Commands.....	21
12.5	Displays.....	22
12.5.1	Instrumentation.....	22
12.5.2	Readability.....	22
12.5.3	Accuracy.....	22
12.5.4	Warnings, cautions, and advisories.....	22
12.5.5	Display/interface failures.....	22
12.5.6	Track and parameter display.....	23
12.5.7	C2 Link status display.....	23

12.6	12.5.8 Telemetry parameter record	23
12.6	Performance requirements	23
	12.6.1 Environmental adaptability	23
	12.6.2 Reliability	24
12.7	Safety	24
12.8	Collision avoidance (CA) systems	24
13	Payload	24
13.1	General requirements	24
13.2	Safety marking	25
13.3	Wiring design	25
13.4	Payload power supply	25
13.5	Storage requirement	25
14	Airworthiness	25
14.1	Documentation	25
	14.1.1 Instructions	25
	14.1.2 Manuals and handbooks	25
	14.1.3 Procedural changes	26
14.2	Composition of an operator's manual	26
	14.2.1 Technical specifications	26
	14.2.2 Flight performance	26
	14.2.3 Aircraft weights	26
	14.2.4 Flight control accuracy	26
	14.2.5 Dimensions	27
	14.2.6 Atmospheric and other environments adaptability	27
14.3	Electromagnetic compatibility considerations	27
14.4	Noise	27
14.5	Built-in test and monitoring	27
14.6	System safety program	28
	14.6.1 Selection of design materials	28
	14.6.2 Properties and processes	28
	14.6.3 Mass properties	28
	14.6.4 Corrosion	29
	14.6.5 Material limitations	29
	14.6.6 Fire hazards	29
	14.6.7 Equipment separation	29
15	UAS software	29
15.1	Software architecture and design	29
15.2	Safety	30
15.3	Security	30
15.4	Software compliance	30
15.5	Software development life cycle	30
16	Other considerations	30
16.1	Ground equipment	30
16.2	Multi vehicle control	31
16.3	Jamming and spoofing	31
17	Automation	31
17.1	General	31
17.2	Software development lifecycle	31
17.3	Remote pilot intervention	32
17.4	System data collection	32
17.5	Automation risk assessment	32
17.6	Automation system architecture	32
Annex A	(informative) Software risk management	33
Annex B	(informative) Electromagnetic environmental effects (E3)	36

Bibliography.....	38
--------------------------	-----------

**iTeh Standards
(<https://standards.iteh.ai>)
Document Preview**

[ISO 21384-2:2021](#)

<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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.

<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>

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.

iTeh Standards

(<https://standards.iteh.ai>)

Document Preview

[ISO 21384-2:2021](#)

<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>

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: <https://standards.iteh.ai>

- 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*

IEC 62133 (all parts), *Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

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 following terms and definitions 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 [ISO 21384-2:2021](#)

<https://standards.iteh.ai/catalog/standards/iso/00617390-7ecb-4579-9502-2c7f22b035ce/iso-21384-2-2021>

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) https://standards.itk.ca/catalog/standards/iso/00617390_7ech-4570-9502-2c7f22b035ce/iso-21384-2-2021 conduct an EMI/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.