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UAS TRAFFIC MANAGEMENT SYSTEM INTEGRATION ACTIVITIES IN THE REPUBLIC OF KOREA

(Presented by the Republic of Korea)

EXECUTIVE SUMMARY

This paper intends to share current status of unmanned aircraft system (UAS) traffic management (UTM) that is being researched and developed in the Republic Korea, which is named “UTM System Development and Demonstration for Safe Operation of Small UAS System in Low-Altitude” and is supported by Ministry of Land, Infrastructure and Transport, Republic of Korea. In addition, this paper will explain UTM based national flight demonstrations carried out along with research and development (R&D) from 2017 to 2021, and suggest the direction that UTM should take.

<i>Strategic Objectives:</i>	This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	Not determined
<i>References:</i>	

1. INTRODUCTION

1.1 Unmanned aircraft system traffic management system (UTM) provides visual line of sight (VLOS)/ beyond visual line of sight (BVLOS) flight plan by providing location information of other drones, airspace/flight information, weather/obstacle information, etc. so that multiple drones can operate safely and efficiently. For each State, safety is the most important factor for any flight operation, including UAS. Therefore, to integrate UAS into the Korean National airspace, various projects and legal reform are in progress by the Government of the Republic of Korea (ROK).

1.2 In the ROK, UTM research has been in progress since 2017 as a research and development (R&D) project, funded by Ministry of Land, Infrastructure and Transport (MOLIT) named “UTM System Development and Demonstration for Safe Operation of Small UAS System in Low-Altitude”. It is led by Korea Institute of Aviation Safety Technology (KIAST), and a total of ten organizations are participating including Korea Aerospace Research Institute (KARI), Electronics and Telecommunications Research Institute (ETRI), and Korea Telecommunication (KT).

1.3 At the same time, MOLIT initiated K-Drone Demonstration Program (UTM pilot program) since 2021 to showcase the UTM operational concepts and UTM capabilities as well as to develop business models for the industry. In addition, MOLIT will proceed the government’s informatization project for drone flight information management system in 2024.

2. DISCUSSION

2.1 Current Status on UTM Research in the ROK

2.1.1 Since 2017, the Korean government has started an R&D project for a drone traffic management system that can provide drone traffic management tasks such as flight plan approval and monitoring information for safe and efficient operation of drones in low altitudes (AGL 150 m or less). When this research project started, only the concept of drone traffic management existed worldwide and the system itself did not exist. In order to link with the rapidly changing speed of technological development and to minimize the period of practical use, the goal was raised to “Demonstration of 20 or more in the test bed (2~3 sites) using the developed UTM system”, and the participants of the demonstration also participated in the research project. It was expanded to general business operators without limiting business operators.

2.1.2 Various opinions have been presented from the beginning of the UTM research as to how the state will operate and manage the UTM business. There were opinions that one centralized UTM Service Supplier (USS) is sufficient because Korea does not have a large area, that USS should be divided by region, and that multiple USS will provide services competitively in one area like mobile communication business. Unlike the United States’ UTM system, where the system structure is distributed, Europe’s -U-space is structured so that both centralized and distributed systems are possible. In case of Korea’s UTM system, it has a distributed structure similar to that of the United States.

2.1.3 A total of nine large flight demonstrations were performed using the UTM system in Korea from 2018 to 2022. Among those, I will introduce two cases. In November 2020, flights were demonstrated with a total of eight drones including two UAMs, at Han River Park in Yeouido, Seoul which is the capital of Korea. A total of 37 sorties were flown, and the UTM system was used to verify traffic management for multiple drone flights simultaneously in an urban environment. Assuming UAM flight as an emergency situation, UAS Volume Reservation (UVR) was issued, and accordingly, the demonstration was carried out

with a scenario in which each flying drone made an emergency landing at a landing point or a designated emergency landing point. The manned aircraft's location was also displayed on the UTM system, which data receive from an automatic dependent surveillance — broadcast (ADS-B) receiver. The UAM was equipped with UTID, a location identification device developed by the research team, it was able to monitor and manage traffic using the UTM system during flight. This demonstration is meaningful in that it was the first demonstration in an urban environment and that the UTM system was verified in connection with the UAM.



Figure 1. UTM flight demonstration with UAM at Urban Area, Seoul, Republic of Korea, Nov 2020

2.1.4 In June 2021, 15 drones flew 181 sorties at Cheongna, Incheon, and a maximum of 13 drones performed simultaneous flights for high density simultaneous flight demonstration. In the demonstration, in addition to research team's drone, a number of various drones were simultaneously flown, including commercial drones such as those made by DJI. In a high-density environment with a radius of 1 km from the building where KIASST is located, 15 drones each performed their mission, and assumed the situation such as UTID communication loss, drone communication loss, discovery of not participating UTM system, etc. In this situation, text message was basically used for communication between the user and the manager, and voice communication was excluded as much as possible.

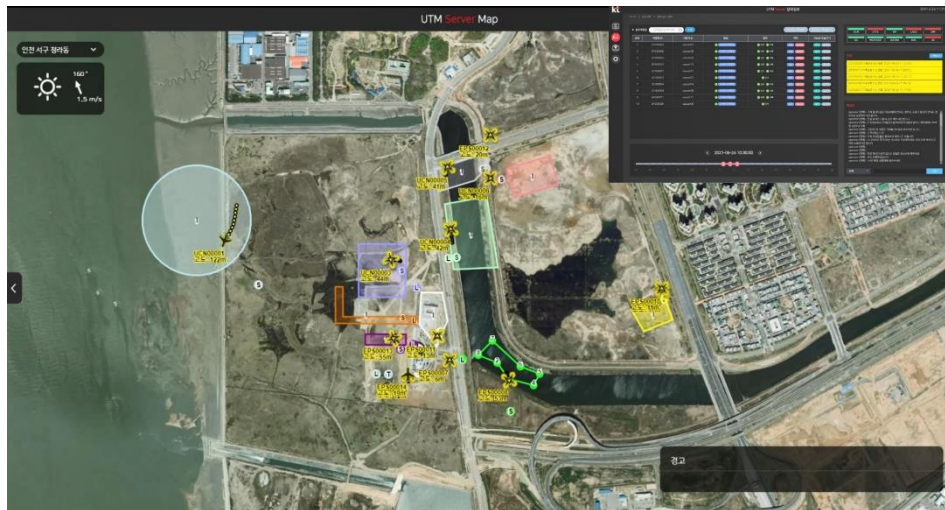


Figure 2. Fifteen drones demonstrated at Cheongna, Incheon, Republic of Korea, June 2021

2.1.5 The UTM R&D project in Korea will be completed later this year. The follow-up R&D task to develop the national FIMS and technologies to implement compulsory remote ID is in progress.

2.2 K-Drone Demonstration Programme (UTM Pilot Programme)

2.2.1 In June 2020, the MOLIT of the Republic of Korea announced the “K-Drone System (Korean UTM) Commercialization Promotion Plan” to support an ongoing R&D project, to establish FIMS and to initiate an UTM demonstration program by a separate financial account to commercialize and create demand for drone traffic management technologies.

2.2.2 The MOLIT initiated K-Drone Demonstration Program (UTM pilot program) since 2021 to showcase the UTM operational concepts and UTM capabilities as well as to develop business models for the industry. As shown in Table 1, a total of seven operators were selected and supported in three operational area: near airport operation, urban operation, and long distance/marine operation.

Table 1. Seven operators in 2021 K-Drone Demonstration Programme

Area	Consortium	Major Operations
Near Airport	KT	Drone operations in controlled airspace near Incheon Intl Airport
Urban	Korea Airport Corporation	Multiple purposed drones in urban area
	HancomInspace	Urban drone corridor/routes
Long-Distance/ Marine operation	Incheon Airport Corporation	Long distance/marine operation on emergency medicine delivery
	Korean Airlines	Long distance/marine operation on emergency medicine delivery
	Marine Drone Technology	Marine delivery operation to foreign anchored ships
	GS Caltex	Marine oil-sample delivery operation between oil tanker and lab

2.2.3 The near airport operation is to develop the automating system for drone flight authorization near airport. KT demonstrated flight within the control airspace near Incheon International Airport, and established an operation concept and operation procedure to utilize UTM system. In addition, during the urban air mobility (UAM) event held at Incheon International Airport, the UAM aircraft is equipped with a UTID (UAS Tracking Identification Device), a location identification device that can be monitored by the K drone system, and manned it with the K drone system. Data linkage between ATM and UTM systems was also performed for the first time, such as simultaneously being displayed on ARTS (Automated Radar Terminal System) of Incheon Intl Airport.

2.2.4 In the long distance/marine sector, four operators, including Incheon International Airport Corporation, Korean Air, GS Caltex, and Marine Drone Technology, participated in the demonstration of long-distance (over 20km) delivery and flight within the non-visible area. The K-Drone System received flight information by installing a UTID (UAS Tracking Identification Device), a communication module based on LTE, on the aircraft, so it became an opportunity to check the LTE communication quality and coverage in the marine environment.

- The marine drone technology demonstrated the delivery of goods to anchored (anchored and stayed at sea) vessels near the southern port of Yeongdo, Busan. In accordance with the restrictions on land disembarkation of ships due to Corona 19, it is a case of attempting a drone commercial delivery business based on the K drone system by using drones to deliver goods from land to ships
- GS Caltex demonstrated the BVLOS delivery operation of oil samples at the Incheon Logistics Center. As a demonstration for transporting oil samples that were previously transported by sea and land by drone, it can be transported within about 5 minutes when using a drone, thereby reducing costs and the expected effect of safety monitoring and prevention of safety accidents through the K-Drone system

2.2.5 In 2022, the MOLIT plans to conduct demonstrations of seven operators in five fields: discovering urban flight routes, near airports and national facilities, operation in public sector, commercial operation and etc.

2.3 Regulatory Reform and Other Challenges

2.3.1 The Korean government is promoting various policies for the early commercialization of UTM. In 2020, when enacting the Act on Promotion of Drone Utilization and Establishment of Infrastructure, regulations on the definition, establishment and operation of the drone traffic management system were included so that public institutions as well as private operators could build and operate the drone traffic management system. The legal basis for the collection of fees and the designation and operation of drone flight routes was also prepared.

2.3.2 In 2021, a new drone classification name system was introduced by reorganizing the classification system based on drone performance and risk. Currently the Remote ID is not mandatory in Korea; however, it will be implemented in 2024. A standard for the Remote ID communication protocol using the network method is also being proposed. In addition, in preparation for the commercialization of UTM, regulations for delegating the current standards of UTM operators and the country's flight approval authority to drone traffic management companies are being prepared.

2.3.3 Afterwards, through systematic research and discussion, it is planning to reorganize related systems such as operation procedures for UTM connected pilots, UTM airspace designation and safety standards, and connection between UTM and UAS Special Flight Permit (COA), which is a special flight approval. Furthermore, Korea needs to revise the law to delegate all flight permits, including drones, to private operators, as the state has authority.

2.3.4 In addition, we conducted demonstrations in connection with unspecified drones and operators, not participating in R&D research, and formed a USS Consultative Body composed of national, public institutions, and private operators interested in providing UTM services to share research results. and facilitated the activation of the industrial ecosystem of the UTM service business by enabling the demonstration. Although the USS Council does not participate in research such as Incheon International Airport Airlines, Korea Airports Corporation, SKT, LG U+, LH, and Korea Electric Power Technology, they are potential consumers who are highly likely to use or commercialize future air mobility.

2.3.5 There are many challenges left for UTM implementation and commercialization. In the future, the government level UTM concept of operations (ConOps) for the practical use of UTM needs to be discussed with aviation authority. The UTM ConOps for R&D project should include research goals and

specific technologies for development, whereas the government level ConOps should present a goal and technology neutral or a method for carrying out the goal.

2.3.6 Preparation for the emergence of multiple USSs, the government needs to prepare definitions and standards for at least what kind of service is provided by USS. Also, it is necessary to prepare a notice similar to the current air traffic certification standard and the government need to start think about how to support the profit structure to enhancing the UTM industry and participate in USSs.

2.3.7 At the ICAO level, it seems necessary to discuss and be ready to the contents and procedures necessary for linking UTM and ATM in the future, and the authority of responsibility at low altitudes including automated systems.

3. **CONCLUSION**

3.1 The ROK will share the R&D progress with Member States continuously and wishes to cooperate with interested States on the development of UTM system.

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