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UAS traffic management (UTM) —

Part 7: **Data model for spatial data**

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Foreword

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This document was prepared by Technical Committee, ISO/TC20, Aircraft and space vehicles, Subcommittee SC 16, Unmanned aircraft systems.

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Introduction

In order to enable UAS (Unmanned Aircraft Systems) to operate safely, there is a need to define the data model that is related to various spatial information for common use between the UAS operators and the UAS Traffic Management (UTM) system. Existing standards regarding spatial data for safely operating UAS including static data and dynamic data do not exist, whereas efforts are underway to establish related standards on the part of ASTM and EUROCAE.

This document can be used as a reference model. Implementations of this specification could lead to cost reductions in maintenance/expansion for application developers as well as compilation/maintenance of map data for map providers.

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UAS traffic management (UTM) —

Part 7: **Data model for spatial data**

1 Scope

This document specifies the data model that is related to various spatial information for common use between the UAS service provider and the system for operation control, e.g. UTM. The data model is included in the scope in the way that it specifies the names of the items for the model, while the communication architecture is not included in the scope.

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 21384-4:2020, Unmanned aircraft systems — Part 4: Vocabulary

ISO 19157:2013, Geographic information + Data quality h.ai)

3 Terms and definitions

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For the purposes of this document, the following 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 https://www.iso.org/obp

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

3.1

Aerodrome

A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft

[SOURCE: ICAO/Annex 2]

3.2

CNS

Communications, navigation, and surveillance systems, employing digital technologies, including satellite systems together with various levels of automation

[SOURCE: ICAO Doc. 9750]

3.3

elevation

vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level

[SOURCE: ICAO/Annex 4]

3.4

flight route

specified route designed for channelling the flow of traffic as necessary for the provision of UTM

3.5

geo-Limitation

geo-Limitation is an entity that represents area surrounded by virtual boundary lines in the real world

3.6

height above ellipsoid

HAE

vertical distance of a point or a level, on or affixed to the surface of the earth, measured from WGS 84 ellipsoid

3.7

unmanned aircraft

UA

aircraft which is designed to be operated remotely or autonomously

[SOURCE: ISO 21384-4]

3.8

vertiport

infrastructure or system with supporting services and equipment intended for landing, groundhandling and take-off of manned or unmanned vertical take-off and landing (VTOL) aircraft.

[SOURCE: ISO 21384-4]

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3.9 unmanned aircraft system UAS

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airraft and its associated elements which are operated remotely or autonomously bfa871ec588ae/iso-dis-23629-7

[SOURCE: ISO 21384-4]

3.10

UTM

UAS Traffic Management is a federated set of services designed to ensure safe, secure and efficient integration of multiple manned and unmanned aircraft in the airspace in collaboration among all involved parties

4 Data model

4.1 Overall data model

Overall data model shall consist of four packages: Ground Map package, Obstacle Data package, Virtual Data package, Dynamic data package. <u>Figure 1</u> shows overall data model. For the examples of information, see <u>Annex A</u>. For the use case, see <u>Annex B</u>.

An overall, data quality management system shall prove the data quality in accordance with ISO 19157:2013.



4.2 Ground Map package

4.2.1 **Overview**

Ground Map package contains data that are defined as "geographical surface areas (including buildings) designed for specific activities". Ground Map package shall as a minimum contain two entities: Vertiports and Land.

4.2.2 **Attribute of Vertiport**

Table 1 summarizes minimum attributes of Vertiport.

Attribute	Description
Identifier	Information for identifying the entity
Generate time	Information indicating the time the entity was generated
Disappearance time	Information indicating the time the entity will be disappeared
Available time interval	Information indicating the time interval the port is available
Elevation	Information indicating the elevation.
Geoid undulation at elevation	Information indicating the geoid undulation at elevation
Time zone	Information indicating the time zone

Attribute	Description
Magnetic variation	Information indicating the magnetic variation
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the centre point of the entity in terms of latitudes and longitudes.
Administration contact details	Information indicating the entity's administration contact details (e.g. ad- ministration's name, address, telephone)
Types of UA permitted	Information indicating the types of UA (e.g. model, size, weight) the entity is permitted
Conditions for operation	Information indicating the conditions for operation (e.g. unavailable under wind, rain conditions)
Resources	Information indicating the equipment of the entity (e.g. energy supply, re- pairment, on-site staff)
Availability of emergency landing	Information indicating availability of emergency landing

Table 1 (continued)

4.2.3 Attribute of Land

Land is an entity that represents artificially divided areas for specific activities in the real world. Table 2 lists minimum attributes of Land.

iTehrable 2 Attributes of Land EVIEV	V

Attribute	Description II dards. Iten. al)
Identifier	Information for identifying the entity
Generate time	Information indicating the time the entity was generated
Disappearance time	Information indicating the time the entity will be disappeared
Elevation	Information indicating the elevation.
Geoid undulation at elevation	Information indicating the geoid undulation at elevation
Time zone	Information indicating the time zone
Magnetic variation	Information indicating the magnetic variation
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the centre point of the entity in terms of latitudes and longitudes
Availability of emergency landing	Information indicating availability of emergency landing
Type of land	Information indicating the type of land (e.g. farmland, road, etc.)

4.3 Obstacle Data package

4.3.1 Overview

Obstacle Data package shall contain data that are defined as "tangible objects having a temporarily or permanently fixed location in the real world". Obstacle data package shall as a minimum contain two entities: Static and Temporal Obstacle.

4.3.2 Attribute of Static Obstacle

Static obstacle can be used for buildings, pylons, trees, etc. <u>Table 3</u> summarizes minimum attributes of Static Obstacle.

Attribute	Description
Identifier	Information for identifying the entity
Generate time	Information indicating the time the entity was generated
Disappearance time	Information indicating the time the entity will be disappeared
Height	Information indicating the height of the entity's maximum vertical extent measured from a specified datum (specified in type of height)
Type of height	e.g. AGL, MSL, HAE.
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the centre point of the entity in terms of latitudes and longitudes
Type of obstacle	Information indicating the type of obstacle (e.g. building, tower, pole, anten- na, etc.)

Table 3 — Attributes of Static Obstacle

4.3.3 Attribute of Temporal Obstacle

Temporal can be used for short-term erections or for modifications to a Static obstacle such as scaffolding. <u>Table 4</u> summarizes minimum attributes of Temporal Obstacle.

Attribute	Description TREVIE VV
Identifier	Information for identifying the entity
Generate time	Information indicating the time the entity was generated
Disappearance time	InformationIndicating/the time the entity will be disappeared
Height https://standards.	Theormation indicating the height of the entity's maximum vertical extent measured from a specified datum (specified in type of height)
Type of height	e.g. AGL, MSL, HAE.
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the centre point of the entity in terms of latitudes and longitudes
Type of obstacle	Information indicating the type of obstacle (e.g. scaffolding, construction equipment, etc.)

Table 4 — Attributes of Temporal Obstacle

4.4 Virtual Data package

4.4.1 Overview

Virtual Data package shall contain data that are defined as "virtual objects that are intangible representations (including computer simulated representations) of attributes of particular real-world areas or objects". Virtual Data package shall as a minimum contain four entities: Airspace, Flight Routes, Geo-Limitation, and CNS coverage.

4.4.2 Attribute of Airspace

<u>Table 5</u> summarizes attributes of Airspace.

Table 5 —	Attributes	of Airspace
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Attribute	Description
Identifier	Information for identifying the entity

Attribute	Description
Generate time	Information indicating the time the entity was generated
Disappearance time	Information indicating the time the entity will be disappeared
Upper limit	Information indicating the altitude of the entity's maximum vertical extent
Lower limit	Information indicating the altitude of the entity's minimum vertical extent
Type of height	e.g. AGL, MSL, HAE.
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the centre point of the entity in terms of latitudes and longitudes
Administration contact details	Information indicating the entity's administration contact details (e.g. ad- ministration's name, address, telephone)
Conditions for operation	Information indicating the conditions for operation (e.g. weather conditions, aircraft performance, operation procedures), either generally applicable to all operations, or limited to specific operations.
Requirements of UTM	Information indicating the requirements of UTM (e.g. sharing of traffic infor- mation between manned and unmanned aircraft).
Type of airspace	Controlled airspace, uncontrolled airspace, authorized airspace, unauthorized airspace, etc.

Table 5 (continued)

4.4.3 Attribute of Flight Route h STANDARD PREVIEW

Table 6 summarizes attributes of flight four Affight route may have many elements and may also have a temporal element.

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https://sTable.6tch.aAttributes.of.Flight Route194-47cb-8e5b-

Attribute	Description
Identifier	Information for identifying the entity
Generate time	Information indicating the time the entity was generated
Disappearance time	Information indicating the time the entity will be disappeared
Upper limit	Information indicating the altitude of the entity's maximum vertical extent
Lower limit	Information indicating the altitude of the entity's minimum vertical extent
Type of height	e.g. AGL, MSL, HAE.
Shape	Information indicating the shape and size (e.g. polygon, polyline, polynomial curve or circle) of the entity
Location	Information indicating the vertices or the centre point of the entity in terms of latitudes and longitudes, where vertices are indicated for polylines, polygons, and polynomial curves, and the centre point in case of circles.
Sequence of elements	Information indicating the sequence of elements the flight route entity entails, along with a time element if necessary.
Tolerance	Information indicating the tolerated deviation from the entity in terms of distance from a given location, based on the same ICAO principles that are used in Required Navigation Performance (RNP).
Administration contact details	Information indicating the entity's administration contact details (e.g. administration's name, address, telephone)
Conditions for operation	Information indicating the conditions for operation (e.g. weather conditions, aircraft performance, operation procedures), either generally applicable to all operations, or limited to specific operations.
Requirements of UTM	Information indicating the requirements of UTM (e.g. sharing of traffic infor- mation between manned and unmanned aircraft).