

DRAFT INTERNATIONAL STANDARD

ISO/DIS 21384-2

ISO/TC 20/SC 16

Secretariat: **ANSI**

Voting begins on:
2021-03-11

Voting terminates on:
2021-06-03

Unmanned aircraft systems —

Part 2: UAS Components

ICS: 49.020

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/DIS 21384-2](https://standards.iteh.ai/catalog/standards/sist/00617390-7ecb-4579-9502-2c7f22b035ce/iso-dis-21384-2)

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

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.



Reference number
ISO/DIS 21384-2:2021(E)

© ISO 2021

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO/DIS 21384-2

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



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	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 List of abbreviated terms	3
5 General design requirements for unmanned aircraft systems	5
5.1 General	5
5.2 Function and Reliability	5
5.2.1 Design	5
5.2.2 Components	5
5.3 Maintainability and supportability	6
5.3.1 Design	6
5.3.2 Documentation	6
5.3.3 Support	6
5.4 Fatigue durability	6
5.5 Transportation, storage and packaging	7
6 Aircraft Structures	7
6.1 General requirements	7
6.1.1 Fatigue evaluation and damage tolerance	7
6.1.2 Conspicuity	8
6.1.3 UA Construction	8
6.1.4 Moving parts	8
6.1.5 Attached parts	8
6.2 Aircraft identification	8
7 Propulsion	8
7.1 Propulsion risk management	9
7.2 Engines and motors	9
7.2.1 General requirements	9
7.2.2 Mounting and Installation	9
7.2.3 Combustion engines	9
7.2.4 Electric motors	10
7.2.5 Electronic speed controller (ESC)	10
7.3 Thrust mechanisms	10
7.3.1 Propellers and Rotors	10
7.3.2 Turbine and fans	10
8 Electrical systems	11
8.1 General	11
8.2 Electrical Safety	11
8.3 Ground electrical systems	11
8.3.1 RPS power system	11
8.3.2 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	12
9.2 Fossil fuels	12
9.3 Fuel cells	12
9.3.1 General requirements	12
9.3.2 General safety requirements	12

10	Avionics	12
10.1	Avionic equipment - general	12
10.2	Flight control systems	13
10.2.1	General requirement	13
10.2.2	Flight Control Hardware	13
10.2.3	Flight Control Software	13
10.2.4	Course accuracy	14
10.2.5	Airspeed	14
10.3	Flight control actuator	14
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)	15
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	Redundancy	17
10.7.1	Hardware redundancy	17
10.7.2	Software redundancy	17
10.8	Failure modes	17
11	C2 Link	18
11.1	Antenna module design	18
11.2	C2 Link	18
11.2.1	Operations	18
11.2.2	C2 Link Security	18
11.2.3	C2 Link protocol	18
11.3	Data Features	19
11.3.1	UA status Data	19
11.3.2	Delay requirements	19
11.4	Reliability Requirements	19
11.5	Security Requirements	19
12	Remote Pilot Station	19
12.1	Features	19
12.1.1	Data monitoring systems	20
12.2	Design requirements	20
12.2.1	System	20
12.2.2	Structure	20
12.2.3	Ergonomics design	20
12.3	Functional requirements	21
12.3.1	Mission planning	21
12.3.2	Data Link control	21
12.3.3	Flight Control Commands	21
12.4	Displays	21
12.4.1	Instrumentation	21
12.4.2	Readability	22
12.4.3	Accuracy	22
12.4.4	Warnings, cautions, and advisories	22
12.4.5	Display/interface failures	22
12.4.6	Track and parameter display	22
12.4.7	C2 Link status display	22
12.4.8	Telemetry parameter record	22
12.5	Performance requirements	23
12.5.1	Environmental adaptability	23

iTech STANDARD PREVIEW

(standards.itech.ai)

ISO/DIS 21384-2

[https://standards.itech.ai/catalog/standards/sist/00617390-7ecb-4579-9502-](https://standards.itech.ai/catalog/standards/sist/00617390-7ecb-4579-9502-2c7f22b035ce/iso-dis-21384-2)[2c7f22b035ce/iso-dis-21384-2](https://standards.itech.ai/catalog/standards/sist/00617390-7ecb-4579-9502-2c7f22b035ce/iso-dis-21384-2)

12.5.2	Reliability	23
12.6	Safety	23
12.7	Collision avoidance (CA) systems	24
13	Payload	24
13.1	General requirements	24
13.2	Payload safety marking	24
13.2.1	Wiring design	24
13.2.2	Payload power supply	24
13.3	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	Process changes	25
14.2	Composition of an operator's manual	25
14.2.1	Flight performance	25
14.2.2	Aircraft weights	26
14.2.3	Flight control accuracy	26
14.2.4	Dimensions	26
14.2.5	Atmospheric and other environments adaptability	26
14.2.6	Mechanical Environment adaptability	27
14.2.7	Electromagnetic compatibility considerations	27
14.2.8	Noise	27
14.3	Self-test and monitoring	27
14.4	System safety program	27
14.4.1	Selection of design materials	27
14.4.2	Properties and processes	28
14.4.3	Corrosion	28
14.4.4	Material limitations	29
14.4.5	Design considerations	29
14.4.6	Equipment separation	29
15	UAS software	29
15.1	Software architecture and design	30
15.1.1	Safety	30
15.1.2	Security	30
15.2	Software compliance	30
15.3	Software development life cycle	30
16	Other considerations	30
16.1	Ground Support Equipment	30
16.2	Multi vehicle control	30
16.3	Jamming and spoofing	31
17	Automation	31
17.1	General	31
17.1.1	Software development lifecycle	31
17.1.2	Remote pilot intervention	31
17.1.3	System data collection	32
17.2	Automation risk assessment	32
17.3	Automation system architecture	32
Annex A (informative) Software risk management		33
Annex B (informative) Electromagnetic environmental effects (E3)		36
Bibliography		38

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 on 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 the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 16, *Unmanned aircraft systems*.
<https://standards.iteh.ai/catalog/standards/sist/00617390-7ecb-4579-9502-2c7f22b035ce/iso-dis-21384-2>

Introduction

This International Standard specifies requirements for ensuring the quality and safety of the design and manufacture of heavier than air unmanned aircraft systems (UAS) whose lifting devices are fixed or rotary wings. The standard includes information regarding the unmanned aircraft, any associated remote pilot station (RPS)(s), the command and control (C2) Links, any other required data links (e.g. payload, traffic management information, vehicle identification) and any other system elements as may be required. This standard does not cover passenger carrying UAS, nor technical requirements for the design and manufacturing for UAS components.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO/DIS 21384-2

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

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

ISO/DIS 21384-2

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

Unmanned aircraft systems —

Part 2: UAS Components

1 Scope

This International Standard specifies requirements for ensuring the quality and safety of the design and manufacture of unmanned aircraft systems (UAS) that include unmanned aircraft (UA) with lifting devices that are fixed primary wing structures, rotating components of vertical lifting elements, or both. This standard does not cover technical requirements for the design and manufacturing for UAS components.

This standard does not include equipment considerations unique to comply with UA traffic management systems. Additional equipment not addressed by this standard may be required.

Manufactures should apply requirements where the standard would be applicable to the reasonable expected use of the UAS.

The standard is intended for:

- a) UAS designed for use where a State aviation authority has determined a certificate of airworthiness (C of A) is not required; or
- 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 Alternative Means of Compliance if acceptable to the aviation authority.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and may be useful for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM F3201-16, *Standard Practice for Ensuring Dependability of Software Used*

Doc ICAO 10019, *Manual on Remotely Piloted Aircraft Systems (RPAS)*

IEC 62368-1:2018, *Audio/video, information and communication technology equipment - Part 1: Safety requirements*

ISO/IEC 12207, *Systems and software engineering*

ISO/IEC 18033, *IT Security techniques — Encryption algorithms*

ISO 6858:2017, *Aircraft — Ground support electrical supplies — General requirements*

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

ISO 21384-3, *Unmanned aircraft systems — Part 3: Operational procedures*

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 terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

airframe

the mechanical structure of an aircraft which typically includes the fuselage, wings and undercarriage and excludes the propulsion system

3.2

avionics

electronics as applied to aviation which include engine controls, flight control systems, navigation, communications, flight recorders, lighting systems, threat detection, fuel systems, electro-optic (EO/IR) systems, weather radar, performance monitors, and systems that carry out hundreds of other mission and flight management tasks

3.3

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.

3.4

flight plan

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

3.5

ground speed

the horizontal speed of a UA relative to the ground

ISO/DIS 21384-2
<https://standards.iteh.ai/catalog/standards/sist/00617390-7ecb-4579-9502-87226035ce/iso-dis-21384-2>

3.6

hover

a flight condition in which the VTOL aircraft is maintained in nearly motionless flight over a reference point at a constant altitude and on a constant heading

3.7

landing

phase of flight from the beginning of the landing flare until aircraft exits the landing runway, comes to a stop on the runway, or when power is applied for take-off in the case of a touch and go landing. For rotorcraft – the phase of flight where the rotorcraft transitions from forward flight to hovering prior to touchdown.

3.8

maintenance

performance of tasks required to ensure the continuing airworthiness of an aircraft, including any one or combination of overhaul, inspection, replacement, defect rectification, and the embodiment of a modification or repair

3.9

phase of flight

period within a flight that begins when power is applied to the UA with the intention of flight and continues until such time as power is removed.

3.10

reliability

describes the ability of a system or component to function under stated conditions for a specified period of time

3.11**take-off**

phase of flight from the application of take-off power, through rotation and to an altitude of 50 feet above runway elevation, an altitude where the UAS stops climbing and maintains level flight or until gear up selection, whichever occurs first. For rotorcraft – the phase of the flight where transitions from the surface (or a hover in ground effect) into an out of ground-effect controlled flight condition.

3.12**taxi**

phase of flight in which the aircraft is moving on (or hovering in ground effect) the surface under its own power prior to take-off or after landing

3.13**vulnerability**

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

4 List of abbreviated terms

AES	Advanced Encryption Standard
C2	Command and Control
CA	Collision Avoidance
C of A	Certificate of Airworthiness
COTS	Commercial Off the Shelf
C-UAS	Counter-UAS
DAL	Design Assurance Level
DoD	Department of Defence
E3	Electromagnetic Environmental Effects
ECU	Environmental Control Unit
EMC	Electromagnetic Compatibility
EME	Electromagnetic Environment
EMF	Electromagnetic Frequency
EMI	Electromagnetic Interference
EMSEC	Emanations Security
ESC	Electronic Speed Controller
EUROCAE	European Organisation for Civil Aviation Equipment
FBIT	Flight Built in Test
FC	Flight Controller
FCS	Flight Control System
FMEA	Failure Mode Effective Analysis

FMECA	Failure Modes, Effects And Criticality Analysis
FTA	Fault Tree Analysis
GNSS	Global Navigation Satellite System
HERF	Hazardous Electromagnetic Radiation to Fuel
HERO	Hazardous Electromagnetic Radiation to Ordnance
HITL	Human In the Loop
HMI	Human-Machine Interface
HUMS	Health and Usage Monitoring Systems
ICAO	International Civil Aviation Organisation
ICT	Information, Communication and Technology
IMU	Inertial Measurement Unit
IEC	International Electrotechnical Commission
INS	Inertial Navigation System
ISED	Innovation, Science, and Economic Dev
ISO	International Organization For Standardization
LAN	Local Area Network
LOS	Line of Sight
LRU	Line Replaceable Units
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
NDI	Non-Destructive Inspection
PBIT	Pre-Flight Built in Test
PUBIT	Power Up Built in Test
PWM	Pulse Width Modulation
RLOS	Radio Line of Sight
RPAS	Remotely Piloted Aircraft System
Rm	Mission Reliability
RTK	Real Time Kinematic
SDLC	Software Development Life Cycle
TBT	Technical Barriers to Trade
UA	Unmanned Aircraft

UAS	Unmanned Aircraft System
UPS	Uninterruptable Power Supply
UTM	UAS Traffic Management
VTOL	Vertical Take-Off and Landing
WTO	World Trade Organization

5 General design requirements for unmanned aircraft systems

5.1 General

The systems related to the design of an unmanned aircraft system consists of the unmanned aircraft, communication system, mission payloads, RPS and maintenance 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 unmanned aircraft system, wherever possible:

- a) Simplify the design criteria to reduce the product complexity;
- b) Identify the components critical to flight safety;
- c) Ensure the reliability of the UAS throughout the Operational Flight Envelope, applying safety margins and redundancy for components critical to flight safety;
- d) Minimize 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)/ 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 on the UA;
- g) Adopt software reliability design and analysis tools;
- h) Apply protections designed to avoid damage to the UAS during the packaging, handling, transportation and storage;
- i) Establish specific design approach and references to evaluate gust loads, whenever UA configuration leads to extremely severe loads; and
- j) 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.

5.2.2 Components

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

- a) mission time between fatal failures;
- b) mean time between failures or failure rate;