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AGENDA ITEM 4: AIR NAVIGATION

ADOPTION OF SWIM FOR K-UAM IMPLEMENTATION

Presented by the Republic of Korea

INFORMATION PAPER

SUMMARY

The Republic of Korea(ROK) is conducting UAM R&D by using high-strategic technologies for next-generation air mobility. Ministry of Land, Infrastructure and Transport(MOLIT) is conducting a project to establish Communication, Navigation, Surveillance and information(CNSi) systems for UAM stakeholders in urban air mobility(UAM) environment to ensure safe UAM operations. This paper presents ROK's effort to introduce the Flight & Flow Information for a Collaborative Environment (FF-ICE) concept in the K-UAM and UAM demonstration including UAM over SWIM.

ADOPTION OF SWIM FOR K-UAM IMPLEMENTATION

1. INTRODUCTION

1.1 Urban Air Mobility (UAM) is emerging air and ground transportation 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 and noise pollution).

1.3 Many different kinds of high-strategic technologies. For instance, High-Definition (HD) Map, metaverse, autonomous driving Vehicle-to-Everything (V2X) communication will be proactively adopted for the implementation. Also, the Concept of Operations (ConOps) defined the ICAO GANP/ASBU (e.g., SWIM, Air Flow Traffic Management and etc.) also would be introduced to the UAM.

1.4 ROK established the domestic UAM ConOps in 2021. MOLIT is conducting R&Ds to develop fundamental technologies for UAM implementation with Industry-Academic Cooperation.

1.5 As the UAM is in the beginning phase, ROK held respective open UAM demonstrations in 2020 and 2021. The open demonstration 2021 was held at Gimpo International Airport, Seoul and UAM over SWIM was also demonstrated by using the SWIM system developed by KAC.

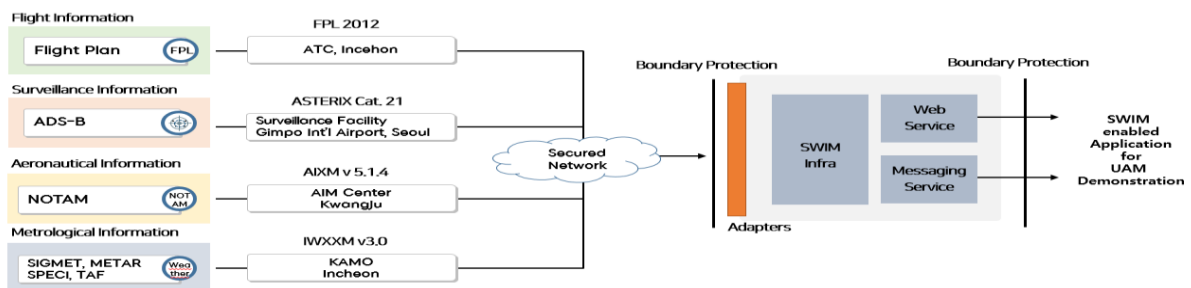
1.6 This paper presents UAM over SWIM demonstration UAM demonstration event held at Gimpo International Airport, Seoul, in 2021.

2. DISCUSSION

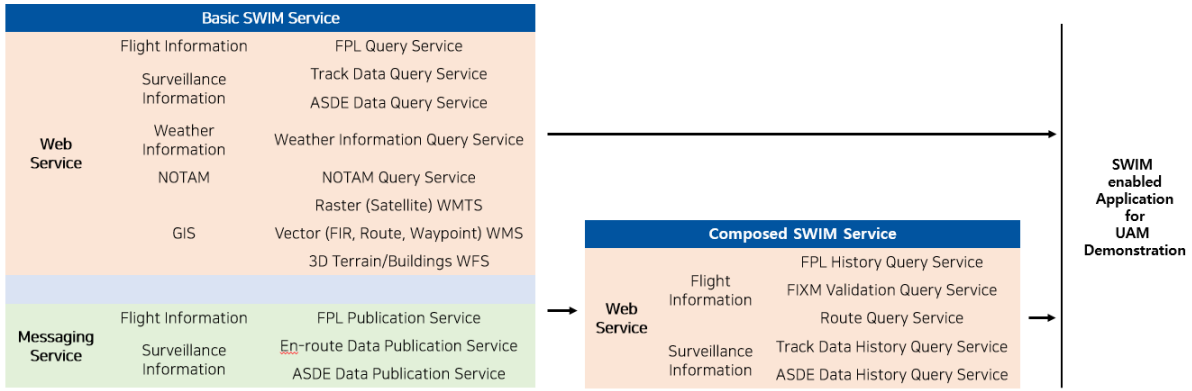
2.1 ROK has been operating SWIM testbed since 2018 in Gimpo international Airport, Seoul. SWIM testbed consists of components as follows:

- SWIM Bridge : Collects or receives ATM information from legacy system;
- Mediation Service : Converts or transforms legacy format data to standard format data;
- Information Service : Allows service consumer to consume information;

2.2 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]



[Figure 2 Information Services]

2.3 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).

2.4 For this UAM demonstration, SWIM-enabled application, which displays Air Traffic Management (ATM) information and real-time position of UAM vehicle, consumes information through SWIM services as shown in Figure 3.



[Figure 3 UAM over SWIM Demonstration ('21)]

3. LESSON-LEARED

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

4. FUTURE PLAN

4.1 ROK established UAM Team Korea (K-UAM) to develop information exchange environment among stakeholders (i.e., SWIM) that is enable to ensure the K-UAM operational safety and the initial commercialization by 2025. K-UAM team includes stakeholders (e.g., Airport Operator (e.g., Korea Airports Corporation(KAC), Internet Service Providers(ISP) (e.g. SK Telecom), specialized research institutes (e.g., Korea Aerospace Research Institute - KARI) and also Private Organizations (e.g., Hanwha Systems).

- 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.);

5. ACTION BY THE CONFERENCE

5.1 The Conference is invited to note the information contained in this Paper.

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