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Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office of Civil Aviation FOCA
Innovation and Digitalization Unit
Swiss U-Space Program

SUSI's Remote ID Demonstration of September 16 2019

1 Executive Summary

On September 16 2019, the Swiss Federal Office of Civil Aviation (FOCA) coordinated a demonstration of the ASTM WK65041 (UAS Remote ID) standard in collaboration with six industry participants, members of the Swiss U-Space Implementation (SUSI) program: ANRA Technologies, Airmap, Involi, Orbitalize, skyguide, and Wing.

The event was a success. All involved companies delivered a solid performance. Our learning will prove useful in our efforts to drive forward the regulatory framework related to the safe and secure integration of drones in the national airspace. The networked Remote-ID solution in particular proved fully satisfactory. Data exchange among participants worked flawlessly, the display providers were able to show a fully consistent picture of the airspace. The broadcast solution also worked as expected in the limits currently defined by the standard. The operationalization of the standard's broadcast portion remains, however, an open question as the proposed solutions, Bluetooth and Wi-Fi, have clear limitations. The demonstration also highlighted the need to better quantify the limitations and the performance of the broadcast solution.

On the regulatory side, FOCA is now equipped to start working on an onboarding and monitoring process in collaboration with SUSI members interested in providing networked Remote ID services.

2 Goals

2.1 EU Regulation and Broadcast solution

The demo was set up to learn about possible solutions regarding the implementation of the Delegated Act (EU) 2019/945 of 12 March 2019[1], defining remote identification of drones and establishing that remote identification data shall *be received directly by existing mobile devices within the broadcasting range*.

Section 4.4.1 of the standard is relevant for the Delegated Act. It states that *Equipment on participating UAS continuously transmit Remote ID data using one of the transmit protocols in this standard (Bluetooth or Wi-Fi). (…) The initial technologies were selected for compatibility with commonly carried handheld devices that have their own receiver antenna.* FOCA also aimed to better understand Appendix X1 specifying the performance Characteristics of three implementation of the standard: Bluetooth 4 (Legacy), Bluetooth 5 (Long Range), and WiFi Aware.

2.2 Network Solution and Swiss U-Space Conops

Another objective of the demonstration was to test the implementation of a U-Space Remote Identification Service. The Swiss U-Space CONOPS had introduced the notion of an e-identification service[2] earlier in the year. The service was designed as a federated and interoperable approach to remote

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0945

[2] https://www.bazl.admin.ch/bazl/en/home/good-to-know/drones-and-aircraft-models/u-space.html

identification, which would be available in areas where connectivity is available. Given the Swiss geography, this represents more than 95% of the country.

Section 4.5.1 of the standard addresses the technical implementation of a networked remote identification solution. *Network Remote ID can be used when both UAS operations and end users of Remote ID display applications access the internet, typically via cellular network*. Section 4.8.3 later adds that *The interoperability paradigm consists of two parts: (1) A standardized discovery mechanism, referred to as the Discovery and Synchronization Service (DSS), (…) and, (2) Service-specific data exchange protocols.* The details of those building blocks are described below. The demonstration aimed at testing the applicability of the standard to the Swiss U-Space CONOPS.

2.3 Information to and feedback from national stakeholders

Representatives of different government agencies (Federal Office of Communications, Federal Police, Military Aviation Authorities, Swiss Air Force), representatives from several regional police forces (Kantonspolizeien), and representatives from the Swiss Association for Civil Drones (Drohnenverband) were invited to a workshop in order to gather feedback on the concepts and initial implementations of the standard. Before the demonstration, they received an overview of the new European regulation and an explanation of the standard.

2.4 Testing the Swiss U-Space Implementation Program

The Swiss U-Space Implementation (SUSI) program is a collaborative effort from FOCA, skyguide, the Swiss Air Navigation Service Provider (ANSP) and a group of industrial stakeholders. SUSI was set up to identify, quantify, develop and effectively implement the U-Space capabilities and technologies in Switzerland. The Remote ID demonstration was the first concrete action regarding the implementation of an identified U-Space service. The goal was to test the ability of interested parties to deliver a result that would support the creation of the necessary onboarding and oversight processes for the deployment of a competitive national “e-identification” service.

3 Setup

3.1 Timeline

The demonstration was approved on July 16 2019 and communicated to SUSI member on July 18. Weekly calls were organized to discuss technical and organizational matters. The speed of execution was supported by the organization of a similar demonstration in the US a few days earlier, on September 13, in which 3 participants (ANRA, Airmap and Wing) also participated.

3.2 Roles

The standard defines three roles (description rephrased):

- *Network Remote ID (Net-RID) Service Providers*: an entity getting data from the UAS and sharing them in the network, for instance by integrating APIs (interfaces) in the Ground Control Station used by the drone operators and sharing the data over a mobile connection.
- *Net-RID Display Providers*: an entity that aggregates data from Net-RID Service Providers
- *Display Client*: the interface to users (police, citizens, …), an app or webpage showing drones on a user interface such as a map

The Swiss Remote ID Demo split the roles as follows:

- Net-RID Service Provider: ANRA, skyguide (via Airmap), Wing
- Net-RID Display Provider: ANRA, skyguide (via Airmap), Orbitalize, Wing
- Display Client: Net-RID Service Provider: ANRA, INVOLI (via Wing), Orbitalize, skyguide (via Airmap), Wing

3.3 Discovery and Synchronization Service

Network Remote ID used an underlying Discovery and Synchronization Service (DSS) which enabled different Net-RID Service providers to be discoverable (find each other) for the area of interest requested by the Net-RID Display Providers. The DSS is a distributed capability that can be provided by several entities sharing data based on specifications from another ASTM standard (under development[3]). During the demo, the DSS was provided by skyguide (via AirMap) and Wing via the InterUSS Platform[4], an open-source project by the Linux Foundation which implements the DSS.

3.4 Drones

Four drones were used during the demo, all from DJI: one Inspire and three Mavic. This choice was related to the existing integration of the participants' software with DJI's Ground Control Station.

3.5 Location

The demonstration took place in Ittigen, near Bern, next to FOCA's headquarters. The area of the demo was located within Bern-Belp Airport's CTR, however outside of its 5 kilometers radius, where flights are possible without restrictions up to 150 meters AGL. All flights were limited to 120 meters AGL to be aligned with the upcoming European regulation that limits flight in the open category to that altitude.

4 Results

4.1 Feedback from guests (authorities, law enforcement)

The feedback from the participants was overall very positive in particular in regards to the tools that were presented to them during the demo. Questions targeted mostly the implementation of the new regulation in Switzerland as a whole, for instance the link with the registry and pilot competencies.

The question of data retention and data access for the police was also raised. The standard offers two mechanisms to protect operators' data: a temporal limit and a geographical limit. Data is only displayed for sixty seconds and RID-Net Providers can only query an area with a diagonal of 3.6 km. The goal is to minimize the use of the Remote ID as a tool to collect and aggregate data on drone operations. The police was, however, interested in accessing data further in the past. A distinction between the use of RID by the general public and the law enforcement agencies is therefore required. FOCA will take the necessary regulatory action to ensure proper access to data in due time and in the framework of a related but separate tracking service.

4.2 Broadcast UAS

One participant, ANRA, offered to help evaluate the broadcast UAS solution. The test was limited to Wi-Fi as Bluetooth was not implemented. Available drones were not equipped with the necessary hardware to broadcast data, therefore an external box with the required hardware had to be fitted on the drone (Inspire 2).

The Wi-Fi Aware solution worked as expected. However, it must be noted that only a single mobile phone, a Pixel 2XL, had the necessary features to receive the data transmitted by the drone.

Although it was out-of-scope of the standard, a transmission over service set identifier (SSID) was also tested. This solution was available on all mobile phones used in the demo as it is simply the way used by mobile phones to detect Wi-Fi networks. The refresh rate was limited to one second and the drone

[3] https://www.astm.org/DATABASE.CART/WORKITEMS/WK63418.htm

[4] https://interuss.org/

appeared on the list of available Wi-Fi network as a string mixing its ID and its position (latitude, longitude). We were made aware that starting with Android 9 (Pie) the refresh rate by default for active apps is restricted to four scans every 2 minutes[5].

The lack of commonly available devices that can receive data over Wi-Fi Aware from the drones raised concerns in regards to operationalization of the broadcast part of the standard. Even if the technology proved to be fit for purpose, the limited number of mobile devices equipped to receive Wi-Fi Aware could significantly limit the deployment of this technology in the short term.

4.3 Networked UAS

Five different display clients using four Net-RID Display providers were able to show the three drones flying simultaneously in a consistent manner. The frontends were tested at FOCA's headquarters on different supports and operating systems while the drones were flying roughly a kilometer away. Everything worked as expected.

The altitude, height and speed of the drones were displayed. The direction of the flight could be estimated using the trajectory of the aircraft over the last sixty seconds, which was shown as a trail (See Annex A, picture 2). Compared with the EU requirements, only the position of the pilot or the takeoff point had not been implemented yet by the participants.

A non-equipped participant was successfully displayed on all frontends using the networked solution. By definition, the flight itself was not visible, however the flight area was announced using the skyguide/Airmap application and displayed by all Display Clients. The solution worked as expected.

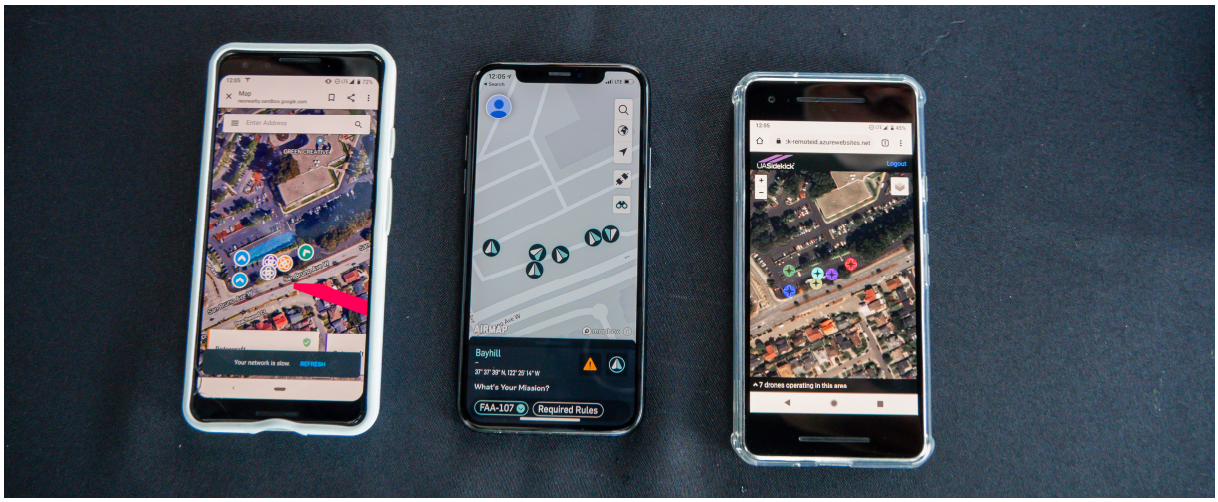
5 Conclusion

The European Regulation requires drones to broadcast data in a way that existing mobile devices can receive them. The Swiss FOCA performed follow-up investigations in the days after the demo and reached the following conclusion: at the time of writing, Wi-Fi is available on most drones but its proposed implementation on the mobile device side (Wi-Fi Aware) is only available on a small fraction of devices. We are not aware of a fixed roadmap regarding when, if ever, this technology will become widely adopted. Our understanding is that SSID, another Wi-Fi mechanism, is not included in the standard because, although available on all mobile devices, the latest implementations of Android have limited refresh rates and because all drones would be displayed on all phones in the Wi-Fi settings. Those two facts make SSID difficult to use for Remote ID. Bluetooth, on the other hand, is readily available on all mobile devices. To the best of our knowledge, the vast majority of drones sold today are not equipped with Bluetooth, leading to the exact same challenges as Wi-Fi but in reverse. In addition, we are not aware of studies showing that the proposed solutions would work at scale in urban environments. Formal tests in this direction are needed before nation-wide deployment of the technology could be supported. In summary, although technological solutions are available, the question of the operationalization of the broadcast portion of the standard is fully open. The gap between the European regulator's intent (Delegated Act) and the documented deployment capabilities from the industry is cause of concerns.

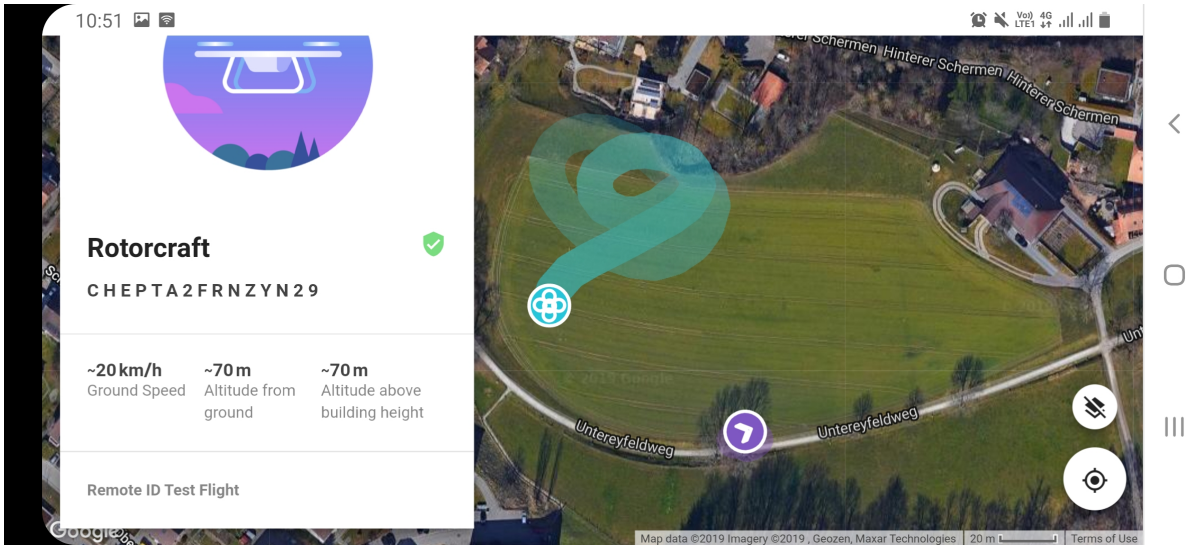
The networked solution worked as intended. All elements of the standards could be satisfactorily demonstrated, including the use of DSS. There are aspects to be further explored such as what would happen if one of the providers would fail. FOCA will work in the coming months to develop onboarding processes as well as the necessary oversight mechanism for U-Space service providers who would like to perform any of the roles described in the standard. These efforts will be performed within the framework of SUSI to ensure collaboration with all stakeholders.

[5] https://developer.android.com/guide/topics/connectivity/wifi-scan

Annex A: Examples of Display Clients



A.1 Static drones display on different display clients (from the US demo)



A.2 An application displaying a moving drone with a 60-second trail, in blue (from the Swiss demo)