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U-space Field Test V1 Report

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Content

1 Executive Summary (Zusammenfassung)

U-Space ist in Europa das fortschrittlichste rechtliche und technische Konzept zur Ermöglichung skalierbarer Drohneneinsätze ausserhalb des direkten Sichtkontakts (BVLOS). Es leistet zudem einen Beitrag zur Umsetzung der Ziele der Drohnenstrategie 2.0 der Europäischen Kommission. Die U-Space-Infrastruktur ermöglicht es, das wirtschaftliche und gesellschaftliche Potenzial von Drohnen zu erschliessen und die Führungsrolle Europas im globalen Drohnenmarkt zu sichern. Dies wird auch in der gemeinsamen Erklärung «A European Lead Market for Civilian Drones – Now or Never» hervorgehoben, die im Juli 2025 von einer Gruppe von EU-Parlamentarierinnen und -Parlamentariern unterzeichnet wurde. Gleichzeitig zeigen die bisherigen Erfahrungen, dass das U-Space-Konzept weiterhin komplex ist. Es muss weiter getestet, präzisiert, verfeinert und validiert werden, bevor eine breite Akzeptanz und Anwendung durch die vorgesehenen Nutzerinnen und Nutzer erreicht werden kann.

Der vorliegende Bericht fasst die Ergebnisse des U-Space-Feldtests (Feldtest V1) zusammen, der im November 2025 im Rahmen der vom BAZL koordinierten schrittweisen Einführung von U-Space in der Schweiz durchgeführt wurde. Ziel des Tests war es, die technische und operative Reife sowie die Interoperabilität des U-space zu beurteilen. Ebenfalls war es das Ziel, die nächsten Umsetzungsschritte zu definieren und Empfehlungen für die Weiterentwicklung des europäischen Rechtsrahmens sowie für künftige Implementierungsphasen abzuleiten.

Die Ergebnisse des Feldtests V1 zeigen, dass U-Space derzeit noch nicht ausreichend ausgereift ist, um die Erwartungen im Hinblick auf einen breiten Drohneneinsatz zu erfüllen. Solange U-Space-Lufträume in Europa nur punktuell eingerichtet werden, bleiben zentrale Fragen zur wirtschaftlichen Tragfähigkeit und zur langfristigen Nachhaltigkeit offen. Zudem ist zu klären, welches Verhältnis zwischen dem risikomindernden Nutzen für Betreiberinnen und Betreiber in der offenen Kategorie und der zusätzlichen betrieblichen Komplexität durch U-Space-Dienste als angemessen gilt.

Der Feldtest zeigt weiter, dass die U-Space-Dienste und -Funktionen unterschiedliche Reifegrade aufweisen. Die einzelnen U-Space Service Providers (USSPs) konnten ihre Dienste im Rahmen des Feldtests isoliert betrachtet zufriedenstellend erbringen. Die Interoperabilität zwischen den USSPs stellte jedoch eine wesentliche Herausforderung dar. Die Validierung ihrer Dienstleistungen war nur mit einem automatisierten Prüfverfahren möglich («automated testing»). Dieses ermöglichte es den USSPs, ihre Implementierungen schrittweise zu validieren, das Systemverhalten abzugleichen und die Interoperabilität unter kontrollierten und reproduzierbaren Bedingungen zu überprüfen. Daraus ergibt sich, dass das automatisierte Prüfverfahren und ein koordiniertes Release-Management entscheidend zur Steigerung der Reife von U-Space beitragen können.

Der Verkehrsinformationsdienst hat sich, obwohl er nicht vollständig getestet wurde, als der von Drohnenbetreiberinnen und -betreibern am meisten nachgefragte Dienst herausgestellt. Im Rahmen des Feldtests basierte dieser Dienst jedoch ausschliesslich auf Daten aus der Netzidentifikation. Der Fluggenehmigungsdienst und der Geo-Sensibilisierungssdienst boten in ihrer aktuellen Ausgestaltung nur einen begrenzten operativen Nutzen. In einzelnen Fällen führten sie zudem zu einer erhöhten Komplexität für Drohnenbetreiberinnen und -betreiber in der offenen Kategorie. Diese Beobachtungen deuten darauf hin, dass eine Überprüfung des praktischen Nutzens der vier verpflichtenden U-Space-Dienste im aktuellen operativen Kontext angezeigt ist. Dies gilt insbesondere unter Berücksichtigung der spezifischen Eigenschaften des Luftraums Zürich.

Nach Abschluss des Tests wurde mehrfach festgestellt, dass der Einsatz mehrerer Bildschirme, ungewohnte Benutzeroberflächen sowie die damit verbundenen Prozesse nicht ausreichend mit den tatsächlichen Betriebsabläufen übereinstimmen. Dies führte zu Bedenken hinsichtlich der Akzeptanz durch die Nutzerinnen und Nutzer sowie bezüglich des konkreten Mehrwerts für Sicherheit und Effizienz. Verschiedene U-Space-Dienste können bereits erfolgreich über Schnittstellen (APIs) bereitgestellt werden. Die Ausgestaltung von Benutzeroberflächen und der User Experience ist hingegen weiterhin ungeklärt.

Die teilnehmenden USSPs konnten teilweise nachweisen, dass technische Robustheit gegeben ist und tragfähige Geschäftsmodelle bestehen. Ein umfassender Nachweis aller relevanten Elemente konnte jedoch nicht erbracht werden. Drohnenpilotinnen und -piloten in der offenen Kategorie wiesen darauf hin, dass Kostenstrukturen, Nutzenversprechen, Preisgestaltung und Geschäftsmodelle der USSPs weiterhin intransparent sind. Dies führt zu einer derzeit ungünstigen Einschätzung des Verhältnisses von Aufwand und Nutzen. Diese Situation reflektiert sowohl die bekannte Wechselwirkung zwischen der Entwicklung von U-Space und dem Drohnenmarkt als auch grundlegende Unausgereiftheiten des bestehenden Regelwerks sowie eine unzureichende Kommunikation zwischen USSP und Nutzerinnen und Nutzern.

Auf Grundlage dieser Erkenntnisse kommt das BAZL zum Schluss, dass sich der Ansatz der schrittweisen Einführung von U-Space bewährt hat. Dieser Ansatz ermöglicht es, strukturiertes Feedback an die EU-Institutionen zu übermitteln und gleichzeitig die weiteren Implementierungsschritte gezielt anzupassen. Massgeblich ist dabei die Frage, ob in einem bestimmten Bereich bereits ausreichende Umsetzungsreife vorliegt oder ob weiterer Testbedarf sowie gezielte Rückmeldungen erforderlich sind.

Einige Drohnenbetreiberinnen und -betreiber haben ihre Bereitschaft signalisiert, weiterhin an den Feldtests teilzunehmen. Sie betrachten U-Space als eine besser skalierbare Alternative zum derzeitigen Ansatz der fallweisen Risikobeurteilung. Das BAZL stellt zudem fest, dass der Aufbau einer U-Space-Infrastruktur voraussichtlich zu einem effizienteren Einsatz von Behördenressourcen führen wird. Auf Basis des aktuellen Reifegrads des U-Space-Rahmens wird davon ausgegangen, dass sich der Zeitaufwand für den SORA-Bewilligungsprozess (Special Operation Risk Assessment) um rund 30 Prozent reduzieren lässt.

U-Space steht im Einklang mit der übergeordneten Zielsetzung, die von Skyguide erbrachten Leistungen schrittweise zu automatisieren und dadurch die Betriebskosten zu senken. Das BAZL fordert die EASA und die EU-Kommission auf, die Erkenntnisse aus dem Feldtest V1 bei der Weiterentwicklung der rechtlichen Rahmenbedingungen zu berücksichtigen. Zudem wird das BAZL seine Planung für das Jahr 2026 auf Grundlage der vorliegenden Erkenntnisse anpassen und einen Umsetzungszeitplan festlegen, der dem Reifegrad der USSPs sowie des geltenden Rechtsrahmens Rechnung trägt. Gleichzeitig sollen die Kommunikation zwischen den beteiligten Akteuren gestärkt und ein unverändert hoher Sicherheitsstandard für alle Luftraumnutzer sichergestellt werden.

2 Abbreviations and Acronyms

Abbreviation	Full expression
AMC/GM	Acceptable Means of Compliance / Guidance Material
ANSP	Air Navigation Service Provider
ARA	U-space Airspace Risk Assessment
BVLOS	Beyond Visual Line Of Sight
CAA	Civil Aviation Authority
CIS	Common Information Service
ConOps	Concept of Operations
CTR	Control Zone
DIAS	Drone Industry Association Switzerland
EASA	European Union Aviation Safety Agency
EC	European Commission
EPAS	European Plan for Aviation Safety
EU	European Union
FOCA	Swiss Federal Office of Civil Aviation
HEMS	Helicopter Emergency Medical Service
MS	Member State
SDD	Service Description Document
SLA	Service Level Agreement
SORA	Specific Operation Risk Assessment
SUSI	Swiss U-space Implementation
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UI	User Interface
US	United States
USSP	U-space Service Provider
UX	User Experience

3 Introduction

Given Switzerland's pioneering role in drone innovation, the Federal Council has highlighted in its aviation policy report the importance of enabling advanced drone technologies and integrating them safely and efficiently into the existing aviation system. In its response to Postulate Christ 22.4580, *"Development and regulation of civil drones in Switzerland"* (December 2024), the Federal Council identifies U-space as the key infrastructure required to achieve this objective.

The number of requests for complex BVLOS operations requiring approval by FOCA under the SORA methodology continues to increase. The current SORA approval process, however, demands substantial time and resources from both FOCA and operators. At the same time, access to airspace for complex drone operations remains limited due to the comparatively high volume of low-level traffic in Switzerland, particularly helicopter operations, and the comparatively liberal Swiss regulations for take-off and landing of helicopters outside aerodromes. In this context, many of the systems, processes, and technologies required to minimise air risk and to support complex operations at scale are not yet fully mature and harmonised in Europe.

The deployment of the U-space infrastructure would address these technological and procedural challenges by providing digital services that effectively characterise and mitigate air risk and facilitate coordinated operations between drones and manned aviation, while introducing strategies to minimize drones to drones collision risks. These services would not only serve as key enablers for expanded BVLOS operations but would also significantly streamline the existing FOCA authorisation processes, while maintaining highest safety standards in accordance with the EPAS.

3.1 Scope of the document

This document presents the findings from U-space Field Test V1, conducted as part of Switzerland's phased U-space implementation in the Zurich area. It consolidates the technical, operational, safety, and economic observations gathered during the Field Test V1, together with structured feedback from participating USSPs, drone operators and Skyguide. Based on these findings, FOCA formulates a set of evidence- and feedback-based recommendations addressing both policy considerations and technical implementation aspects, intended to inform subsequent U-space implementation phases in Switzerland and future regulatory developments at European level. The document also outlines key conclusions and proposes initial directions for the next steps in U-space testing and implementation in Switzerland.

The core of this document is structured into three main sections:

(1) **Preparing Field Test V1**,

(2) **Field Test V1**, and

(3) **Feedback from Field Test V1 Participants**.

Section (1) covers the learnings from the scoping of the Field Test V1 and the automated tests with USSPs, the risk assessment for the safe Field Test V1, and the selection of drone operators willing to participate in the test. Section (2) describes the execution of the Field Test V1 itself, including additional tests with simulated flights conducted a few days afterward. The final section (3) presents the feedback received from participants in Field Test V1. Each section includes a description of the activities performed and, where applicable, a list of observations derived from those activities. Although these activities are presented sequentially in this report, they were conducted largely in parallel due to the constrained timeline of the test campaign.

4 Overview: U-space implementation Switzerland

4.1 Roles and Responsibilities

For the U-space market to mature, operational responsibilities and oversight capabilities are shared among FOCA, Skyguide, and USSPs. The current regulatory framework reflects these evolving roles by defining the set of services and functionalities to be provided in the U-space and by establishing performance and safety requirements for USSPs and tasks for the authority.

4.1.1 Common Information Services

Although IR (EU) 2021/664 allows Member States to designate a single entity to provide the CIS on an exclusive basis within a U-space airspace (single CIS provider), FOCA decided to adopt a distributed model. Under this model, the CIS data defined in Art. 5 of IR (EU) 2021/664 are made available directly to USSPs by FOCA and/or Skyguide. Figure 1 below provides an overview of the CIS data made available by FOCA and Skyguide (top right corner).

FOCA selected the distributed CIS approach with the assumption to make best use of existing infrastructure and to minimise overall system costs. FOCA already provides data on UAS geographical zones to drone operators and will continue to do so in the U-space set-up. By leveraging existing infrastructure, established processes, and existing responsibilities, FOCA believes that significant investment and operating costs can be for the moment avoided, in the spirit of providing the most pragmatic solution adapted to today’s stringent timeline and budget.

From FOCA’s perspective, the provision of CIS data to USSPs using industry standards and communication protocols also avoids the need to build and operate an additional central CIS platform. Such a platform would likely be complex and costly to procure, implement, secure, and maintain, and it would introduce a risk of data latency as well as errors through additional data handling and transformation. A central platform would also become a critical dependency: If it degrades or fails, the impact would be system-wide and could trigger high contingency and recovery costs. In a distributed set-up, failures are more contained, and the overall cost of outages can be reduced. From an assurance and lifecycle perspective, direct provision improves traceability and auditability because USSPs can attribute data clearly to the source, reducing ambiguity about where information may have been modified.

Monopolistic provision is limited to data that must be delivered by Skyguide for safety or infrastructure reasons and provide other CIS data as open government data free of charge to users. This helps keep costs under control while leaving competitive services and functionalities to the open USSP market. The tasks that Skyguide is required to provide for U-space are set out in the national Ordinance on Air Navigation Services (SR 748.132.1). The Confederation will compensate Skyguide for the development and operation of these tasks at least until end of 2026.

4.1.2 Industry roles and responsibilities for establishing U-space services

Aligned with the regulatory framework, FOCA expects industry to develop the majority of services in response to market structures, customer needs, and emerging opportunities. Industry will therefore play a central role in designing and deploying services, as well as in developing and maturing the underlying standards. FOCA expects services to be developed against these standards to demonstrate compliance with the safety requirements set out in the regulatory framework and the ARA.

Manual service approval processes are resource-intensive and not scalable. FOCA therefore supports automated testing and verification mechanisms for U-space services (see Chapter 6.4.1). This approach lowers barriers to market entry for USSPs by enabling them to deploy new service instances and release feature updates without waiting for a potentially lengthy review process by the authority. The test baseline for the automated tests are defined by the USSPs on their own, with supervision by FOCA, in the dedicated working package (see Section 5.3).

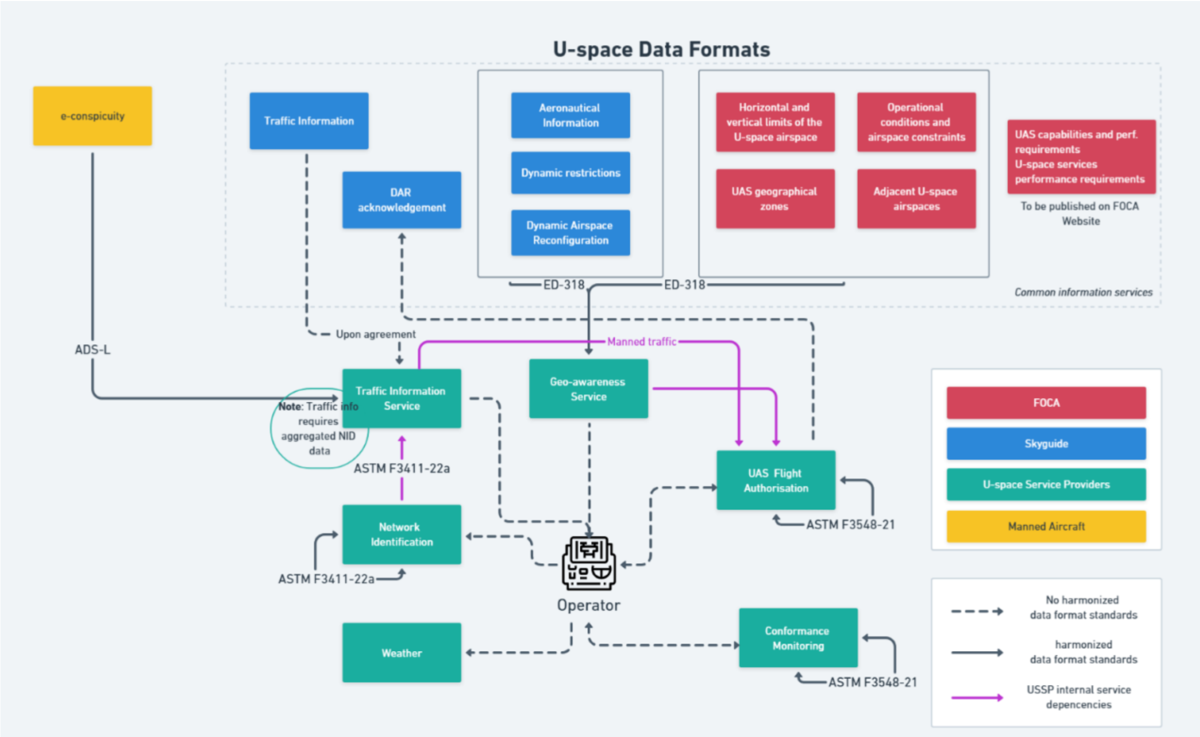

Figure 1: Overview of the Swiss U-space architecture, with a particular focus on the CIS (top-right box).

4.2 U-space soft launch in Zürich

In its postulate report, the Federal Council emphasises the need to implement the first U-space infrastructure in the airspace over Zürich. Zürich represents one of the most complex operational environments in Switzerland, characterised by high traffic density and significant low-level helicopter activities. A 2024 study by DIAS shows that most Swiss drone companies and manufacturers, as well as much of the relevant academic research, are concentrated in the greater Zürich area, contributing to a steady increase in drone activity. A 2025 EUROCONTROL study confirmed these observations. A portion of the Zürich CTR has therefore been selected for the initial U-space implementation (Figure 2).

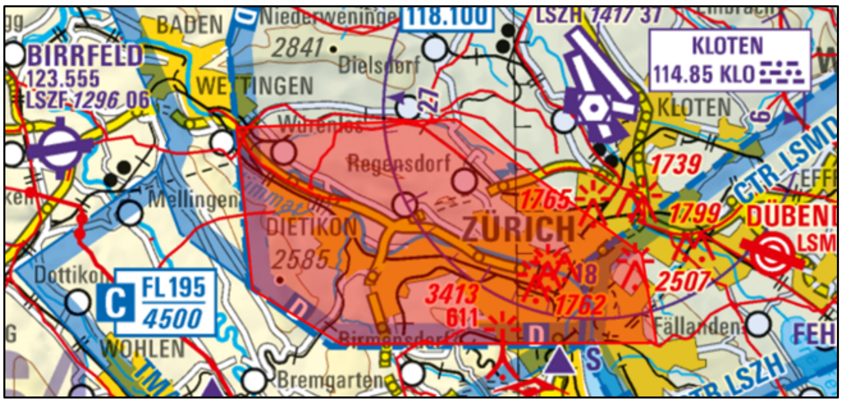

Figure 2: Illustration of the tentative U-space airspace volume in Zürich.

To enable the provision of U-space services within a designated U-space airspace, the following key tasks must be completed:

- **Designation of the U-space airspace**, following a comprehensive ARA of the selected area.
- **Integration of USSPs**, responsible for delivering the required services to drone operators.
- **Provision of CIS**, for sharing common information with USSPs.

These activities are closely interdependent. Due to the pioneering nature of the U-space concept and the limited availability of European reference models or standards, it is not feasible to define a fixed sequence of tests and milestones in advance. Lessons learned during each phase may necessitate adjustments to both the approach and the timeline. Consequently, the implementation process must remain iterative, adaptive, and evidence-driven, allowing for the continuous incorporation of new technical, operational, or regulatory insights.

4.2.1 Version 1 and Version 2 of U-space

An initial distinction has been made between two main stages of implementation: Version V1 and Version V2. Version V2 is then followed by the full U-space deployment. Figure 2 illustrates the phases of U-space implementation in Switzerland as originally presented to all stakeholders. The V1 phase serves as a preparatory stage, enabling FOCA to gather operational feedback from drone operators and USSPs and to refine the approach for Version V2 and the subsequent U-space deployment. This phase was completed in November 2025, in accordance with the mandate of the Federal Council and FOCA's strategic objectives for the year. This report is based on the findings of the V1 Field Test. It has to be noted that although the overall strategy remains the same, milestones and timelines are expected to drift according to foreseen development and changes.

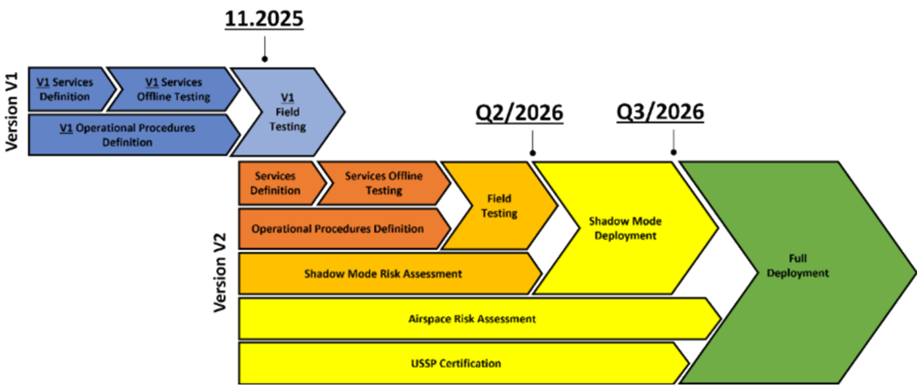

Figure 3: Illustration of the different phases of the Swiss U-space soft launch. The content of the following phases is based on the findings of the Field Test V1 in blue.

The difference between Version 1 and Version 2 lies in the different service functionalities that are tested. While Version 2 field testing covers testing of all system functionalities as required by the EU U-space regulatory framework, Version 1 is a partial version of U-space, including only the Network Identification Service (Art. 8 of IR (EU) 2021/664), parts of the Geo-awareness Service (Art. 9 of IR (EU) 2021/664), parts of the UAS Flight Authorisation Service (Art. 10 of IR (EU) 2021/664) and parts of the Traffic Information Service (Art. 11 of IR (EU) 2021/664).

The scope of Field Test V1 was deliberately limited due to technical and practical reasons. The activities in WP1 and WP2 showed that the remaining gaps and open questions related to the provision dynamic airspace reconfiguration and manned traffic data in the U-space system were still too significant to be addressed within Field Test V1. A strategic decision was therefore taken to focus on elements that are either already well defined in the regulatory framework, covered by relevant industry standards, or have been implemented in other jurisdictions, such as the US. By contrast, the provision of manned traffic data or dynamic airspace reconfiguration data within a U-space system has not yet been developed or tested, either in Europe or globally, and the associated standards are still under development.

The table below provides an overview over the functionalities that will be tested in Field Test V1 and Field Test V2.

Service/Functionality	Field Test V1	Field Test V2
Network Identification Service	✓	✓
Geo-awareness Service	*No Dynamic Airspace Reconfiguration information*	✓
UAS Flight Authorisation Service	*No manned traffic checks* *Only strategic deconfliction*	✓
Traffic Information Service	*No manned traffic information*	✓
Dynamic Airspace Reconfiguration	*No*	✓

Table 1: Overview over U-space services and functionalities that are tested in the field test V1 and field test V2.

5 Preparing Field Test V1

5.1 Participating USSPs

In December 2024, FOCA sent a request for information to EASA and EASA MS to obtain an overview of USSPs currently undergoing certification with their competent authorities. The information received was used to contact all USSPs that were, at that time, in the certification process. All contacted USSPs responded positively and expressed their willingness to participate in the Zürich U-space implementation. Five USSPs participated in the full duration of the preparation phase of the Field Test V1 through weekly coordination meetings. The objective of these meetings was to jointly define the SDDs for the Network Identification Service and the Flight Authorisation Service.

FOCA coordinated the preparations for the Field Test V1 in close collaboration with the following USSPs:

- **ANRA Technologies** (a certified US-based USSP),
- **Avielo** (a Swiss-based USSP currently undergoing certification),
- **AVISION** (a Swiss-based USSP currently undergoing certification),
- **Innov'ATM** (a certified French-based USSP),
- **Wing** (a US-based drone operator and manufacturer acting as its own USSP currently undergoing certification).

During the preparation phase, some USSPs subsequently decided to discontinue their activities. In addition, not all USSPs completed the automated tests and therefore did not provide services in Field Test V1 (see Chapter 6.4).

5.2 Service Description Documents (SDDs)

The SDDs define the common framework and minimum technical and operational requirements for service provision. All SDDs created within the framework of the Field Test V1 are publicly available on GitHub at https://github.com/swiss-foca/u-space and are available to be reused by other CAAs for their U-space implementation activities. SDDs are living documents and are expected to be updated regularly to reflect operational experience, as well as evolving standards and regulatory developments. For example, performance requirements for USSPs are defined in the SDDs for each U-space service, in line with the regulatory framework and available industry standards (e.g. ASTM F3411-22a, ASTM F3548-21, ED-318). During Field Test V1, these requirements were lower than the final performance targets for full U-space implementation.

5.2.1 Key observations

Observation 1: The definitions and requirements for each U-space service, as outlined in the IR 2021/664 and associated AMC/GM, provide an initial service framework, but lack sufficient detail on the service characteristics and limitations and constraints sparking from real-life experience, to enable harmonised service implementation. Additional analysis and testing is required to establish if the service concept defined in AMC/GM is complete, coherent and contributes to the anticipated policy benefits.

Observation 2: As SDDs are key documents for ensuring effective coordination among USSPs and harmonised U-space implementation and USSP onboarding in different MS across Europe, FOCA suggests including the requirement for USSPs to adhere to SDDs in the associated AMC and GM to IR (EU) 2021/664.

5.3 Organisation: Working Packages

FOCA structured the U-space implementation activities through dedicated Working Packages (WP) that address the technical, operational, and governance dimensions of the implementation effort:

- **WP1 (USSP-USSP data exchange)**: Definition of services, agreements, and interfaces, and establishment of the test baselines and interoperability framework between USSPs.
- **WP2 (USSP-CIS data exchange)**:
    - **ANSP data provision**: Definition of concepts, services, agreements, and interfaces, and establishment of the test baselines and data provision and exchange framework between USSPs and the ANSP.
    - **FOCA data provision**: Definition of concepts, services, agreements, and interfaces, and establishment of the test baselines and data provision and exchange framework between USSPs and the FOCA.
- **WP3 (Operationalisation)**: Comprising the automated testing procedures that verify conformance with the SDDs and applicable industry standards. Execution of automated testing, onboarding of USSPs, and verification of compliance with the U-space framework.
- **WP4 (USSP-Operator interface)**: Coordination of drone operators and preparation of the operational environment for live testing activities.

The structure of WP2 is a direct consequence of implementing the distributed CIS model in the Swiss U-space architecture, under which CIS data are made available by Skyguide and/or FOCA. In practice, USSPs retrieve the data needed for the Geo-awareness service from both Skyguide and FOCA (see Figure 1, Chapter 4.1) and use this information to provide the Geo-awareness Service to drone operators. Consequently, the Geo-awareness service comprises two SDDs: one covering the data provided by Skyguide and another covering the data provided by FOCA. None of the two are available on github at the moment. Skyguide's SDD has been delivered to USSPs directly, while FOCA's SDD is still under development.

In turn, WP1 focuses on U-space services that are provided by USSPs (see Chapter 4.1). FOCA expected USSPs to define the SDDs independently, while accompanying the work in a supervisory role to ensure that the technical capabilities and test baseline defined in the documents are aligned with the regulatory framework and the ARA.

The USSPs were free to choose the WPs in which they wished to participate. Participation in WP3, however, was mandatory for all USSPs intending to take part in the Field Test V1. Activities conducted under WP3 simulated representative operational scenarios in the U-space and assessed USSP system interoperability prior to live operations. As such, successful completion of the requirements of WP3 (i.e. pass all gates in the automated tests) constituted a prerequisite for participation in the Field Test V1. USSPs that did not complete the WP3 procedures, or that failed to successfully pass the defined gates, were not authorised to participate in the Field Test V1.

5.4 Automated tests

Building on FOCA's previous experience in the implementation and testing of U-space services in earlier years—most notably the multiple tests dedicated to the implementation of the Network Remote Identification service by SUSI between 2021 and 2022—it has already been demonstrated that automated software testing is an essential tool for the robust technical implementation of the U-space regulatory framework. Automated testing enables efficient and reliable validation of new software releases whenever they are introduced.

The importance of automated testing is further reinforced by the choice of a free-market approach for U-space implementation, which is actively supported by the EC. Under this approach, multiple USSPs provide services within a given U-space airspace, provided that they are able to exchange data seamlessly at any time. FOCA actively supports this free-market approach, which is expected to limit costs for users, foster innovation, and strengthen the system's technical and regulatory robustness.

In a context characterised by increasingly short software release cycles and by regulatory and technological frameworks that are still evolving and therefore subject to further updates, automated testing emerges as the most effective means of addressing these challenges while ensuring an appropriate level of safety and regulatory oversight of USSPs. FOCA therefore concludes that, for the next iteration of the regulatory framework, it is appropriate to recommend the inclusion of automated testing within the AMC and GM of IR (EU) 2021/664.

It is acknowledged that the implementation of automated tests may be perceived as complex from a USSP perspective and may initially impact USSP service development, as compliance with such tests must be considered during system design and implementation. However, the upfront investment in time and resources is largely offset by the subsequent gains in efficiency, streamlining, and operational facilitation. The experience gained during the Field Test V1 illustrates this point, as further detailed in the following sections.

FOCA commissioned the development of the automated test suite required for the implementation of the services evaluated during the Field Test V1, in line with the principles and discussions conducted within the framework of InterUSS activities (https://interussplatform.org) that were also relevant for the development and implementation of the US UTM concepts. The test suite is open source and ready to be used by other USSPs that intend to test their system against industry standards.

Although automated testing activities are primarily associated with WP3, as described in the previous section, WP1 also played a critical role, as the SDDs developed with WP1 directly influenced the scope and content of the tests to be performed by the USSPs. All USSPs that participated to WP3 were also involved in WP1.

USSPs were required to undergo automated compliance testing against the applicable industry standards and SDD provisions. They were expected to progressively pass these automated tests and to submit the corresponding test reports to FOCA as evidence of compliance. FOCA urges other CAAs to accept reports from automated testing as evidence of compliance and interoperability.

The challenge remains, however, to ensure that the automated test scenarios address the regulatory performance objectives in a complete and correct way, in particular for those functional elements that are not addressed by the industry standards and for which the bespoke solutions must be developed. Traceability of test script against regulatory requirements has not been in the focus of the Field Test V1 iteration, but rather on the feasibility of automated testing.

5.4.1 Automated testing strategy

Further details on the automated testing strategy are provided in the U-space Field Test V1 ConOps (Annex 1). In summary, automated testing is structured into a series of gates, with progression to subsequent gates granted only upon the successful completion of all tests at the preceding gate.

- **Gate 1 – Self-validation:** Automated testing performed on the USSP's own system to verify that the USSP implementation complies with the applicable requirements, defined in the SDDs. Once FOCA has validated the successful completion of all gate 1 tests, FOCA instructs Skyguide to issue an authentication token[1] granting the USSP access to gate 2.

- **Gate 2 – Simulation:** This test suite includes all required integration and interoperability tests within the U-space test environment. USSPs test their services against other USSPs in a dedicated testing environment. Upon completion, the participant is required to submit a gate 2 test report to FOCA. FOCA reviews the submitted report to verify compliance with the onboarding requirements. Upon successful review and acceptance of the gate 2 test report, FOCA instructs Skyguide to issue the authentication token for the production environment (gate 3), which effectively authorises the USSP to participate in the Field Test V1.

- **Gate 3 – Production environment** for the Field Test V1. USSPs can finally access the production environment that will be used for the real test.

5.4.2 Test results

The results of the test are documented in the dedicated test reports. These reports are confidential and stored by FOCA until further notice. Of the five USSPs participated to the development phase of the Field Test V1, three USSPs participated to WP3 and two were able to pass all tests in time for the Field Test V1. The third USSP was able to access the production environment approximately one week after the test.

5.4.3 Key observations

Observation 3: Not all USSPs that actively contributed to the preparation of the Field Test V1, particularly to the development of the SDDs, were able to pass all gates of the automated testing defined under WP3 in time for the Field Test V1. Interoperability testing proved especially challenging. This demonstrates that the certification process under Art. 15 of IR (EU) 2021/664 does not, on its own, provide sufficient assurance that a USSP's technological capabilities meet the required safety performance levels. Automated testing is therefore an essential mechanism to verify compliance and ensure that USSP systems perform reliably and safely in an interoperable environment.

Observation 4: One of the advantages of automated testing is that USSPs can continuously develop their software and verify new versions against a standard test suite, ensuring that updates remain functional. This approach works well for gate 1 tests, where each USSP tests its own services independently. However, gate 2 tests—where USSPs must test their services against each other—require additional organisational measures. In a competitive market environment, this coordination can be difficult to achieve and may create perceived advantages or disadvantages depending on each USSP's development pace, resources, and context.

Observation 5: Due to the interdependent nature of USSP systems, a newly released software version from one USSP may not be fully compatible with an older version deployed by another USSP. Consequently, each software release—whether planned (e.g. new versions) or unplanned (e.g. hotfixes)—requires coordinated testing involving all affected USSPs. This requirement represents a significant operational challenge, as it effectively assumes that all USSPs maintain continuous development and coordination capacity, including the availability of shared testing windows, potentially across different time zones, to support the testing needs generated by releases from other USSPs. Additional coordination mechanisms are therefore necessary to ensure both fairness and safety for all participants in the system. To address these coordination problems, a shared update calendar could be

[1] The authentication tokens are access tokens that enable data exchange between USSPs. USSPs must use an authorization server to obtain access tokens and participate to the system. In 2024, FOCA decided to transfer the technical responsibility for access to the U-space system to Skyguide. This approach offers greater flexibility, as Skyguide can more easily adapt its infrastructure to evolving needs.

introduced to synchronise planned software releases across USSPs, complemented by an ad-hoc process for the management of urgent hotfix deployments. FOCA suggests that these elements should be addressed within the Data Sharing and Governance Agreement, which are currently being created in the framework of WP1 activities in coordination with the USSPs. Furthermore, to improve coordination and consistency of automated interoperability testing activities (gate 2), USSPs should have the option to rely on a single, shared test runner.

Observation 6: The pace at which USSPs were able to progress through the tests of the different U-space services provided a clear indication of the relative maturity and ease of implementation of each service. Based on the ability of USSPs to successfully pass the automated tests, the Flight Authorisation service appeared comparatively more mature, albeit the functional scope has been significantly reduced compared to the scope defined by the regulation. This is largely explained by the fact that similar authorisation mechanisms with the limited scope have already been implemented and operationally exercised by several USSPs in the US, which is a positive sign in view of global harmonisation of UTM/U-space frameworks. However, not all functionalities associated with the Flight Authorisation Service were covered within the scope of Field Test V1 (see Chapter 5), and therefore its maturity cannot yet be considered fully assessed. In contrast, the Network Identification Service encountered more difficulties during the testing phase, particularly with respect to interoperability aspects. Nevertheless, when assessed in terms of functional completeness, Network Identification was observed to be more advanced than Flight Authorisation, with a broader set of features already implemented and available.

Observation 7: USSPs connected to the CIS to retrieve the geo-data required for the test. For the Field Test V2, two dedicated SDDs for the Geo-awareness Service will be created (one focusing on data provided by Skyguide, the other on data provided by FOCA). Verification was performed through dedicated meetings between FOCA and the USSPs to validate both the ability to ingest the data and the correct visualisation of the geo-data for specific geographic positions within the U-space airspace according to the existing standard requirements. While verification of data ingestion could relatively easily be integrated into the automated testing framework, the final validation of correct data presentation at the user interface level remains challenging to automate. This leads to the conclusion that automated testing is most effective when applied to services provided via APIs, rather than those relying on graphical user interfaces (GUIs).

Observation 8: The authorisation server is a critical element of the U-space architecture, as it controls who is permitted to participate in the network. At the time of Field Test V1, neither European institutions nor MS had taken a position on which entity should hold the access keys to the U-space network, and the regulatory framework does not provide specific guidance on this aspect. FOCA decided to transfer the technical implementation for access to the U-space system to Skyguide. The requirements for the implementation are defined in the associated SDD.

5.5 Risk Assessment for the Field Test V1

Before carrying out the Field Test V1, a specific risk assessment was conducted to ensure that the planned activities would not significatively increase the collision risk for any existing airspace user in the future U-space airspace in Zürich during the Field Test V1.

The Field Test V1 risk assessment is not equivalent to the ARA for the final U-space airspace. Rather, it constituted a specific risk assessment and the definition of mitigation measures tailored to the environment and conditions of the Field Test V1. It was reviewed and approved by the Swiss U-space implementation ARA team, which is a multidisciplinary group of safety experts from various teams within FOCA as well as Skyguide, with extensive experience in airspace risk management, including domains such as air traffic management, helicopter operations, and related operational areas, although not necessarily with specific expertise in drone operations. Several iterations and discussions were conducted with the ARA team to define a test environment that does not affect the safety of any airspace user.

The outcome of the Field Test V1 risk assessment suggested conducting all drone operations during the Field Test V1 under Open category in accordance with the current regulatory framework. In addition, it has been determined that remote pilots were not permitted to use the USSP services during the flights to ensure full isolation between the tested USSP system and drone operations. To maintain safety and avoid additional workload for the remote pilots, an additional person — a so-called test operator — defined by the remote pilot was designated for each operation. This person, independent from the remote pilot, was responsible for interacting with the selected USSP platform and performing the required tests.

The location of the U-space test volume has been limited to area where drones would not be subject to Skyguide ATC approval (that is, further than 5 km from the runway, and below 120 m SFC), as suggested in the Swiss regulation.

A concern was raised regarding the integration of data for the Network Identification Service. The ARA team emphasised that neither the software installed onboard the drone nor the software running on the drone controller should be modified to obtain telemetry data. Any such modification would require the altered software itself to undergo a rigorous safety assessment to ensure an appropriate level of safety. Consequently, telemetry data from drones were obtained through alternative sources. For example, in the case of DJI drones, telemetry data are transmitted by default to the manufacturer’s cloud infrastructure. The data was therefore collected from the cloud and subsequently forwarded to the Network Identification Service.

5.5.1 Relationship between ARA and SORA

FOCA proposes the following delineation of responsibilities between the SORA methodology, covering individual drone operations, and the ARA, covering the U-space, when operations take place in U-space airspace. Flying in a U-space airspace does not change the operation type (Open vs Specific) and has no impact on the SORA assessment for VLOS operations.

Risk	Drone Operation (SORA)	U-space (ARA)
Ground risk	Assessed for each drone operation during SORA; independent of U-space.	Assessed cumulatively during ARA; sets U-space capacity limits (e.g. cumulative flight hours/year).
Drone-to-drone collision risk	Outside the scope of SORA.	Included in cumulative ground risk in ARA; mitigated via Flight Authorisation and Network Identification Services.
Air Risk Class (ARC)	Residual “ARC-b” can be claimed without additional evidence if conditions defined in ARA are met.	ARA defines conditions (e.g., geography, weather minima) under which U-space airspace qualifies as residual “ARC-b” as suggested in GM4 to Art. 3(4) of IR (EU) 2021/664.
TMPR Detect / Feedback-loop	Detect and Feedback-loop sufficient performance can be claimed for ARC-b BVLOS without additional evidence when using the Traffic Information Service.	ARA ensures the Traffic Information Service provides sufficient detection performance for rARC-b BVLOS operations.
TMPR Decide / Command / Execute	Applicant must demonstrate compliance with avoidance performance (risk ratio) defined in ARA.	ARA defines the minimum avoidance performance (risk ratio) for residual “ARC-b” BVLOS operations in the U-space.

Table 2: Overview over proposed delineation of responsibilities between SORA and ARA.

The objective is to further discuss and refine this delineation within the framework of the EASA Air Risk Task Force, which is mandated to develop guidance on the application of SORA in U-space, with the aim of achieving a common European understanding of the respective responsibilities of the different risk assessment methodologies.

When performing the ARA, it is essential to ensure a holistic view of air risk management. Rather than presenting only the risks associated with the U-space airspace itself, the assessment should provide a comprehensive overview encompassing the applicable regulatory framework, the risks assessed and mitigated through the SORA methodology, and those assessed and mitigated through the ARA. FOCA will prepare a dedicated overview and share it with EASA and the EASA Member States for discussion in the EASA Air Risk Task Force and/or the U-space Task Force.

5.5.2 Key observations

Observation 9: The ARA team expressed overall satisfaction with the use of automated testing and with the principle that only USSPs that successfully passed these tests were authorised to participate in the field test. The assurance that all tests are successfully passed by all participants for each software release was also positively received. Overall, this approach was considered appropriate to ensure that new software versions maintain an adequate level of safety. In addition, the test reports generated by the automated testing suite were identified as a valuable input that may provide further information to support the finalisation of the U-space ARA.

Observation 10: One of the most important procedural points raised concerns the relationship between the SORA methodology and the U-space concept. This relationship is not yet fully understood. In particular, the ARA team found it challenging to obtain a complete overview of how air risk is managed: which risks are already mitigated through SORA or through the regulations applicable to the Open category, which risks are now mitigated through the U-space airspace and the USSP services, and which new risks are addressed specifically due to U-space (such as the risk of collision between two drones in an increasingly dense airspace).

Observation 11: According to Art. 3 of IR (EU) 2021/664, MS are required to assess safety, security, privacy and environmental risks when designating a U-space airspace. In practice, assessing security, privacy and— to some extent—environmental risks have proven challenging. It is widely acknowledged that these risks fall outside the responsibilities and competences of a CAA and are typically addressed by dedicated national authorities mandated to manage them to an acceptable level. Safety should be the main focus of the ARA. To address privacy, security, and – to some extend – environmental risks in the framework of the ARA, the coordination between different competent authorities in the MS is necessary.

Observation 12: The use of baseline statistics on current drone activity proved highly valuable during the ARA process. Having reliable data on how the future U-space airspace is used today greatly supports the assessment of potential risk impacts and should be considered essential for future ARAs. Although each operator’s approval or Open category procedures were duly considered, there remained a potential risk that the tests could artificially increase the number of drones flying in the area. This could have resulted in an unrealistically high drone density, thereby increasing the collision risk with manned air traffic. To demonstrate that this concern did not apply, statistics on the average number of daily drone flights in the area were provided to the ARA team. These data showed that Field Test V1 would not lead to a significant increase in daily drone activity and therefore would not introduce additional air risk.

5.6 Selecting drone operators for the test

FOCA invited holders of a valid SORA authorisation in the area in Zürich to participate to the Field Test V1. On 7 October 2025, FOCA organised a virtual matchmaking session between USSPs and drone operators interested in participating in the Field Test V1. During this session, the USSPs willing to participate in the Field Test V1 presented their organisation, service offerings, and technical requirements for operator connectivity. Based on this information, operators selected their preferred USSP for participation. Operators who did not select a USSP—or who did not intend to connect to one—were not permitted to participate in Field Test V1.

All drone operators that decided to participate to the Field Test V1 and connected to a USSP were using DJI drones. Although USSPs successfully developed platforms or plugins to get telemetry data directly from the DJI cloud, all the other services were provided directly over user interfaces proprietary of each USSP.

The observations below indicate that the communication and feedback loop between drone operators and USSPs require improvement. At present, U-space services often appear to be developed in isolation—or primarily to meet regulatory requirements—rather than to deliver a service that is fully aligned with the needs of end-users.

5.6.1 Key observations

Observation 13: For USSPs participating in the virtual matchmaking session between USSPs and drone operators, this session marked their first direct interaction with their prospective customers (especially if we refer to Open category drone operators). Some USSPs presented their solutions in a way that seemed more suited to investors than to drone operators. As a result, several operators reported that they did not clearly understand the practical benefits of the U-space services or how these services operate and should be used.

Observation 14: One specific challenge was the language used in several U-space services platforms. Many USSPs offered their solutions only in English, while several drone operators are not sufficiently familiar with English. As a result, these operators were effectively limited to choosing USSPs that had already made the effort to provide a multilingual platform. At a European level, this illustrates that—even if relatively simple to address—language availability can become a significant barrier to the acceptance and wider adoption of U-space services.

Observation 15: Some drone operators complained that the onboarding to USSP system is tedious and long, taking several days to be fully integrated with the system. Specifically, it has been pointed out that it could take some hours to understand how to connect a drone to a Network Identification Service.

6 Field Test V1

Field Test V1 was conducted on 19 November 2025, between 13:00 and 18:00, and was structured in two distinct phases: The first phase focused on basic operational scenarios, the second phase addressed more advanced scenarios, allowing a progressive evaluation of U-space services under increasing operational complexity. The test day was characterised by cold weather conditions.

Prior to the execution of the tests, drone operators were provided with a dedicated Field Test V1 manual and participated in a briefing session led by FOCA, in which the test objectives, scope, and the test campaign process have been explained. Detailed descriptions of the test scenarios, assumptions, and procedures are provided in Annex 1 (ConOps of Field Test V1).

The test campaign did not include operations involving BVLOS drone operators nor non-DJI drone platforms. Consequently, the feedback collected and the conclusions drawn are primarily representative of VLOS operations conducted using DJI systems, which limits the generalisability of the findings to other operational concepts and technical ecosystems.

The objectives of the Field Test V1 and their associated success criteria are presented below.

Code	Objective	Description	Success Criteria

OBJ1	**Verify automated testing of USSPs**	Verify that each USSP successfully completes the required automated tests on the InterUSS Platform, based on the latest SDDs and interface specifications, before participating in the Field Test V1.	At least two USSPs have successfully passed the automated test suite defined by FOCA prior to field deployment.
OBJ2	**Demonstrate interoperability sbetween USSPs**	Ensure that multiple USSPs can exchange mandatory data in compliance with Art. 7 IR (EU) 2021/664. requirements and FOCA's technical specifications.	Stable and continuous data exchange observed during the Field Test V1, with no significant loss of synchronisation or data integrity.
OBJ3	**Assess service maturity and feasibility in isolated context**	Test and evaluate the ability of U-space services — even if limited in scope and in isolation — to function within the Zurich CTR.	U-space services showcase current performance throughout the V1 phase; technical feasibility confirmed for transition to V2. Note that the Field Test V1 will not assess the full-service scope.
OBJ4	**Collect operational and stakeholder feedback**	Gather technical and procedural feedback from drone operators, USSPs and FOCA to refine the regulatory, technical, and operational framework for the V2 phase.	Consolidated internal feedback report delivered at the end of Field Test V1, including recommendations for system, process, and regulatory improvements.
OBJ5	**Evaluate service resilience and recovery**	Assess how U-space services and USSP systems handle degradation events (e.g. disconnection, loss of connectivity or power) and their ability to recover to a stable state without user intervention.	Following service interruptions, systems restore normal operation automatically or through clear operator prompts, without data inconsistency or service failure.
OBJ6	**Assess drone operator situational awareness and alerting mechanisms**	Evaluate how effectively the system communicates critical states such as disconnections, geo-awareness violations, or deviations from authorized flight volumes to the remote pilot or operator.	Test operators can detect and correctly interpret alerts or visual cues for anomalies and take appropriate corrective actions in all test cases.

Table 3: List of for the Field Test V1.

6.1 Scope

As indicated in Chapter 5, the scope of the Field Test V1 was limited to a set of specific functionalities of the Network Identification Service, the Geo-awareness Service, and the Flight Authorisation Service. See Table 1 in Chapter 5 as reference. Within this framework, the test session focused on the following aspects:

Part 1 – Basic Scenarios

- Retrieving information from the Geo-awareness Service
- Connection to the Network Identification Service
- Request and processing of Flight Authorisations
- Situational awareness via the Traffic Information Service (limited to drone traffic)

Part 2 – Advanced Scenarios

- Disconnection from the Network Identification Service
- Deviations from the Flight Authorisation volume
- Loss of Internet connectivity on a USSP device
- Loss of battery of a USSP device

Further details on the organization of the tests and the safety measures taken can be found in the U-space Field Test V1 ConOps, in Annex 1.

6.2 Results

Of the five USSPs initially participating in the U-space implementation activities, only three expressed their willingness or had the capacity to participate to these tests. Of the three, two passed the automated tests, which allowed them to have access to the tests with the drone operators. The results of the test were the following:

- **OBJ 1 – At least two USSPs successfully pass the automated tests: Achieved**. Two USSPs qualified and participated in the field activities.
- **OBJ 2 – Stable and continuous data exchange between USSPs: Not yet achieved.** The interoperability test failed due to a configuration issue that was identified and resolved only after the test.
- **OBJ 3 – U-space service maturity: Evaluated under limited conditions.** Individually, the USSPs' services functioned as expected, but the limited scope and the isolation from the real-life environment of drone operations, as required by the risk assessment, did not allow assessing the objective to full extend.
- **OBJ 4 – Collect feedback from stakeholders: Achieved.** We received extensive feedback from operators and other stakeholders.
- **OBJ 5 – Evaluate service degradation: Partially achieved.** Excluding interoperability, service behaviour remained stable;
- **OBJ 6 – Evaluation of alerts from drone operators: Partially achieved.** Some USSPs provided information on critical states, though some operators found tools like federal geoportal (map.geo.admin.ch) more practical. This point was quite complex to evaluate as differing for each different USSP. Some implemented more evolutes alerts while others are more complex to use.

At the end of the tests, it has been decided to schedule an additional session of test to give a chance to USSPs to correct the issues related to OBJ 2 that was unsuccessful. The three USSPs spent another week working together on cases related to exchange of information of simulated drones and simulated drone flights. It must be noted that this unscheduled amount of R&D work fell exactly in the week of Thanksgiving, making it way more challenging for US-based USSPs to have engineers available and with less resources.

6.3 Additional test with simulated flights

An additional session of tests was performed to give a chance to USSPs to correct the issues related to the stable and continuous data exchange (OBJ 2) that was not fulfilled within the deadline set by FOCA for the Field Test V1. This test session happened with simulated flights, hence, no drone operator participated. During this session, the third USSP that was excluded from the Field Test V1 was able to pass all automated test related to WP3. Therefore, the three USSPs spent another week working together on cases related to exchange of information of simulated drones and simulated drone flights (in other words, no involvement of Drone operators has been done this time).

6.3.1 Results

Short description of the results

- **OBJ 1 – At least two USSPs successfully pass the automatic tests: Achieved and Updated**. Three USSPs qualified and participated in the field activities.
- **OBJ 2 – Stable and continuous data exchange between USSPs: Achieved.** The three USSPs were able to exchange positions of live drones and flight plans.

6.4 Key observations

Observation 16: The fact that the issue related to USSP interoperability was resolved within a single week, while simultaneously completing the onboarding of a third USSP into the test environment, constitutes a notable example of the effectiveness and efficiency of automated testing for U-space implementation. Despite the very limited timeframe—including the Thanksgiving holiday period in the US—and with development teams distributed across three different time zones, it was possible to rectify the issue and successfully pass the required tests within one week.

Observation 17: Nevertheless, the majority of drone operators expressed disappointment that USSP interoperability was not achieved during Field Test V1. Several operators emphasised that more extensive simulation testing should have been conducted prior to field deployment, in order to identify and resolve such issues before operators were asked to test the services in live operational conditions.

Observation 18: During Field Test V1, it was observed that each participating USSPs implemented its own software interface to ingest telemetry data from DJI drone platforms in support of the Network Identification Service. While these solutions enabled the provision of the service for the purpose of the Field Test V1, they relied on heterogeneous, USSP-specific integration approaches. Given the critical role of telemetry ingestion for remote identification, this fragmentation was identified as a potential weakness from a certification, robustness, and long-term sustainability perspective. The observation highlights the need to explore more standardised approaches for telemetry access, such as common or harmonised APIs applicable across drone manufacturers, to improve consistency, facilitate certification, and support scalable deployment of Network Identification services.

7 Feedback from drone operator on Field Test V1

This section contains the consolidated feedback FOCA received from the drone operators participating in the Field Test V1.

7.1 Operational feedback

Several drone operators reported that the **Traffic Information Service (TIS)** is the most safety-relevant, as it directly contributes to air risk mitigation and addresses multiple challenges related to air traffic detection, including the quantification of the percentage of detected air traffic—currently perceived as one of the main limitations of the SORA methodology for BVLOS operations. Due to the complexity of the service and the fact that some baselines remain largely undefined, namely communication protocols, data exchange mechanisms, and applicable standards, TIS tests were not included in Field Test V1 and were instead deferred to Field Test V2 in Q2 2026.

For some drone operators, the three services tested during Field Test V1 offered limited operational benefits and it was reported that they even increased the complexity of Open category operations.

7.1.1 Geo-awareness

Swiss drone operators are accustomed to obtaining airspace information via the federal geoportal (map.geo.admin.ch), including its established colour coding and information structure. Receiving the same information through unfamiliar user interfaces led to confusion and, in some cases, difficulties in correctly interpreting airspace constraints. They therefore expressed a preference for introducing standardized color-coding of restricted areas to avoid operator confusion. Furthermore, drone operators reported confusion regarding the geo-awareness service, as it provides an “awareness-only” function and does not prevent operations in areas displayed as restricted zones (e.g. prisons) on the map.

7.1.2 Network Remote Identification

Due to interoperability issues, it was not possible to visualise the position of drones connected to different USSPs operating within the Zürich airspace during the Field Test V1. As a result, drone operators considered this service to be immature at its current stage. This test will be repeated in the framework of the Field Test V2. Drone operators reported confusion caused by the current colour coding, as their own drone were displayed in the same colour as other nearby drones. They suggested introducing a standardised colour-coding scheme that allows operators to clearly distinguish their own drone from other drones.

7.1.3 Flight Authorisation

Drone operators conducting Open Category flights reported multiple issues with this service, including: (a) requesting for flight authorisation has been perceived as an additional procedural burden without a corresponding safety benefit, particularly in airspace areas with limited drone traffic. (b) Once a request for flight authorisation has been submitted, the operator's flexibility is significantly decreased. This is particularly problematic for operations where flight paths cannot be precisely anticipated in advance. (c) Drone operators reported increasing incentives to "block" airspace in an unfair manner, in order to gain flexibility. Furthermore (d), a limitation specific to the scope of Field Test V1, whereby the service primarily prevents conflicts with other drones occupying the same four-dimensional volume, while for other airspace restrictions (e.g. flights over prisons) it merely provides a recommendation not to fly, as authorisations may be obtained through alternative channels. Finally, (e) the prohibition of multiple drones from operating simultaneously within the same airspace volume, even in cases where operations are conducted under VLOS and operators are coordinating with one another, was reported as overly conservative. It was perceived as unnecessarily restrictive from an operational perspective.

In addition, several drone operators reported that the information provided by the USSPs was very difficult to interpret and that some user interfaces were not practical to use. For example, on one platform it was not possible to visually distinguish the operator's own drone from other drones in the same airspace (e.g. through colour coding), which created confusion during operations. Moreover, the use of multiple screens has been deemed particularly frustrating. Unfamiliar user interfaces, and associated processes were frequently identified as insufficiently aligned with real operational workflows, raising concerns regarding operator acceptance and tangible safety or efficiency gains.

7.1.4 Feedback on the relationship with USSPs

Participating USSPs partially demonstrated technical robustness; however, the certification maturity and economic sustainability could not be evaluated. Open category drone operators highlighted that cost structures, value propositions, and long-term economic viability remain uncertain, resulting in an unfavourable risk–benefit perception. This reflects both the well-known "chicken-and-egg" challenge of the U-space and drone market, and broader maturity limitations of the current regulatory framework, as well as insufficient communication between USSPs and drone operators.

7.2 Key observations

Observation 19: Despite the scope of Field Test V1 having been clearly defined and communicated as limited—both in terms of objectives and services to be tested—feedback from drone operators suggests that expectations were misaligned. Several comments referred to the absence or insufficient performance of services that were explicitly outside the scope of the test, such as conformance monitoring, strategic deconfliction, and the Traffic Information Service. This indicates that communication challenges may have occurred regarding the objectives and limitations of the test campaign, which will be carefully addressed for Field Test V2.

Observation 20: The very constrained timeline of Field Test V1 was repeatedly highlighted by participants as a contributing factor to confusion and frustration. While this feedback acknowledges the effort deployed by all parties under challenging conditions, it also suggests that the compressed schedule may have limited participants' ability to fully understand, prepare for, and contextualise the test objectives and results.

Observation 21: While several U-space services can already be effectively delivered via APIs, significant uncertainty remains regarding UI/UX aspects. The absence of a clearly defined regulatory framework for information visualisation contributed to heterogeneous and, in some cases, suboptimal user interfaces across USSPs.

Observation 22: The services tested during Field Test V1 were perceived by several participants as introducing increased complexity, operational and financial burden for Open category drone operators, without delivering proportional operational or safety benefits at the current stage of implementation. As long as the benefits of using these services for Open category drone operators, the acceptance and willingness to pay for and use them is expected to be limited.

Observation 23: While discussions took place regarding the retrieval of telemetry data from the DJI cloud, questions remain as to when USSPs will transition towards providing their services directly via APIs, independently of manufacturer-specific cloud infrastructures.

Observation 24: The Flight Authorisation Service, as implemented and tested for Open Category operations, was perceived by several drone operators as overly constraining and insufficiently aligned with their operational needs. While operators acknowledged the regulatory role of the service, feedback highlighted that its current implementation does not yet provide clear operational value commensurate with the additional procedural burden introduced. In this context, FOCA considers that the Flight Authorisation Service for Open Category operations should evolve toward implementations that remain fully compliant with the regulatory framework while being significantly simplified, intuitive to use, and demonstrably value-adding for operators. USSPs are therefore encouraged to focus on service designs that facilitate Open Category drone operations—particularly in low-traffic environments—by reducing unnecessary complexity and better supporting real operational workflows. This is especially relevant given that Open Category operations currently represent the majority of drone activities within U-space.

Observation 25: The treatment of GUI and information visualisation within the U-space regulatory framework remains insufficiently defined. While not all USSPs intend to provide services via GUI, the absence of a clear regulatory concept or effective standardised guidance has led to inefficiencies and misunderstandings, with negative impacts on operational performance and potential implications for safety. In addition, guidance on the integration of U-space functionalities into existing drone control interfaces is currently lacking. At the same time, FOCA cautions against over-regulating or excessively standardising user interfaces. Experience with existing non-mandatory services has shown a tendency towards detailed prescriptive requirements, which may significantly increase regulatory complexity without proportional safety benefits. Moreover, the development of generic and safety-relevant test suites for user interfaces would be particularly challenging without a high degree of harmonization, which remains difficult to achieve even for deterministic U-space services.

Observation 26: Consistent with Observation 26, FOCA considers it more effective to prioritise an API-based approach to U-space service provision, as this approach is currently more mature and better suited for automated testing. The evaluation of dedicated graphical user interfaces should therefore be deferred to a later stage. Prioritising API-based service delivery enables U-space functionalities to be integrated into user interfaces and operational tools already used by drone operators, thereby reducing operational complexity and better aligning with real operational workflows.

Observation 27: State aircraft drone operators (e.g. police) also participated in Field Test V1. They reported a strong interest in the U-space infrastructure, particularly the security-related benefits of the Network Identification and Geo-awareness Services. First, they expressed interest in being able to issue UAS geographical zones in real time to better respond to operational needs. It was agreed that this functionality will be tested during Field Test V2 in strong coordination with the participating USSPs and state aircraft drone operators.

8 Conclusions

From FOCA's perspective, the scaling of BVLOS operations in Switzerland, as at European level, is intrinsically linked to the successful deployment of U-space, provided that the framework can effectively support large-scale, economically viable, and safety-relevant operations.

At the same time, the findings of Field Test V1 indicate that the current maturity of U-space—both from a technical and a regulatory standpoint—does not yet fully meet the expectations associated with large-scale deployment. Uncertainty remains regarding the short-term sustainability of USSPs, as well as the appropriate balance between accrued risk mitigation benefits for drone operators in the Open category and the additional operational complexity introduced by U-space services. These aspects must be carefully considered when assessing deployment strategies and market models.

Observations from Field Test V1 indicate that the significant safety value for drone operators is expected through the provision of Traffic Information Service, enabling detection of all aircraft and thus effective air-risk mitigation. In the Swiss context, this is directly linked to challenges related to conspicuity in the Swiss airspace and ground infrastructure surveillance coverage, which remain central limitations of current operational risk assessment methodologies. FOCA's work in this area is closely connected to the national conspicuity initiative (FASST-CH), which aims to establish large scale conspicuity of the Swiss airspace, and more broadly to national surveillance coverage challenges.

In contrast, U-space services tested during Field Test V1 were perceived by drone operators as offering limited immediate operational benefit, particularly for Open category drone operations, while introducing additional operational and cognitive burden. Feedback indicates that this was not solely a maturity issue of the U-space concept, but also a consequence of USSPs failing to adequately incorporate operator perspectives and to clearly communicate the rationale, benefits, and intended operational use of the services. As a result, services that are regulatory-compliant in principle were experienced as unnecessary or intrusive in practice, undermining trust and acceptance among operators.

A particularly challenging aspect remains the delivery of U-space services to end users through graphical user interfaces. Demonstrating the safety of such interfaces, while ensuring usability and operational relevance, has proven to be complex. Limited experience gained during the test campaign suggests that, during the initial phases of U-space deployment, the provision of services via APIs, integrated into user interfaces already used by drone operators, could represent a more pragmatic approach.

From an architectural and market perspective, experience gained during the test campaign indicates that the distributed approach—where the CIS is provided by both Skyguide and FOCA, while the four mandatory U-space services are delivered by one or more interoperable USSPs is technically sound. For USSPs, this model acknowledges that the short- and medium-term viability of USSP business models remains to be demonstrated; for CIS, the key challenges of the distributed architecture are yet to be addressed.

Furthermore, finalising the ARA remains a resource-intensive exercise, because requirements for new services and processes still need to be defined. For this reason, unambiguity should be removed right at the beginning. To ensure harmonisation, existing international industry standards are leveraged wherever possible. In parallel, FOCA, in coordination with EASA and other MS, is developing a baseline for a shared and holistic understanding of risk assessment in U-space, including a clear delineation between elements addressed through SORA, those covered by the ARA, and areas where the distinction is not yet clear or cannot yet be made. prioritising safety aspects in the framework of the ARA, non-safety risks, such as privacy, security, and environmental impacts (e.g. noise), remain relevant; however, they may need to be addressed through separate processes in coordination with the responsible entities.

The Field Test V1 further confirmed that automated testing is a critical enabler for U-space implementation, particularly in environments where multiple USSPs coexist. Automated testing supports interoperability, robustness, and controlled evolution of services, but also requires careful planning, strong technical expertise, and clear governance arrangements between stakeholders.
Finally, feedback from participating drone operators—particularly those engaged in or preparing for BVLOS operations—indicates a continued willingness to experiment with U-space concepts, recognising their potential to provide greater scalability than today's case-by-case SORA-based approach. FOCA also recognises that, once sufficiently mature, U-space infrastructure has the potential to significantly reduce the administrative burden associated with the processing of operational authorisations, benefiting both operators and authorities.

9 Next steps

Building on the findings of Field Test V1, FOCA will continue to pursue a phased implementation approach for U-space in Switzerland. This approach has proven effective in enabling structured feedback to the European regulatory process while allowing FOCA to progressively adapt its national implementation strategy based on demonstrated maturity.

The timeline and sequencing of future phases will be adjusted in line with the findings of this report. In particular, FOCA distinguishes between three categories of actions:

- **continued implementation** for services or functionalities that have reached a sufficient level of technical, operational, and regulatory maturity (e.g. Network Identification Service);
- **additional testing and validation** for services or functionalities that require further development and risk assessment (e.g. Traffic Information Service, Dynamic Airspace Reconfiguration, Flight Authorisation Service);
- **regulatory feedback and coordination** for aspects that fall outside FOCA's direct competencies, in close cooperation with EASA, the European Commission, and other stakeholders.

Within this framework, FOCA will proceed as outlined below.

1. Continuation and refinement of the Zürich U-space ARA

FOCA will continue the ARA of the Zürich airspace and, where feasible, assess potential adjustments to the proposed U-space boundaries with the objective of reducing overall airspace complexity and implementation risk. It is important to analyse and keep into account how the future U-space airspace is currently used by manned aviation and to understand their operational needs and concerns regarding drone integration. This contributes to building a constructive environment of inclusion and safety around the U-space airspace volume (see second point below).

2. **Specify the requirements for safe blue-light operations in the U-space airspace**

In the context of the Zürich area, when the cloud base is very low, low-altitude blue-light operations may penetrate U-space airspace at any time. In this context, helicopter pilots highlighted the need for an appropriate buffer for air traffic detection—defined either as a fixed distance (e.g. 5 km), a fixed time horizon (e.g. one minute prior to entry into the U-space airspace), or another performance-based parameter —to ensure safe drone operations in the vicinity of manned operations.

Discussions with helicopter pilots highlighted the need for an appropriate buffer around the U-space volume to provide drone operators operating near the boundary with sufficient time to react to approaching manned aircraft. This buffer may be defined by using different operational criteria, such as a fixed distance (e.g. 5 km), a fixed time horizon prior to entry into the U-space airspace, or another suitable performance-based parameter. While such a buffer is considered essential from a safety perspective, it is not currently addressed in the AMC/GM for the U-space regulatory framework. Consequently—and in direct continuity with Observation 12—FOCA assesses the need for establishing an ADS-B Transponder Mandatory Zone (TMZ) encompassing both the U-space airspace and the associated buffer area, which should be reflected in the AMC/GM of the IR (EU) 2021/666 (with the potential surveillance volume illustrated in Figure 4 below, while the operational volume corresponds to the currently envisaged U-space airspace).

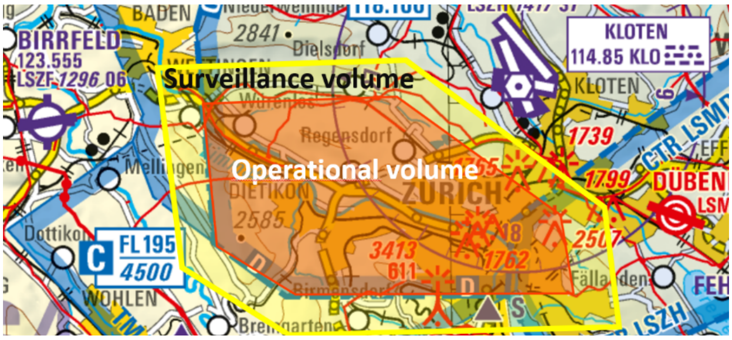

Figure 4: Increase detection volume for the Traffic Information Service.

3. Balancing testing activities across Open Category and BVLOS operations

Future test phases will recognise that Open Category operators represent a numerous users of U-space services, and that their adoption is a key factor for the progressive deployment and acceptance of U-space. At the same time, BVLOS operations remain the primary long-term driver for U-space scalability and safety benefits. Future testing activities will therefore seek to strike a balance between these two dimensions.
In this context, FOCA will assess whether U-space services deliver tangible operational value to Open Category operators in a manner that is proportionate, intuitive, and aligned with real operational workflows, while avoiding the introduction of unnecessary complexity. In parallel, selected test scenarios will continue to address the needs of BVLOS and other Specific Category operations, ensuring that the end-to-end operational loop between drone operators and USSPs is effectively closed and that the system progressively matures toward large-scale deployment.
This balanced approach aims to ensure that U-space evolves in a way that supports early adoption by Open Category operators, while remaining fit for purpose for future BVLOS operations and consistent with the strategic objectives of the U-space framework.

4. API-based service delivery and operational integration

FOCA will prioritize the testing of **API-based service provision**, enabling drone operators to integrate U-space services directly into user interfaces and operational tools already in use.

This approach aims to:

- reduce operational complexity for drone operators,
- avoid parallel user interfaces,
- support more realistic operational workflows during testing.

GUI developed by USSPs may continue to be used for testing purposes where relevant, but the focus will increasingly be placed on service integration rather than standalone visualization.

5. Strengthening coordination and governance between USSPs

FOCA will actively orchestrate coordination among participating USSPs to establish common agreements and practices related to:

- update and release windows,
- testing procedures and validation phases,
- release management and rollback mechanisms.

This work will build on existing SDDs and aim to further refine U-space governance, including service-level expectations and coordination mechanisms between USSPs.

6. Continued development of Traffic Information Service and Dynamic Airspace Reconfiguration

FOCA will continue to promote and advance the objectives of the national conspicuity initiative, which is fully aligned with the needs of both drone operators and existing airspace users.

Future test phases will place particular emphasis on:

- complete versions of the services tested during the Field Test V1
- the Traffic Information Service,
- Dynamic Airspace Reconfiguration concepts,
- stronger operational involvement of Skyguide, especially with respect to manned aviation integration and surveillance data.

7. Identification of future U-space airspaces

FOCA will identify one or more new candidates U-space airspace areas in uncontrolled or controlled airspace characterised by lower airspace complexity and risk, while maintaining operational and business relevance for drone operators. Purely theoretical or non-operational areas will be avoided.