International Civil Aviation Organization

The Sixth Meeting of System Wide Information Management Task Force (SWIM TF/6)

Video Tele-Conference (VTC), 17 – 20 May 2022

Agenda Item 7: State, Regional and Global SWIM Updates

UAM DEMONSTRATION OVER SWIM IN THE REPUBLIC OF KOREA

(Presented by Korea Airports Corporation (KAC), Republic of Korea)

SUMMARY

This paper presents UAM demonstration over SWIM in the Republic of Korea (ROK) that was held at Gimpo International Airport, Seoul, in 2021.

1. INTRODUCTION

1.1 Urban Air Mobility (UAM) is emerging as a 3-dimensional means of transportation flying above the ground, which co-operates with current urban transport infrastructure (e.g. subway, bus, or taxi) to convey passenger and cargo using eco-friendly electric vertical take-off and landing (eVTOL) vehicle.

1.2 Congestion in the ground transportation is expected to continue as human resources are concentrated in the metropolitan area. It is expected that UAM could solve urban transportation issues (e.g., traffic congestion, air pollution and noise) as mentioned above.

1.3 ROK established UAM Team Korea (K-UAM) in 2020 to commercialize UAM by 2025. There are 47 organizations or institutes in total in the K-UAM team that includes Ministry of Land, Infrastructure and Transport (MOLIT), Korea Airport Corporation (KAC), SK Telecom, Korea Aerospace Research Institute(KARI) and Seoul National University.

1.4 Many different kinds of high-strategic technologies (e.g. High-Definition (HD) Map, metaverse, autonomous driving and Vehicle-to-Everything (V2X) communication) **will be proactively adopted** for the implementation. Also, the operational concepts defined the ICAO GANP/ASBU (e.g., SWIM, Air Flow Traffic Management and etc.) also **would be implanted to the UAM**. ROK established the domestic UAM Concept of Operations (ConOps) in 2021.

1.5 To move forward ROK's vision to communalize UAM by 2025, ROK held an open UAM demonstration at Gimpo International Airport in November 2021. For the demonstration, SWIM and SWIM-enabled application (i.e., dashboard) were used to monitor and display the movement of eVTOL and ATM information in real-time.

2. DISCUSSION

2.1 As the UAM is in the beginning stage, demonstration followed a flight lifecycle (e.g., Flight Plan (FPL) issue and approval) under an Air Traffic Management (ATM) infrastructure.

2.2 ROK operates SWIM Testbed in Gimpo International Airport, Seoul. SWIM Testbed consists of components as follows:

- SWIM Bridge: Collects or Receives ATM information from a legacy system;

- Mediation Service: Converts or Transforms a legacy format (e.g., FPL 2012) to a XML (e.g., FIXM v.4.1) or JSON based format; and

- Information Service: Allows service consumer to consume information;

(more … SWIM registry, SWIM Infrastructure, Boundary Protection, and etc.)

2.3 It was not required to directly connect to any ATM systems for the demonstration in point-to-point method. For the demonstration, SWIM-enabled application received all information required from the SWIM as shown in Figure 1.

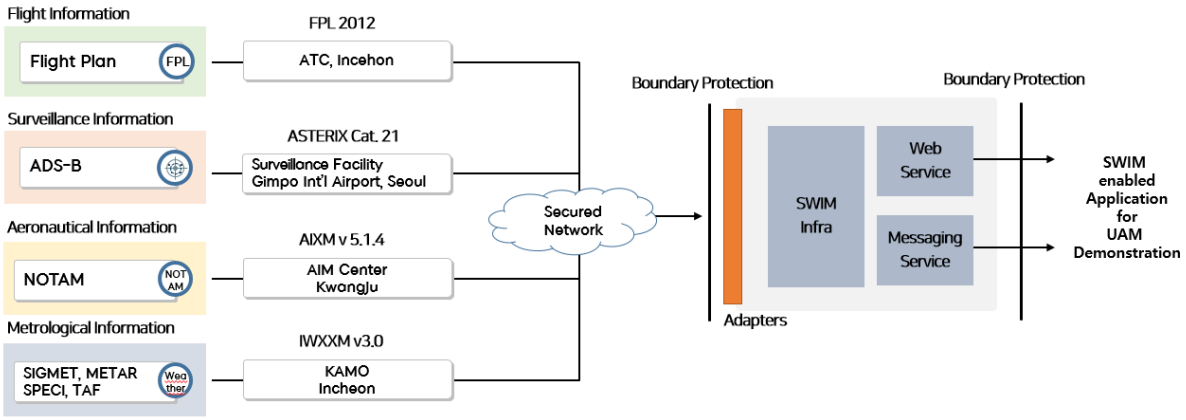

Figure 1 SWIM Testbed Configuration

2.4 FPL and surveillance data were captured in real-time from a SWIM bridge. A mediation service converts data into standardized format (e.g., FPL-FIXM v4.1, and Surveillance-JSON) and information service provides the converted information to a service consumer (i.e., SWIM-enabled application).

2.5 MOLIT and Korea Aviation Metrological Office (KAMO) conducted a digital transformation of aeronautical or metrological information following ICAO GANP/ASBU. Aeronautical and metrological information were received from relevant systems in Exchange Model (XM) formats and were provided to a service consumer through an information service.

2.6 Static data (e.g. AMDB, map, geospatial data) was provided through the GIS service deployed in the SWIM testbed. Information services used in the demonstration is shown in Figure 2.

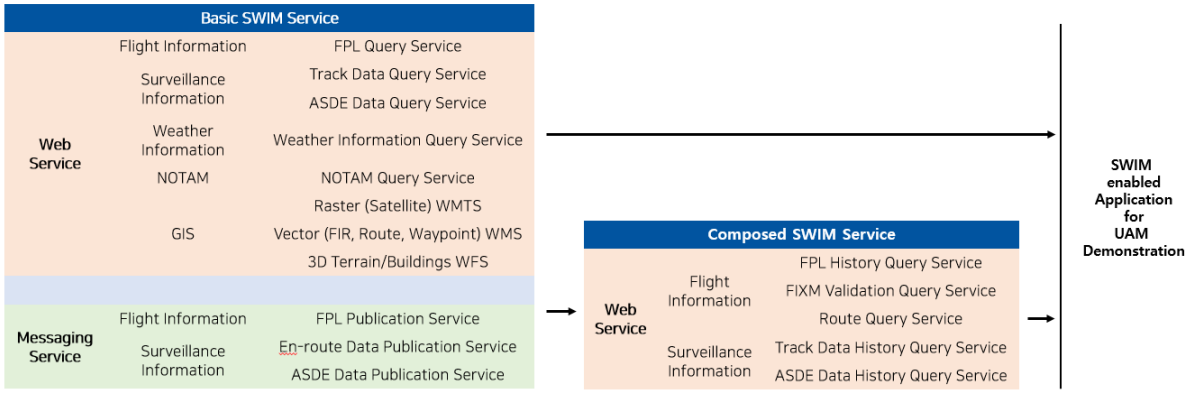

Figure 2 Information Services

2.7 UAM is expected to be flown relatively in low altitude compared to an aircraft. HD map, precise geo-spatial information (e.g., terrain and buildings) in urban area are essential to prevent collision with buildings, better understand and safely manage a vehicle and its noise from the influence of building wind.

2.8 MOLIT conducted a digital transformation of national geo-spatial information. Linked Open Data (LOD) based geo-spatial information is now available to the public using OpenAPI. For this UAM demonstration, SWIM-enabled application, which displays ATM/UTM information, and geo-spatial information in the three-dimensional map as shown in Figure 3

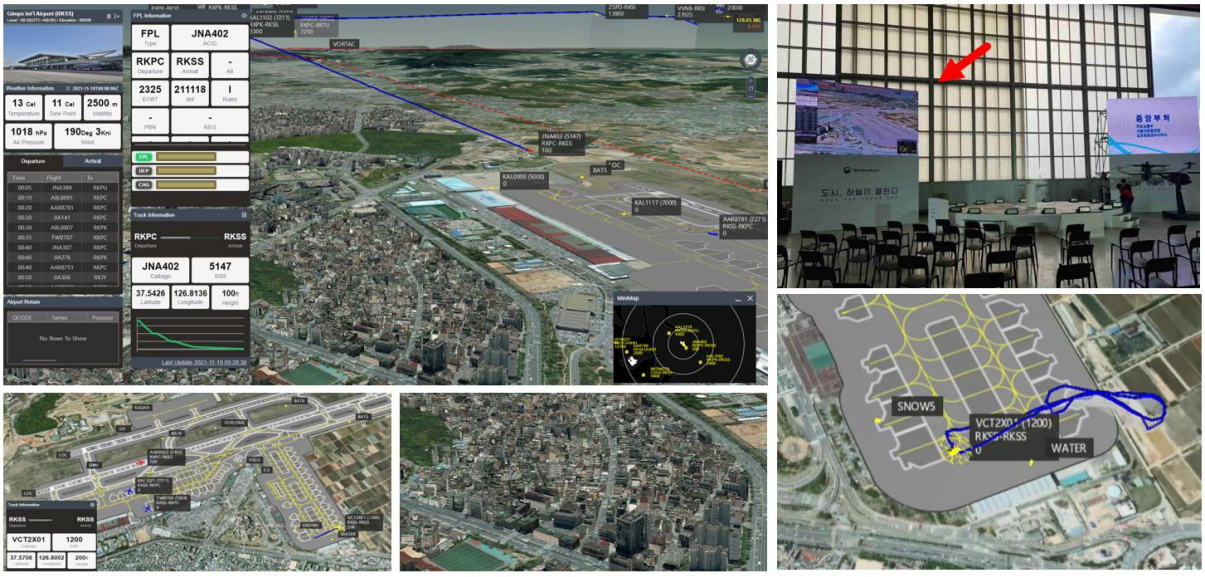

Figure 3 SWIM-enabled Application for UAM demonstration

3. LESSON-LEARNED

3.1 The demonstration showed that SWIM could provide the following advantages:

- Improve data sharing between different information domain stakeholders, and cost-efficiency to get access to the information with a Single Access Point of SWIM;

- Extend information usage and availability based on data-driven and Service-Oriented Architecture (SOA);

- Improve efficiency of maintenance and management of system and information by applying de-facto technologies in the IT industry and conducting digital transformation of a legacy information.

3.2 Flight & Flow Information for a Collaborative Environment (FF-ICE) concept also could be implanted to the UAM. It is expected that implementation of the FF-ICE and SWIM also allow the UAM community to achieve the benefit of the FF-ICE and SWIM.

4. FUTURE PLAN

4.1 ROK will conduct R&D projects to obtain fundamental technologies for UAM, and one of R&D projects is to develop interoperable data exchange environment and CNSi for UAM. (‘22~’25) This project includes sub-projects as follows;

- R&D of surveillance system for vertiport and Provider of a Service for UAM (PSU) in low-density environment;

- R&D development of information sharing system (or environment) for a vehicle within a UAM corridor;

- R&D of ground navigation system for UAM for GPS-denied condition;

- R&D of UAM communication infrastructure using 5G and UAM-ATM information integration system;

- R&D of information sharing system between stakeholders (ATC, Vertiport, and etc.);

4.2 ROK will conduct K-UAM Grand Challenge in 2023. This includes UAM over SWIM as follows:

- FPL planning based on FF-ICE; and

- Real-time surveillance (i.e., eVOTL) monitoring and control;

4.3 ROK plans to initiate the commercial operation of UAM in the urban area in 2025.

5. ACTION BY THE MEETING

5.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matter as appropriate