GOF2.0 D2.4 - Updated Service Specifications

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Rejected By - Representatives of beneficiaries involved in the project

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Edition	Date	Status	Author	Justification
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00.00.02	29.04.2021	draft	WP2 Partners	Enhance and update
00.00.03	30.04.2021	released	WP2 Partners	Release

GOF2.0

GOF2.0 INTEGRATED URBAN AIRSPACE VLD

Abstract

This deliverable describes the GOF2.0 information exchange services documented at conceptual level, following SWIM principles, which could be used to implement U-space airspace, following guidance material to (EU 664/2021).

For each service specification there is a separate document. These documents are embedded in this document, which acts as bucket. As a preview, the data model of each service specification is copied into this document.

The service specifications are a baseline, built on experience from previous projects and the GOF2.0 project execution.

They have been updated based on D2.2, with better understanding gained in integration and trials. Updates were performed in agreement between the GOF2.0 project partners, which could be considered a governance body for the project execution time.

Currently, the following information exchange services are available:

- Traffic/Telemetry (Appendix A)
- Operation Plan (Appendix B)
- Geozones (Appendix C)
- Registration (Appendix D)
- Operational Message (Appendix E)
- Traffic Conformance Monitoring (Appendix F)
- Network Data (Appendix G)
- Ground Control Integration (Appendix H)
- Drone Flight (Appendix I)
- Weather (Appendix J)

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1 Executive Summary

The information exchange services described in this document could be used to implement U-space airspace, following guidance material to (EU 664/2021).

This document is an update to D2.2 Service Specification. Changes were done mostly in the areas of operation plan and network data. New service specifications were introduced for weather service and drone flight. For convenience, service specifications of D2.2 were again included in this document.

> *"The GOF2.0 Integrated Urban Airspace VLD (GOF2.0) very large demonstration project will safely, securely, and sustainably demonstrate operational validity of serving combined UAS, eVTOL and manned operations in a unified, dense urban airspace using current ATM and U-space services and systems.*
>
> *Both ATM and U-space communities depend extensively on the provision of timely, relevant, accurate and quality-assured digital information to collaborate and make informed decisions." [12]*
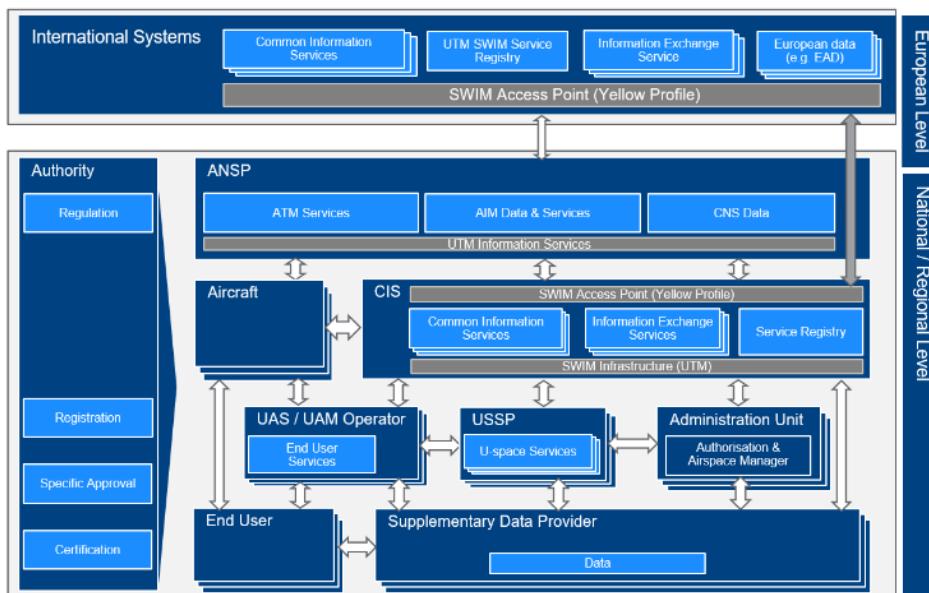

Figure 1 - High level Architecture based on grant agreement

Timely, relevant, accurate and quality-assured digital information is exchanged as shown in Figure 1, indicated by the double arrows. They connect stakeholders in the demonstrated UTM / U-space ecosystem. For each type of information exchanged (e.g. Traffic/Telemetry, Operation Plan, Geodata…).

Information exchange services are introduced and described using formal templates, separating logical, technical and runtime concerns. By defining the interfaces in the system, they enable a modular, interoperable, open, and highly resilient system of systems, allowing for technical variants in implementation and deployment.

This deliverable contains descriptions for the information exchange services identified in GOF2 – harmonizing the information flow between respective services.

2 Introduction

2.1 Purpose of the document

This deliverable contains service specifications for information exchange services on conceptual level.

2.2 Scope

This document contributes to all objectives of the GOF2.0 project, especially those listed below. The focus of this deliverable is indicated in **bold** letters.

- Objective O2: Integrated, lean, modular, resilient and interoperable system architecture supporting safe integration of all UAM vehicles on national and European level

    o Demonstrate **the exchange** of trajectory, weather, connectivity and aeronautical **information through information management, supported by SWIM interoperable services**, to enhance collaborative decision-making at network and global levels, and specifically to allow safe and affordable integration of UAM into a shared airspace at high vehicle densities and in mixed traffic scenarios. Demonstrate **interoperability through standardised interfaces for U-space, CIS and ATM information exchanges, to allow seamless U-space/ATM operations for all operational stakeholders.**

    o Project Results: Documented service architecture, **proposals for standardised interface service descriptions**, performance data from validation trials, tracking performance, probability and reliability of identification and authentication, availability of connectivity, availability of communication means for safety notifications and ATC instruction

- Objective O4: Air-ground and ground-air connectivity and sharing of information digitally

    o Showcase technical means to **enable the exchange of digital information** in support of collaborative management of UAM operations and remote provision of U-space/ATM services:

        ▪ Ground-Air Data link using mobile networks

        ▪ Air-ground Data link using mobile networks

        ▪ **Information Exchanges using the SWIM Yellow Profile**

    o Project Results: Automated **data exchange between the supplementary connectivity data providers and the various stakeholders in the system architecture** for pre-flight and flight operations and services plus validation / audit via measurements

- Objective O7: Virtualisation - allowing more dynamic resource allocation

    o Demonstrate modern-day cloud deployment, **general-purpose communication**, and computer processing capabilities to allow for better performing and more cost-

efficient U-space/ATM service provision. A Centralized cloud deployment serving ANSPs, USSPs and finally all airspace users lead to facilitate data sharing, new synergies, and more cost-efficient management of the U-space/ATM resource network. It facilitates effective interoperability between functional systems.

- o Project Results:

    - U-space service catalogue,

    - Operational and technical performance assessment (Response times for automated and manual flight authorisations.)

    - **Data models**,

    - **ICDs**

    - Airspace assessment

- Objective O9: Definition of novel U-space service essential to enable UAM

    - o Introduce novel U-space services including concept, definition and validation to serve a safe, orderly and efficient integration of UAM. Within the scope of GOF2.0 the following - but not limited to - services will be defined:

        - mobility data: population densities to calculate ground risks

        - connectivity data to ensure reliable communication links between airborne and ground segments

        - hyperlocal weather information

    - o Project Results:

        - U-space services catalogue,

        - **Data models**,

        - **ICDs**

2.3 Intended readership

- Authorities

- Air Navigation Service Providers (ANSPs)

- Civil Aviation Authorities (CAAs)

- U-Space / UTM Service Provides

- U-Space / UTM Infrastructure Providers

- Administrative Units

- Supplemental Data or Data Service Providers

- Drone Manufacturer

- Drone Operators

- General Aviation Operators

2.4 Structure of the document

The document is a bucket for the Service Specifications embedded in the appendices.

As preview, a copy of the data model for each service specification was copied into the appendices.

Please refer to the respective chapter in the appendices for the specific structure of a Service Specification.

2.5 Background

When producing this document and its appendices, several research and standardization activities, as well as projects, initiatives and existing solutions have been considered.

Please refer to the respective chapter in the appendices for the specific background.

2.6 Glossary of terms

n/a

2.7 List of Acronyms

Acronym	Definition
UTM	Unmanned Traffic Management
ATM	Air Traffic Management
SWIM	System Wide Information Management
ICD	Interface Control Document
CIS	Common Information Service
ANSP	Air Navigation Service Provider
USSP	U-space Service Provider

Table 1: List of acronyms

3 References

[2] U-space regulationhttps://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeeting&meetingId=23814)SESAR 2020 GOF USPACE FIMS Design and Architecture – D4SESAR principles for U-space architecture https://www.sesarju.eu/sites/default/files/documents/u-space/SESAR%20principles%20for%20U-space%20architecture.pdf

Appendix A   Traffic/Telemetry

A.1 Data Model
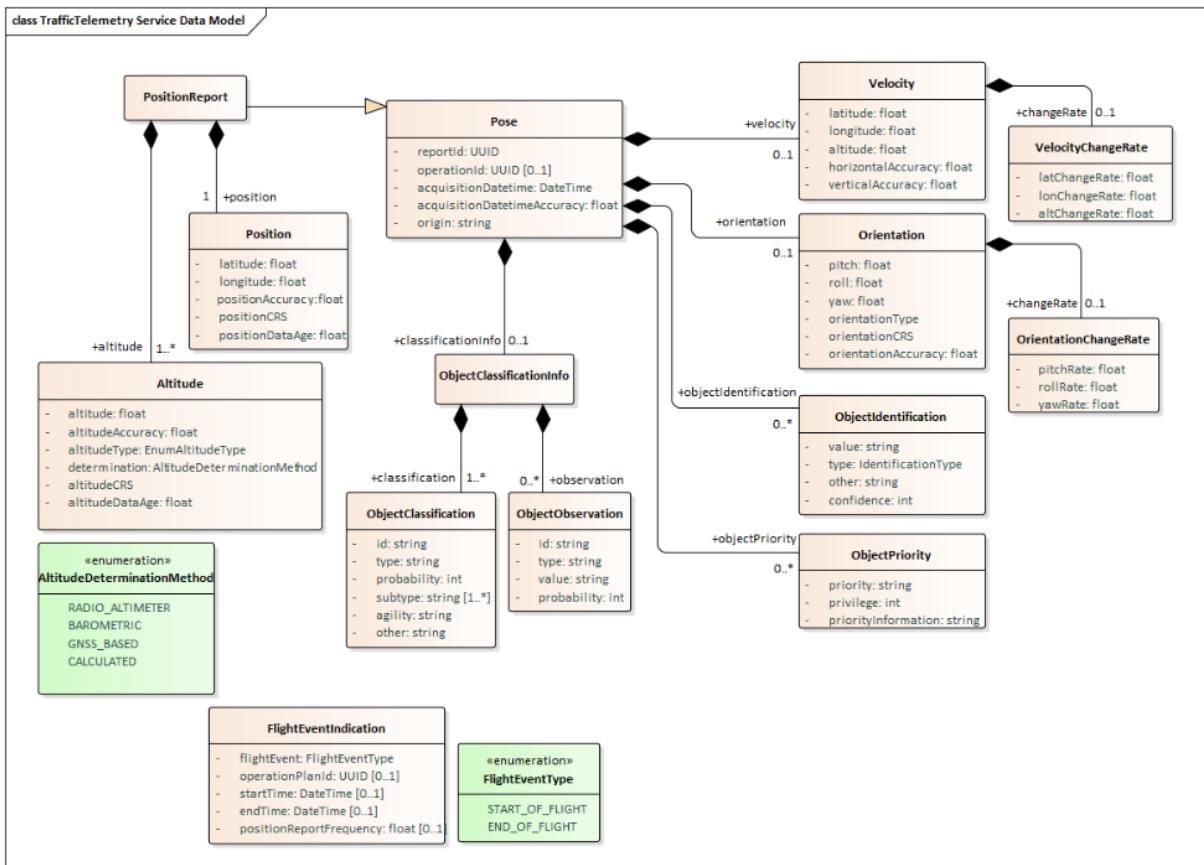
Figure 2: Traffic / Telemetry Exchange Data Model

A.2 Embedded document

D2.4-A GOF2.0 VLD
Service Specification

Appendix B   Operation Plan

B.1 Data Model
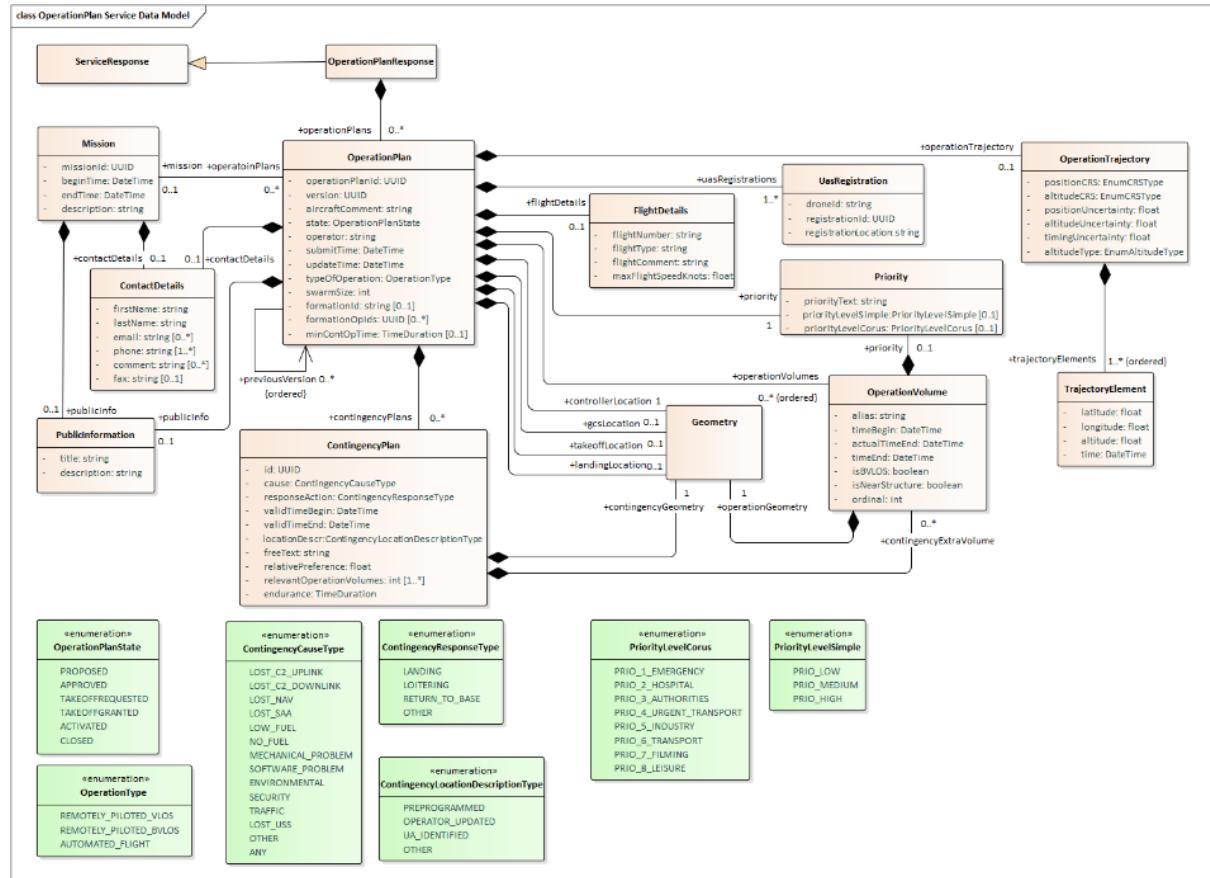
Figure 3: Operation Plan Exchange Model

B.2 Embedded document

 D2.4-B GOF2.0 VLD
Service Specification

Appendix C   Geozones

C.1 Data Model
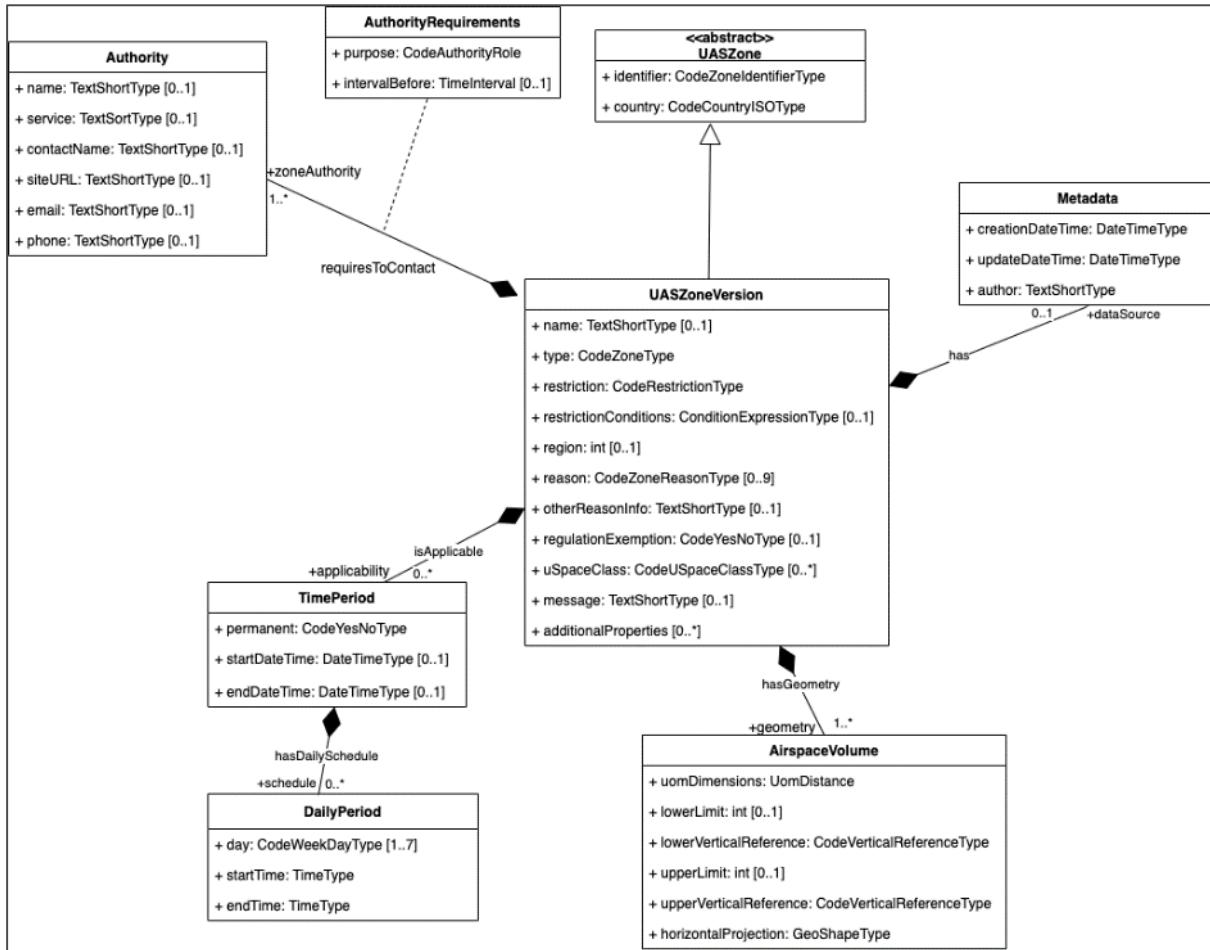
Figure 4: Geozones Exchange Model

C.2 Embedded document

D2.4-C GOF2.0 VLD
Service Specification

Appendix D   Registration

D.1 Data Model
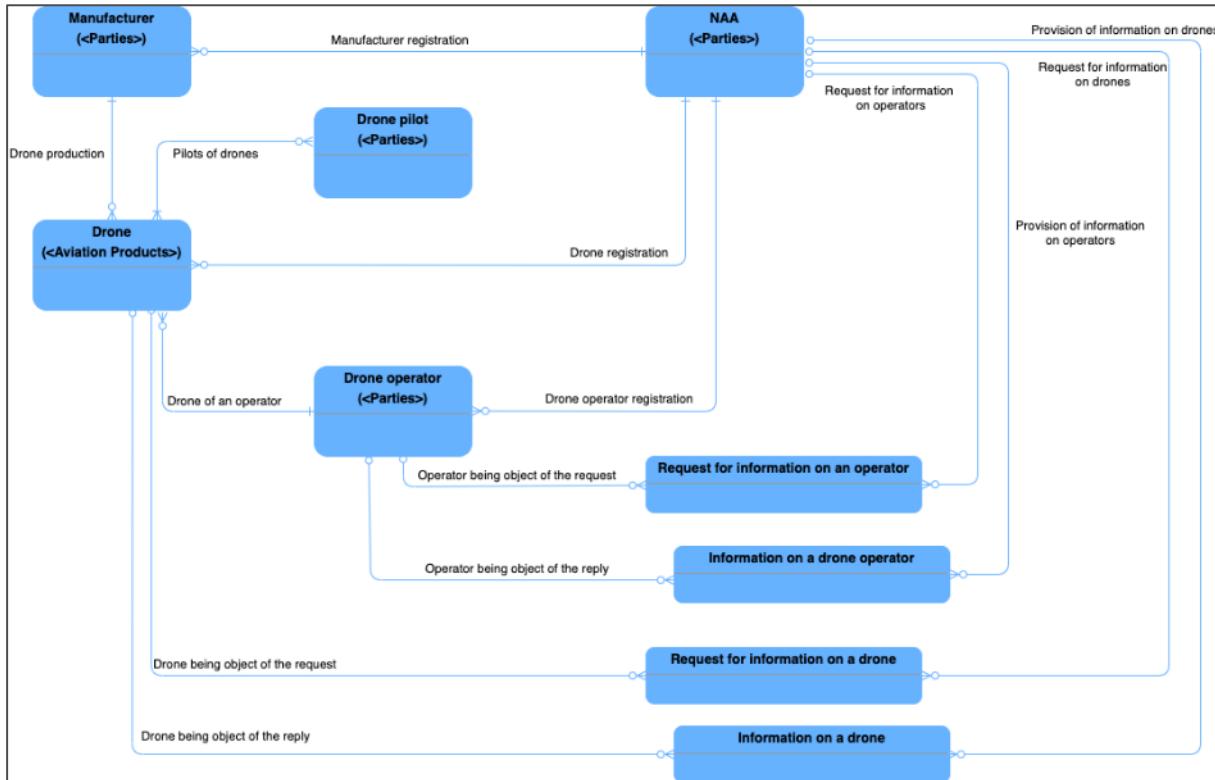
Figure 5: Registration Exchange Data Model

D.2 Embedded document

D2.4-D GOF2.0 VLD
Service Specification

# Appendix E   Operational Message

E.1 Data Model
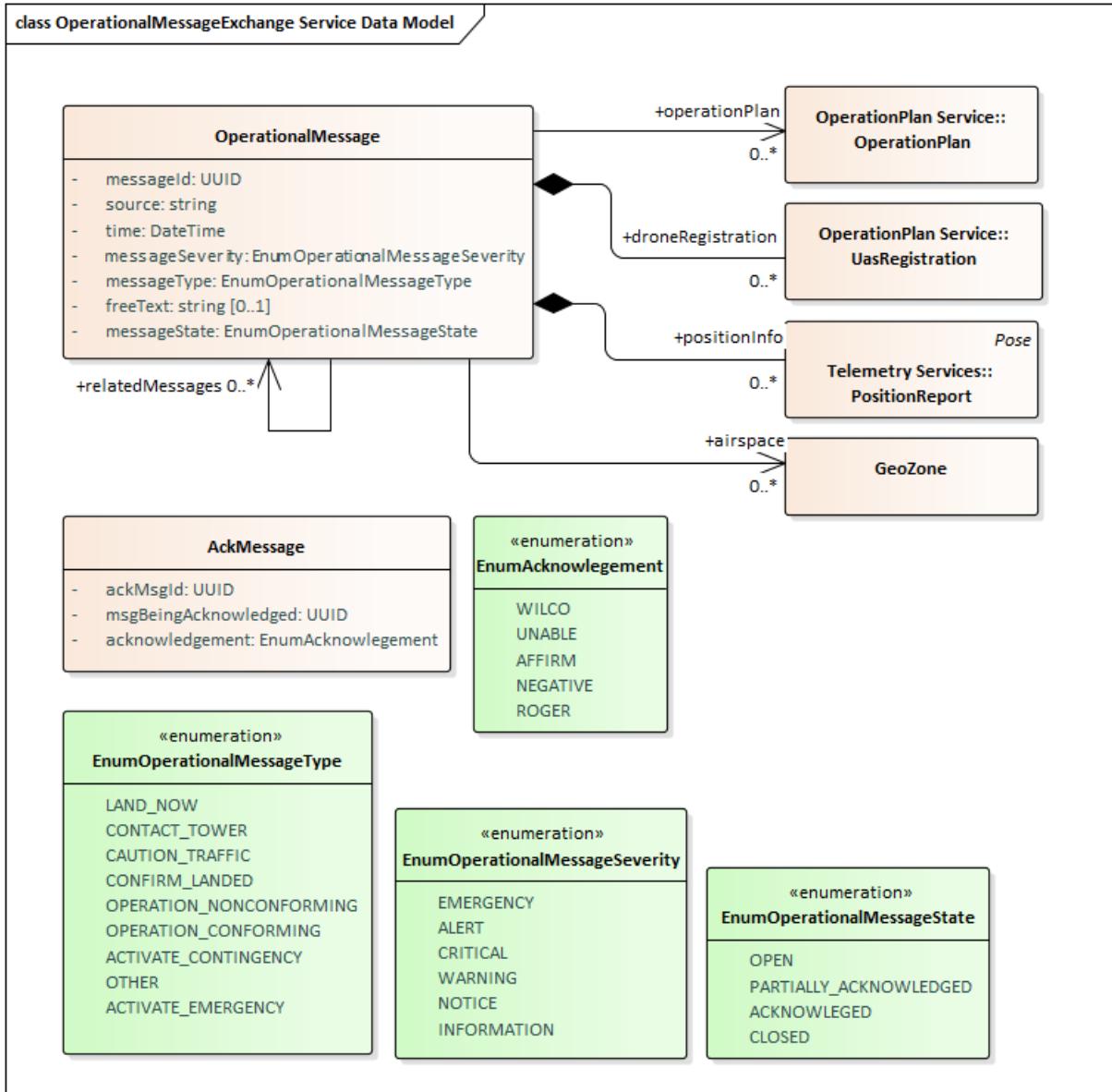
Figure 6: Operational Message Exchange Model

E.2 Embedded document

D2.4-E GOF2.0 VLD
Service Specification

Appendix F Traffic Conformance Monitoring (not validated)

F.1 Data Model
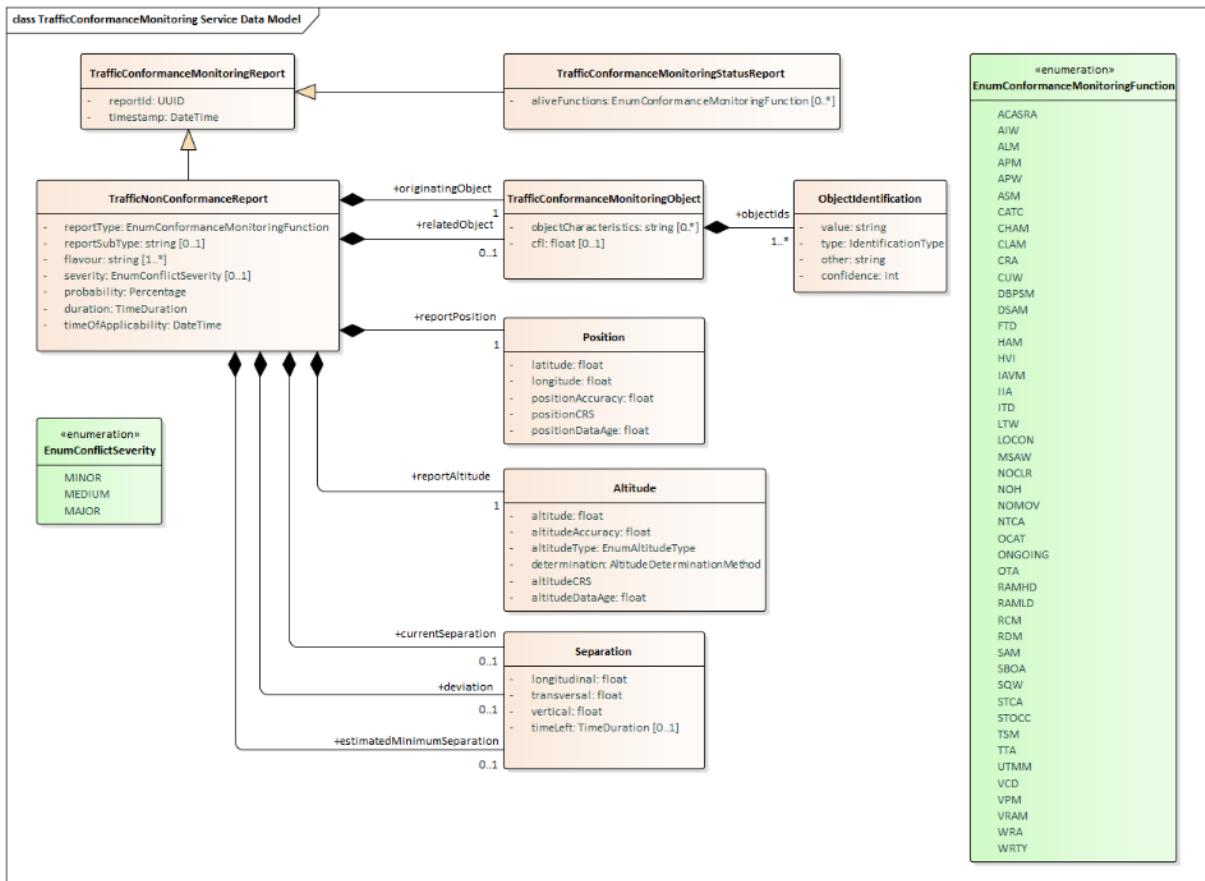
Figure 7: Traffic Conformance Monitoring Exchange Model

F.2 Embedded document

D2.4-F GOF2.0 VLD
Service Specification

Appendix G   Network Data

G.1 Data Model
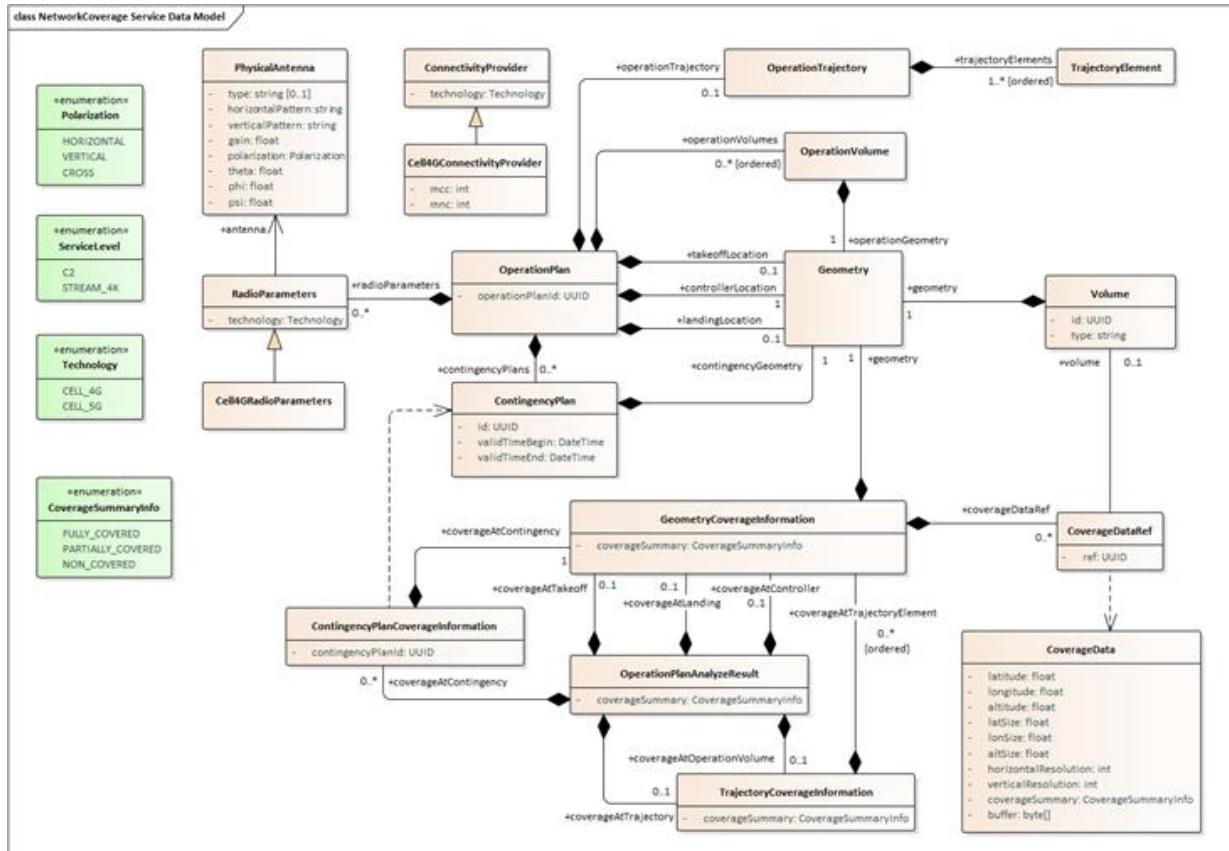
Figure 8: Network Coverage Exchange Model

G.2 Embedded document

D2.4-G GOF2.0 VLD
Service Specification

Appendix H   Ground Control Integration

H.1 Data Model

Where feasible, the information services described in the other appendices have been used in the integration phase approaching the first GOF2.0 trials. GOF 2.0 consortium did not need a specific ground control integration specification based on the operational scenarios run in the trials.

H.2 .Embedded document

Please refer to the other appendices.

Appendix I   Drone flight (proposed)

I.1   Data Model
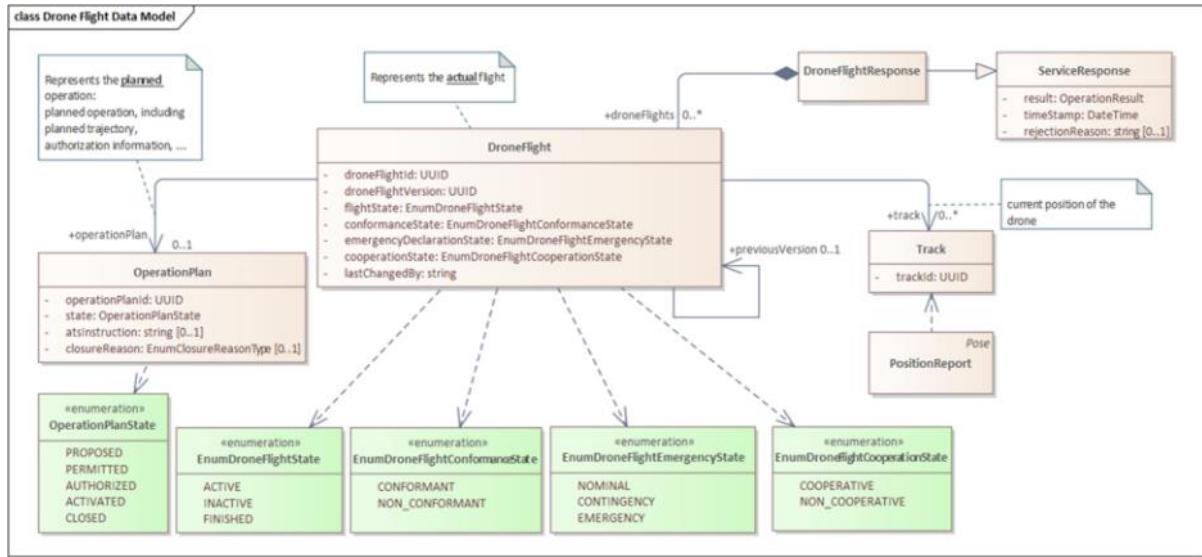
Figure 9: Drone flight exchange model Embedded document

D2.4-I GOF2.0 VLD
Service Specification

# Appendix J   Weather
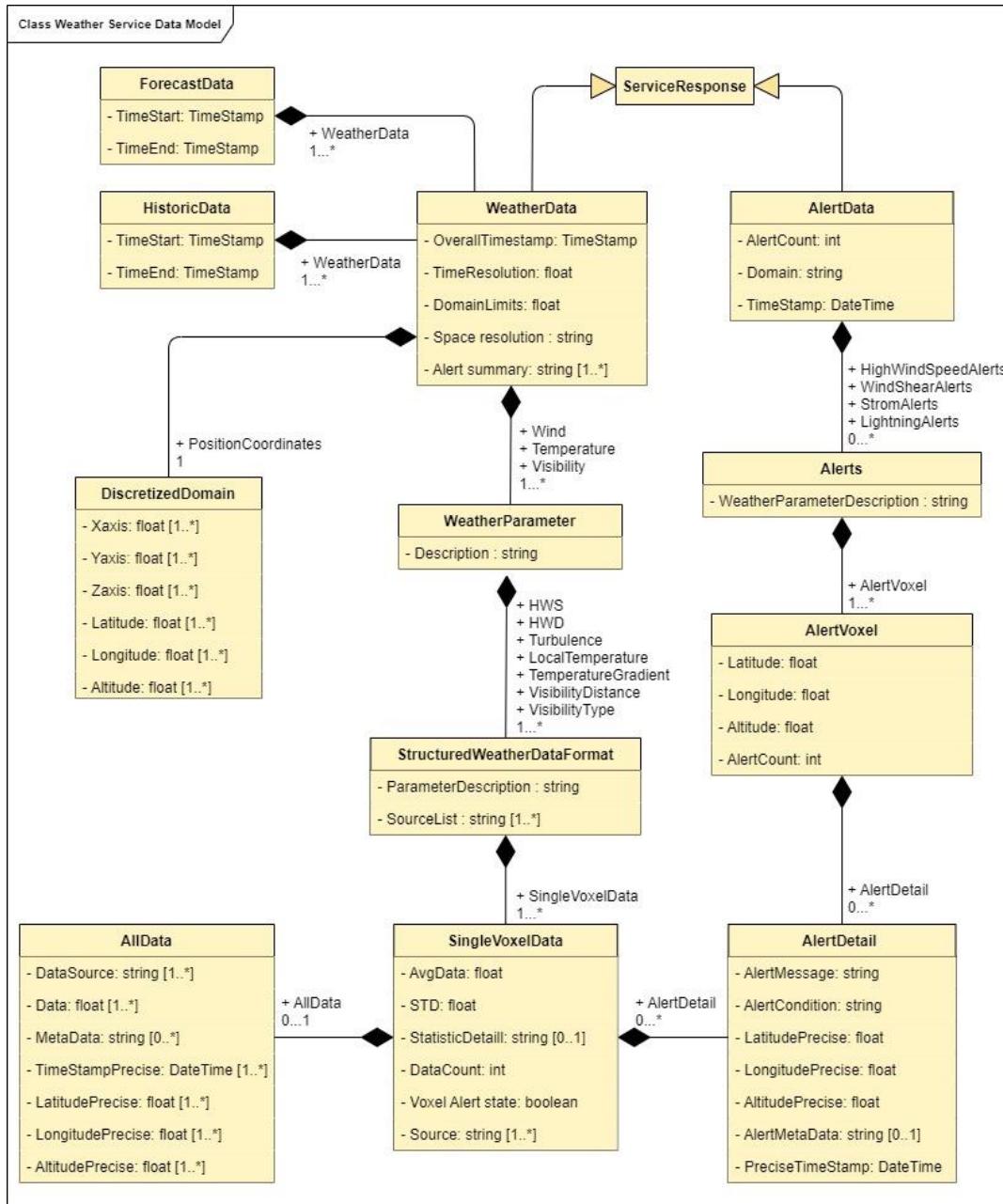
Figure 10: Weather exchange model

J.1 Embedded Document

D2.4-J GOF2.0 VLD
Service Specification