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Categorization and classification of civil unmanned aircraft systems

Catégorisation et classification des aéronefs civils sans pilote

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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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

This document sets out a methodology for the multi-dimensional classification of unmanned aircraft system (UAS). The purpose of this classification model is not to replace any existing regulatory model but to provide a more granular classification tool for use by those who need to approach the classification of UAS from their own perspective and for whom the regulatory model is too broad. Examples may be but are not limited to; engineers, manufacturers, certification bodies, insurance underwriters or accident investigators.

Categorization and classification of civil unmanned aircraft systems

1 Scope

This document specifies requirements for the classification and grading of civil unmanned aircraft system (UAS). This document applies to heavier than air aircraft as well as lighter than air aircraft of any possible architecture.

This document applies to the industrial conception, development, design, production and delivery of civil UAS. It also applies to modification, repair and maintenance of civil UAS.

The characteristics in this document can be used individually or in combination, to meet specific needs of the classification and grading of civil UAS.

Risk-based categorization of UAS operations is prerogative of the aviation authorities and it is hence out of scope of this document.

2 Normative references

The following document is 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[1)], *Unmanned aircraft systems — Part 4: Vocabulary*

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 terminological databases for use in standardization at the following addresses:

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

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

3.1
multicopter
rotorcraft lifted by more than two power driven rotors on substantially vertical axis

3.2
aerostat
lighter than air aircraft

4 Classification and grading principle

Civil UAS classification is proposed from different viewpoints, which are subsequently categorized and graded against a stakeholder specific rule set. The framework provides a valuable tool for all stakeholders in the industry to categorize UAS from their perspective and the perspective of others.

Figure 1 shows a conceptual structure of the UAS classification framework.

1) Under preparation. Stage at the time of publication: ISO/DIS 21384-4:2019.

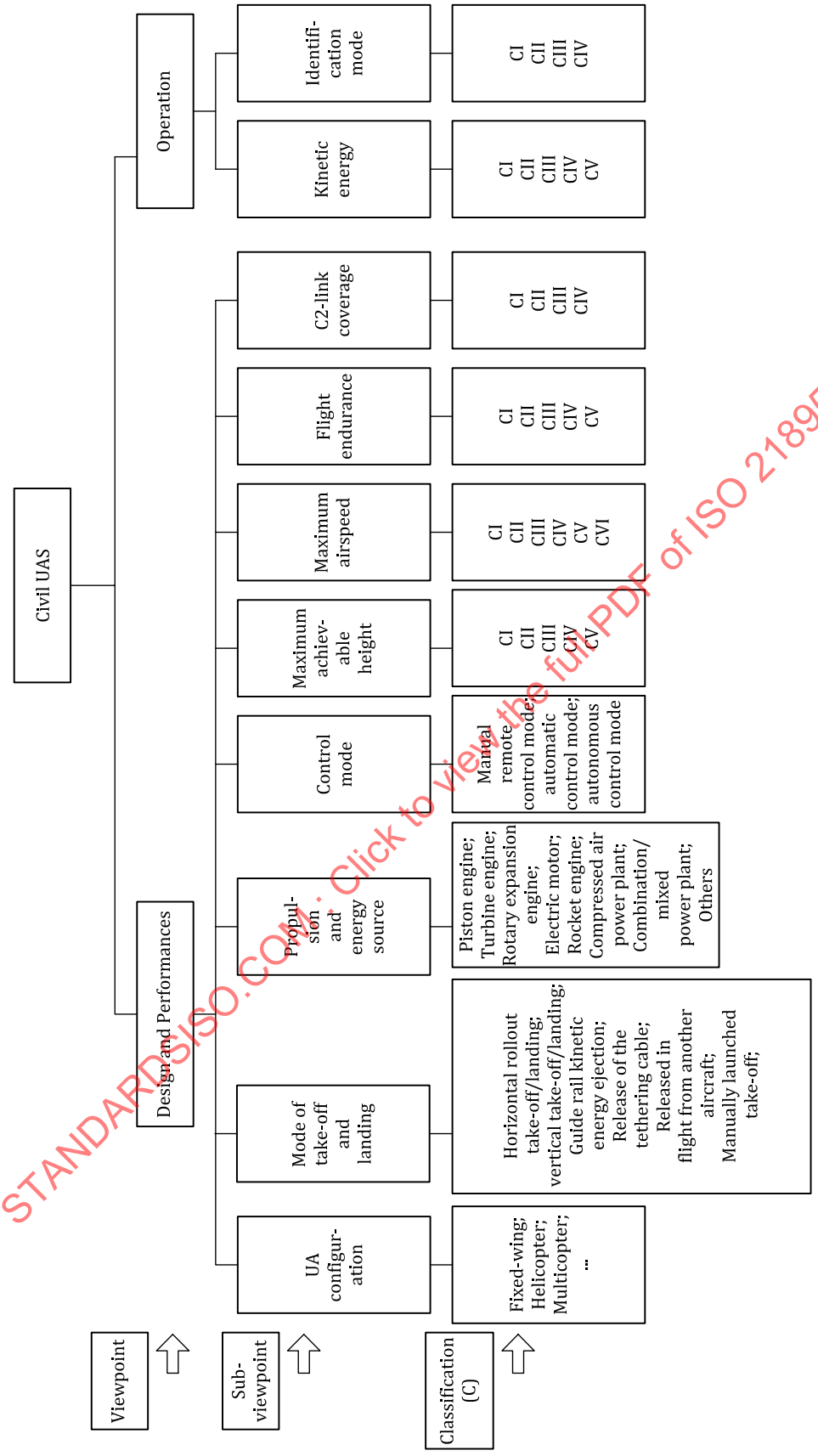

Figure 1 — Civil UAS classification framework

Figure 2 shows an example for grading framework under fixed wing, helicopter and multicopter.

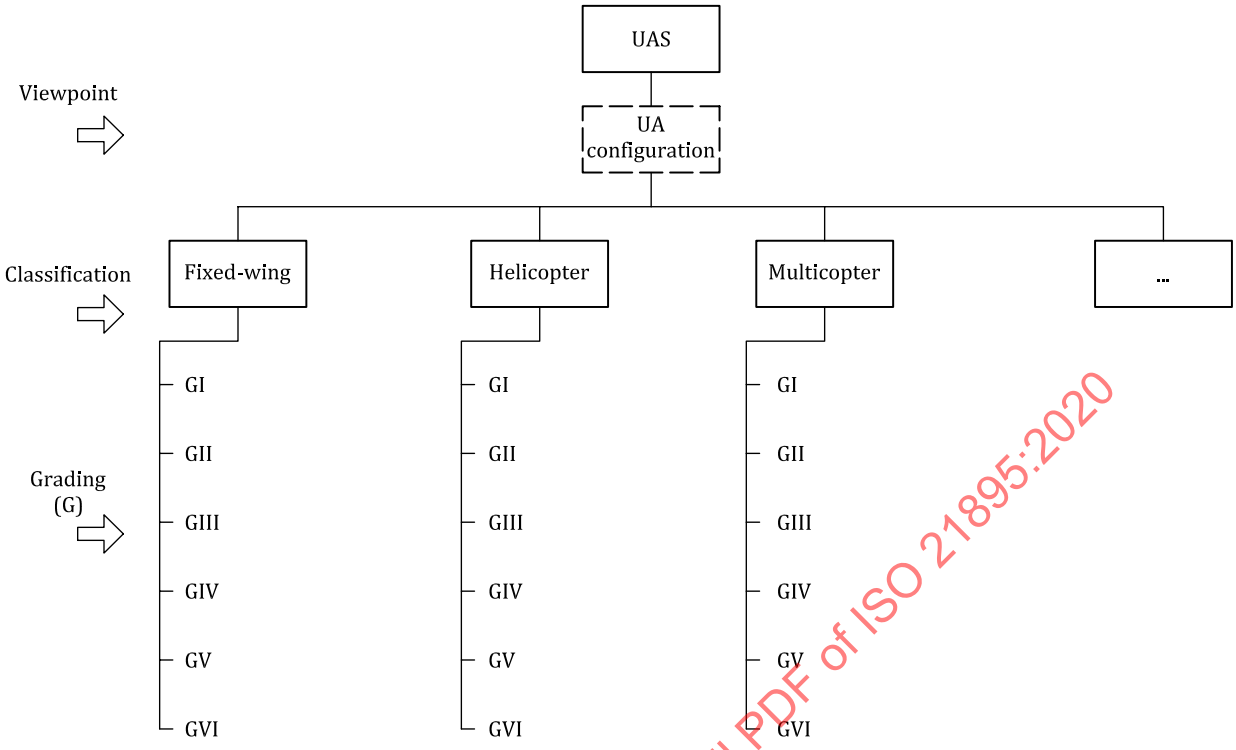

Figure 2 — Example for grading framework under fixed-wing, helicopter and multicopter

5 Classification

5.1 UA-configuration

According to the UA-configuration, an unmanned aircraft (UA) shall be classified as follows:

a) powered fixed-wing plane (or aeroplane);

b) glider;

c) single rotor helicopter;

d) multicopter;

e) gyroplane;

f) parawing, flapping-wing (ornithopter) and other bio-inspired aircraft;

g) vertical take-off and landing (VTOL), other than helicopter or multicopter;

h) airships;

i) tethered or free aerostatic balloons;

j) tethered heavier than air aircraft (e.g. kites);

k) aerostat;

l) others.

5.2 Mode of launch and recovery/take-off and landing

5.2.1 Mode of launch/take-off

The mode of launch/take-off, from an aerodrome, from an elevated platform, from water or from a floating platform, shall be classified as follows:

a) horizontal rollout take-off;

b) vertical take-off;

c) guide rail kinetic energy ejection (e.g. catapult): pneumatic pressure, hydraulic pressure, rubber-cord, electromagnetism, etc.;

d) release of the tethering cable (e.g. by a winch);

e) released in flight from another aircraft;

f) manually launched take-off;

g) others.

Several of these modes may be rocket assisted or rocket propelled.

5.2.2 Mode of recovery/landing

The mode of recovery/landing shall be classified as follows:

a) horizontal rollout landing;

b) vertical landing;

c) parachute recovery;

d) intercepted in flight by a recovery aircraft;

e) net/rope recovery;

f) pulling of the tethering cable;

g) pneumathode recovery (parachutes, airbags or other kinds of shock absorbers);

h) others.

5.3 Engine/powerplant type and energy source

5.3.1 Engine/powerplant type

The engine/powerplant type shall be classified as follows:

a) piston engine;

b) turbine engine;

c) rotary expansion engine;

d) electric motor;

e) rocket engine;

f) compressed air power plant;

g) combination/mixed power plant;

h) others.

5.3.2 Energy source

The energy source of dynamic force production shall be classified as follows:

a) gaseous fuel: hydrogen, etc.;

b) liquid fuel: jet fuel (heavy oil), methanol, gasoline, diesel fuel;

c) battery: lithium battery, nickel-metal hydride battery, fuel battery, etc.;

d) combination/mixed energy source;

e) others: solar energy, wind energy source, air upstream energy, etc.

5.4 Control mode

In terms of control mode, it shall be divided into:

a) manual (control) mode: the drivers use continuous instruction by way of the flight control system to realize direct piloting (human in the loop);

b) automatic (control) mode: according to pre-entered flight instructions, onboard systems, in the case of basically needing no intervention, automatically and continuously complete the entire flight (human on the loop);

c) autonomous (control) mode: program control flight with self-adaptive and self-decision-making abilities (human out of the loop).

The control mode may vary during different phases of flight.

5.5 Maximum achievable height

The maximum intended height shall be classified as:

a) very low level:

   1) level I: maximum height ≤ 15 m (above ground level);

   2) level II: 15 m (above ground level) < maximum height < 120 m (above ground level).

b) medium level:

   1) level III: 120 m (above ground level) ≤ maximum height ≤ 1 500 m (above ground level);

   2) level IV: 1 500 m (above ground level) < maximum height ≤ 18 300 m (standard air pressure altitude).

c) very high level:

   1) level V: maximum height > 18 300 m (flight level 600 standard air pressure altitude).

5.6 Maximum airspeed

The maximum airspeed shall be divided into:

a) level I: maximum airspeed ≤ 70 km/h;

b) level II: 70 km/h < maximum airspeed ≤ 0,15 Ma;

c) level III: 0,15 Ma < maximum airspeed ≤ 0,3 Ma;