K-UAM
Concept of Operations 1.0

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UAM Team Korea
Open the Urban Sky

K–UAM Concept of Operations 1.0

Publisher

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We anticipate that this 「Korean Urban Air Mobility (K–UAM) Operation Concept (ConOps) 1.0」 will serve as a milestone in the development of the UAM industry through innovations and technologies in advanced transportation.

In order to introduce the emerging urban air mobility (UAM) services to Korea's skies and to lead the global market by developing Korea's UAM industry, 37 organizations came together to launch UAM Team Korea (US), a public–private policy council on June 20, 2020. Now that it has been about a year since then, we are very happy to be able to publish this 「Korean Urban Air Mobility (K–UAM) Operation Concept (ConOps) 1.0.」 We express our deepest gratitude to each organization and experts in UTK for participating in the development of this ConOps and publication process or providing technical advice and ideas.

UTK has put in a lot of effort to steadily follow the Korean Urban Air Mobility roadmap (june, 2020) for the commercialization of UAMs for the first time in 2025. We have prepared a technology roadmap drawn from mid– and long–term research and development strategies and projects for each field of UAM in Korea (march, 2021) by gathering the expertise and wisdom of various institutions and experts involved in UTK, and based on this information, the government is planning many comprehensive R&D projects. Plans for K–UAM Grand Challenge project, a public–private joint program that can confirm necessary operating systems for safe operation within Korea's urban airspace was decided by UTK December, 2020, and the government began construction of related infrastructure such as UAM vertiports and support facilities.

Korean Urban Air Mobility (K–UAM)
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This ConOps goes over definitions of basic concepts necessary for the launch and operations of UAM commercial services, roles for each system, and operating procedures for each evolutionary phase. In particular, we anticipate new operational concepts for safe and convenient urban air mobility, such as preparing dedicated UAM corridor in the city center for UAMs, introducing new service provider for UAM air traffic management, and operating Vertiports in the city to serve as milestones for the development of our UAM industry.

We think the task given to us for the future is to concrete and update this ConOps. This ConOps needs to not lag behind on global technological advancements, and should faithfully reflect the needs of the public as well as related companies. We need to validate whether applications to actual urban environments are possible from various aspects through the K-UAM Grand Challenge, and reflect those results.

Because of the difficulty in implementing new modes of mobility in our daily lives, such as urban air mobility and self-driving cars, in order for innovations in transportation and changes in technology happening around us to be accepted, joint efforts are needed. If we can cooperate between the public and private sectors, such as our companies, academia, the government, local governments, and public institutions, we could be the first country in the world to implement and live with such next-generation state of the art mobility. The Ministry of Land, Infrastructure and Transport will be with you.

Thank you very much.

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1 Introduction

1–1 General

Urban Air Mobility (also known as "UAM") is a new air transport system that may be used in conjunction with other modes of transportation to transport passengers and cargo by using eco–friendly electric vertical take–off and landing (eVTOL) that can be operated in the urban environment. UAMs can be operated for public purposes (emergency medical care, etc.), tourism ventures, as well as passenger and cargo–carrying transportation both inside and outside of the city.

The purpose of this ConOps (ConOps: Concept of Operation, Operational Concept) is to establish a basic framework for business promotion and mutual communication between local governments, industries, academia, public institutions, and other stakeholders involved in commercializing the K–UAM. There are no defined processes or procedures in this agree–ment that impede the UAM industry's innovation and development.

This ConOps was created in collaboration with the members of the UAM Team Korea[1] and the K– UAM Policy Council, and it will continue to be updated as stakeholder participation grows and the UAM's operational concept is demonstrated and verified, as well as additional operation scenarios are developed.

1–2 Scope

This document focuses on providing the concept for the UAM operations management to be at the national level for passengers and cargo–carrying transportation purposes, and specific regulations such as pilot license, qualification and certification were not included[2]. In accord–ance with the ConOps, the UAM will be integrated and operated in the national airspace system.

This document is based on the "Korean Urban Air Mobility(K–UAM) Roadmap" ("20.6) (hereinafter referred to as "Policy Roadmap") and "Korean Urban Air Mobility(K–UAM) Tech–

1) UAM TEAM KOREA is public-private policy council with 37 members
2) There is a plan to present it through a separate study on K-UAM law and regulation

nology Development Roadmap (21.3) (hereinafter referred to as "Technology Roadmap") and it divides the types of K-UAM operations into stages, with the important information of the management concept being described majority on the initial phases (2025~2029) including the start of commercialization of the K-UAM in 2025. The role and responsibility of stakeholders, UAM corridor selection and management, and the ideas of normal and abnormal scenarios are provided while taking into account the technological maturity, societal acceptance, degree of ecosystem development, and operational requirements of this period.

1-3 Document Organization

This ConOps consists of the following.

Chapter 1- Introduction and Scope
Chapter 2- Definition of terms
Chapter 3- Evolution of K-UAM
Chapter 4- K-UAM Operational Concept -Initial Phase (2025~2029)
Chapter 5- K-UAM Use Case and Scenario - Initial Phase (2025-2029

2 Definition of Terms

The definition of terms used in the document are as follows.

[Table 1] Definition of K–UAM Terms

UAM Air Operator	Person who establishes the UAM flight plan, flies, operates, and manages the aircraft.
UAM Air Traffic Management Service Provider (UATMSP)	The entity providing and sharing services such as flight safety information, traffic flow management, flight plan approval, and conformance monitoring of UAM Some UAM ConOps is called it as Provider of Service for UAM(PSU)
UAM Air Traffic Management System (UATM)	Air traffic management system for the safe navigation of the UAM aircraft
UAM Corridor	AN exclusively operated airspace volume defining a three–dimensional route segment for safe UAM operations
Strategic Deconfliction	Deconfliction of UAM operational intent via flight plans with information exchanges
Tactical Separation	The avoidance of tactical conflict and collision by maintaining separation between UAM aircrafts in the corridor during flight
Flight Support Information Provider (SDSP)	Provides operational support information services such as terrain, obsta–cles, and weather.
Vertiport	The area of land, water or structure used or intended to be used, for the landing and takeoff of UAM aircraft, together with associated buildings and facilities for transit, delivery, and maintenance services.
Vertiport Operator	A person, organization or enterprise engaged in the operation and management of one or more vertiports monitoring vertiport airspace
UAS Traffic Management Service Provider (USS)	The entities supporting UAS operations under the UAS traffic management (UTM) system
UTM, UAS Traffic Management	Traffic management of UAS operations in low altitude airspace (under AGL 150m[3])
Other Stakeholders	The other entities can be able to access information that affects to UAM operations or receives the effect from UAM operations

3) Height of the aircraft in flight measured with respect to underlying ground surface

3 Evolution of K-UAM Operations

3-1 Basic Principles

When developing the concept of operation for UAM, it's important to analyze the reasonable scenario considering existing technology and institutional preparations, as well as the following major requirements.

- UAM operates within the scope of relevant regulations and policies.
- Within a specified airspace, the UAM works according to a set of rules and methods, and the UAM and related systems must meet the required performance.
- Stakeholders who are directly or indirectly associated to the UAM must maintain safety and security in order for the UAM to operate safely.
- UAM air operators must work with UAM air traffic management service providers (UATMSP) to approve flight plans and provide flight information.
- If necessary, information is shared between the UAM air traffic management service provider and the USS traffic management service provider.
- UAM can be flexible and expandable depending on technological, system, infrastructure, and policy maturity.
- Changes and adjustments that may influence the present air traffic management (ATM) system (e.g., changes in the UAM air traffic management system, establish ment, and adjustment of UAM airspace, etc.) are decided after proper consultation with the appropriate agencies.
- The Ministry of Land, Infrastructure, and Transport is in charge of implementing UAM policies, rejuvenating the industry (policy authorities' role), and planning, managing, and overseeing safety systems (the role of safety authorities).

3-2 Evolutionary developmental approach of K-UAM Operations

The following are the primary indicators for each phase of K-UAM announced by the K-UAM Roadmap & K-UAM Technology Roadmap.

[Table 2] Key Indicators of K-UAM evolution

	Initial Phase (2025~)	Progress Phase (2030~)	Advanced Phase (2035~)
Management of the PIC	On Board	Introducing Remoted pilot	Introducing Autono-mous
Traffic Management System	Gradual increase of UAM air traffic management service providers' roles, and reduction of air traffic controller engagement.		
Automation level of Traffic Management	Introduction of automation	Automation takes the initiative with human monitoring	Complete automa-tion
Operation Method of the Corridor	Fixed corridor	Fixed corridor network	Dynamic corridor networkAutonomous
Air Communication Network	Commercial mobile communication (4G, 5G) and aviation voice communication	Commercial mobile communication (5G, 6G), low-orbit satellite communication, C2 LINK, etc.	
Navigation System	Precision satellite navigation	Precision Satellite Navigation + Image-based Relative Navigation	Combination navigation
Position and Form of Vertiport	Vertiport focused on the center of the capital area	Vertiport focused on the center of capital and metropolitan area	Expansion to nationwide

3–2–1 Initial Phase (2025~): K–UAM Operational Concept

The PIC will board during the initial phases of K–UAM operation, and this is the stage at which the K–UAM operation in a set corridor[4] of a single or multiple K–UAM pilot services in the metropolitan region begins, with the following primary signs.

Location of Pilot and type of operation: Pilot (PIC) board. Initial application of the visible flight method[5]

Traffic management system: Introduction of UAM air traffic management system (verification and advancement through cooperation with air traffic controllers)

Traffic control: Advances from visual based traffic control to data based automation (no human interaction) introduction

Airspace Structure: UAM routes are pre–determined and fixed.

Air communication network: Commercial mobile communication (4G, 5G) and aviation voice communication.

Navigation system: Precision satellite navigation system

Vertiport operation: In order to commercialize K–UAM in the metropolitan region, a modest number of Vertiport infrastructure between the airport and the city center will be established

3–2–2 Progress Phase (2030~): K–UAM Operational Concept

The progress period of K–UAM operation is the stage where the K–UAM operation grows by introducing remote control and if necessary a safety manager[6] will board and a fixed corridor[7] network will be formed in the center of capital and metropolitan areas, and the main indica–tors for this are as follows.

Location of Pilot and type of operation: introduction of remoted pilot (PIC). When the remot–

4) Independent corridor with predefined and no overlapping routes between sections

5) an advanced flight method compared to the existing Visual Flight Rules (VFR), the pilot's visual monitoring and flight with various information is essential for safe operation (same as the US Digital Flight Rules and Europe's Managed Flight Rules). Once the maturity and safety

6) Refers to all safety manager (SIC, second in command) who can manage the passengers and safely land the aircraft in case of an emergency

7) A collection of corridors with predefined overlapping routes between specific sections.

ed system for pilot boarding is established, if remoted pilot control is not applicable, emer–gency intervention and passenger safety will be required to determine whether or not to board the cabin safety manager.

Traffic management system: The provider of UAM traffic management services takes the lead (limited intervention by air traffic controllers, such as opening and closing corridors, and excluding traffic management functions)

Type of traffic control: Data based automation, and human monitoring will be assisted

Airspace Structure: UAM corridor network are pre–defined and fixed.

Air communication network: Commercial mobile communication (5G, 6G), low–orbit satellite communication, C2 LINK, etc.

Navigation system: Precision Satellite Navigation + Video–based Relative Navigation system[8)]

Vertiport operation: Establishment of Vertiport networks to deliver UAM services in cities and metropolitan area, as well as a Vertiport hierarchy based on functions and scale.

3–2–3 Advanced Phase(2035~): K–UAM Operational Concept

This is a stage in K–UAM operation where unmanned autonomous flight is introduced and a dynamic corridor network[9)] is formed in metropolitan regions, leading to maturity in K–UAM operation, with the following primary signs.

Location of Pilot and type of operation: Introduces autonomous flight system[10)]

Traffic management system: Complete operation of the UAM air traffic management system (air traffic controller only intervenes in emergencies)

Type of traffic control: Data–driven automation control, voice control assistance in case of an emergency.

8) As a navigation method that estimates one's location from other object location information, it is a navigation that uses the video information obtained from the UAM aircraft and identifies a specific space to estimate the location from the spatial information of the space provided. It is a useful navigation in an environment where radio navigation is not available.

9) A set of overlapping route corridors newly defined for each UAM service call between specific sections.

10) Determination of whether to board an in-flight safety manager in consideration of passenger safety, etc. in case of an emergency.

Airspace Structure: Dynamic routes on UAM corridor network. A set of overlapping route corridors newly defined for each UAM service call between specific sections.

Air communication network: Commercial mobile communication (5G, 6G), low-orbit satellite communication, C2 LINK, etc.

Navigation system: Precision satellite navigation and complex relative navigation system[11)]

Vertiport operation: Building Vertiport networks in urban areas nationwide and operating automated Vertiports.

3-3 Considerations and Future Policy Direction[12)]

At the time this document was written, the path of K-UAM operation development was based on the primary policy goals that had been established thus far. It is inappropriate to limit the path of UAM's development to merely this framework, given the quickly expanding UAM-related technologies and the newly created UAM industrial ecosystem. Even if the future is unpredictable, it is predicted that if numerous parties planning for the future execute a shared design, it will be of practical assistance in constructing a harmonious industrial ecosystem.

The primary goal for the future is to continue to enhance operating scenarios by taking into account changes in the industry, science, and technology, and to share them with UAM participants as soon as possible. In addition, based on progress in developing the target performance technology for electric power vertical takeoff and landing aircraft set as the technical goal of growth and maturity in the technology roadmap, the concept of operating RAM (Regional Air Mobility) for inter-city movement will be added.

11) A navigation that estimates one's location from location information of other objects using several location sensors

12) Although forementioned “considerations and future policy directions” have not yet been finalized, basic contents on matters that need to be considered for the development of the UAM are included. The content was prepared to present the starting point of the main discussion and is not a fixed policy for the government or the UAM Team Korea. In this regard, it is necessary to establish the direction of promotion through future discussions.

4 Initial Phase (2025~): K–UAM Operational Concept

This chapter solely covers the –predictable K–UAM's first operational idea, which considers existing UAM–related technology and Korean institutional preparations for –commercialization K–UAM's in 2025.

4–1 Overview

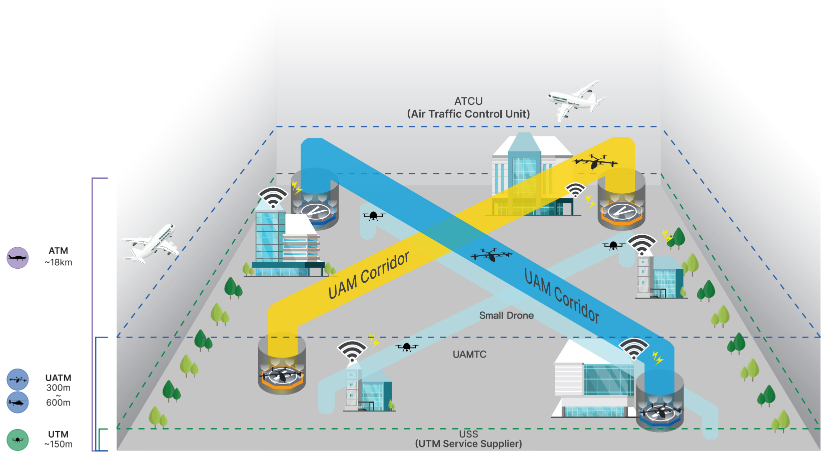
A number of pre–defined UAM fixed corridors are used by the PIC on board and UAM operations. This has a low influence on current air traffic management (ATM) and unmanned aircraft traffic management (UTM) operations.

The Performance–Based Navigation (PBN) rule applies to all UAM aircraft flying inside the UAM corridor. The standards for each corridor, however, may differ. Without direct interven–tion from air traffic controllers, strategic deconfliction and tactical separation take place within the UAM corridor under the guidance and supervision of the UAM air traffic management service provider.

UAM air traffic management service providers communicate information with UAM air opera–tors, aviation authorities, and other stakeholders, and different UAM air traffic management service providers exchange and coordinate information across networks between UATMSPs.

Air traffic controllers seek to regulate nearby aircrafts and avoid stones in the case of a corridor departure due to atypical UAM situations. When a UAM aircraft flies outside of the authorized corridor, the appropriate air traffic management regulations are applied based on the type of operation, airspace grade, and altitude.

[Figure 1] Initial K-UAM Corridor Concept



4-2 Stakeholder Roles and Responsibilities

The roles and duties of significant stakeholder in the UAM operation are defined in this section. Various stakeholders will be able to engage in the process of fulfilling the precise vduties and responsibilities through delegation of authority or contracts in compliance with applicable laws, etc.

4-2-1 Korea Office of Civil Aviation

The aviation authorities are in charge of civil aviation in Korea, as well as establishing safety regulations and overseeing the application of the regulations. They ensure that support policies for promoting the UAM industry have been prepared and implemented, and they prepare regulations, adopt community-based standards, consult with related agencies, coordinate the roles and responsibilities of stakeholders, and perform related authorization and permits, as well as manage and supervise functions to create a safe UAM environment.

Aviation authorities can be largely divided into policy authorities and safety authorities depending on their functions.

4–2–1–1 Policy Authorities

Authorities that draft associated legislation and processes to promote the UAM business in Korea and assist its implementation are known as policy authorities. The key objectives include drafting an unique UAM law to encourage the commercialization of K–UAM and assisting in the development of Korea's UAM industrial ecosystem by defining and coordinating stakeholder roles and responsibilities. It also contributes to the creation of an efficient and harmonious transportation system by facilitating connections and transfers with the existing system.

4–2–1–2 Safety Authorities

Safety authorities develop aviation safety rules and system and oversee the application of them, as well as the safe integration of UAM into Korea's airspace.

In the operation aspect, the authority's primary role is to develop and enforce safety, operation and security regulations for aircraft, vertiport, flight support information system and associated infrastructure. They are also in charge of adopting and maintaining UAM–related industry standards. They also define minimum criteria for UAM operations and are responsible for approval and certificating UAM aircraft, UAM air operators, Vertiports, and licensing pilot and persons engaged in UAM.

oversee and supervise the implementation of safety standards, as well as to

In airspace management aspect, the authority's primary role is to develop and enforce UAM corridor requirements, and minimum standards for UAM air traffic management and define minimum qualifications and systems for safe airspace integration. They are also responsible for approval and regulating UAM corridors proposed by public and industry, UAM traffic management services, and navigation safety facility and infrastructure for safe airspace management. And the authority produces a systematic operating control strategy of the UAM corridor. They also provide advice on the operation of the UAM corridor at the national level of airspace management, conduct a review of the K–UAM transportation system, and coordinate the roles and responsibilities among UAM stakeholders, as well as investments in infrastructure such as Vertiport and navigation facilities for urban air mobility.

To avoid air accidents and promote air safety, safety authorities collect and evaluate data on various aircraft failures and defects, such as accident data, UAM air operator, UAM traffic management service provider, and so on.

4-2-2 UAM Air Operator

Services for transporting passengers or freight for a charge utilizing UAM aircraft are provided to satisfy the demands of UAM clients. In a general sense, UAM air operators are organizations that provide an operational service for the safety and benefit of the public (emergency assist, medical care, search, surveillance, and so on).

UAM air operators comply with the requirements outlined in the operating certificate and Operations Specifications. The operator is in charge of all aspects of the actual UAM operation, including maintaining the airworthiness of UAM aircrafts.

They're also in charge of flight plan creation, submission, and sharing, as well as UAM fleet status information (flight preparation, takeoff, cruise, landing, normal, fault, defects, and so on), UAM aircraft security, ground service and passenger reservation, boarding, and safety management.

In compliance with the regulations regarding emergency scenarios, the UAM air operator must include the emergency landing site in the flight plan.

UAM air operators share information with related stakeholders on the status and performance of the UAM aircraft operating through UAM air traffic management service providers.

4-2-3 Pilot in Command (PIC)

The PIC is expected to board the UAM aircraft. The pilot holds the necessary certificates to ensure that UAM aircrafts follow all rules throughout the flight, and they are solely responsible for the aircraft's and passengers' safety.

Before taking off, the PIC inspects the UAM aircraft's readiness, evaluates whether a safe flight is possible, and makes decisions in collaboration with the UAM air operators during the flight. In addition, if a modification in the flight plan is required in the middle of the flight, they contact the UAM air operator and fly according to the re-approved flight plan.

In addition, if the PIC determines that an emergency has occurred or is likely to occur while monitoring the aircraft condition, flight condition of the aircraft, passengers, and cabin conditions, they will provide passengers aboard the UAM aircraft with appropriate behavioral guidelines and take other necessary safety measures. The issues relating to safety problems occurring in UAM aircrafts and rooms during flights are reported in accordance with the relevant regulations.

4-2-4 UAM Air Traffic Management Service Provider (UATMSP)

UATMSP provides UAM air traffic management services to UAM air operators for safe and efficient operation in the UAM corridor and they do so by establishing, operating, and maintaining navigation safety facilities (excluding Vertiport-related infrastructure) within the corridor.

If a UAM aircraft exits the corridor while in flight, the UATMSP promptly sends pertinent information to the air traffic control agency. If the departure area falls within the control service area, air traffic management will allow UAM aircraft to be directed by the air traffic control agency.

If necessary, a UAM air traffic management service may be provided by a group of UAM air traffic management service providers in the same area or corridor.

4-2-4-1 Sharing of Flight Safety Information and Traffic Management

The UAM air Traffic Management Service Provider (UATMSP) will continue to share flight safety information and flight status of UAM aircraft in the corridor with UAM air operators and related stakeholders, such as airspace limits, weather conditions, etc.

If tactical separation is required due to abnormal conditions in the UAM flight, the UATMSP will work with UAM flight operators, PIC, and others to tactically separate as soon as possible.

The UATMSP will assess the Vertiport accessibility for the UAM aircraft's safe landing (FATO, etc.) and sharing the information with relevant stakeholders.
The UATMSP sharing flight safety information with Air traffic controllers and UAS traffic management service providers if necessary.
The UATMSP can store information for public use, such as system setup, enhancement, and accident investigation. The UATMSP shall be able to share these information across a network of UATMSPs.

4-2-4-2 Flight Plan Approval and Conformance Monitoring

The UATMSP considers flight safety data and other factors when deciding whether or not to accept the UAM air operator's flight plan.[13]

The UATMSP decides the approval of UAM air operator's flight plan taking into accounting the flight safety information.[14]

The UATMSP can share and coordinate flight plans with the UAS air Traffic Management Service Provider with one another if necessary.

The UATMSP should always monitor the trajectories, velocity, and consistency of UAM aircraft compared to flight plans. If any discrepancies are discovered, the UATMSP directs follow-up actions to the UAM aircraft and shares relevant information with air traffic controllers, UAM air operators, other UATMSP, and Vertiport operators.

4-2-5 Supplement Data Service Provider

The flight support information provider provides operation support information such as terrain,

13) At this stage, the air traffic control agency promotes prior confirmation.
14) Shareable information secured by said UAM air traffic management service provider of UAM flight operators, captains, Vertiport operators, and flight support information providers.

obstacles, weather conditions and weather prediction information, and UAM operation noise conditions to related stakeholders such as UAM air operators and UAM air traffic management service providers for safe and efficient UAM operation and traffic management. This data is updated and made available not only during the flight planning step, but also throughout the trip itself.

4-2-6 Vertiport Operator (VPO)

The roles and responsibilities of the VPO presuppose the following assumptions.

- Vertiport(VP) will be categorized based on the type (transportation, maintenance, etc.) and scope (transportation, transportation/charging, transportation/charging/maintenance, etc.), and each will require adequate certificates and facilities.
- UAM aircraft will follow a predetermined departure and arrival rules on preplanned paths.
- The aviation authority will set up a VP airspace around a VP, which will be man aged by the VPO, and be charted.
- Preapproval will be required from the VPO to fly a VP airspace and the information will be shared with UATMSPs by the VPO.
- The level of VP security check will be determined by assessing the UAM's security risk in relation to the weight of the aircraft and the number of passengers.

4-2-6-1 VP Operation

VPO declares business type and scope, get necessary certificates, prepare proper facilities, and obtain clearance from the concerned authorities.

In collaboration with UAM air operator and UATMSP, VPO controls ground operations[15] between landing and takeoff. VP monitors the VP airspace around it to ensure the safe operation of UAM aircrafts.

For efficient and safe ground operation, VPO establishes a data interface system to share the

15) Allocating FATO, taxiing route, ground crews, towing cars and its moving path, ground support equipment, and operation

information of VP resource management, VP surveillance[16], consistency monitoring[17], risk management system, and VP operation status[18]. VP operation status is shared with UAM air operators, UATMSPs, and other VPO installs and operates NAVAIDs (Navigational Aids) at the VP.

VPO should maintain clear means of communication with PIC while the UAM aircraft is on the ground, and during takeoff and landing.

4-2-6-2 Safety

Under normal circumstances, PIC should stop rotors(propellers) during ground movement; self-powered or towed. However, rotor rotation could be used on the ground, if prior approval from VPO is obtained. VPO shall ensure safe ground movements in collaboration with UATMSP, UAM air operator, and PIC.

VPO establishes an adequate safety plan for the energy charging or energy storage replacing system and service. VPO prepares required safety system, and operate and maintain under the approval of concerned authorities.

VPO trains and manages ground crews and passenger guides so that they can securely control the boardings area for safe embark/disembark. Proper signs, markings, and lighting should be installed.

VPO monitors the VP airspace around it. UATMSPs, UAM air operator) should be notified and exchange relevant information immediately, if any risk element (non-cooperative aircraft, hazardous wildlife, etc.) is detected in the airspace.

4-2-6-3 Emergency Response

VPO should develop and implement an emergency response plan require by applicable fire codes, and establish and operate necessary facilities under the approval of concerned authorities.

16) Monitoring infrastructure status, VP, local weather around the VP, support facilities, and abnormal conditions.
17) Monitoring the current situation of landed aircraft and ground support resources (ID, location, route, schedule, etc.) in comparison to the original plan
18) Status of FATO and station, passenger waiting and flow, abnormal situation, etc

VPO coordinates with local organizations (police, fire department, municipality) in response to an emergency occurring at VP or in its surroundings, and undertakes regular preventive training.

4–2–6–4 Security

VPO establishes a restricted area[19] within VP to ensure safe and efficient UAM operation, facilitates which can distinguish the area[20] are installed and operated. The determination of the restricted zones and the operational plan[21] must be carried out and maintained with the approval of the relevant authorities.

Vertiport operators approve entry into restricted areas after completing security screening of Vertiport workers, PIC,[22] passengers and carry–on items, and allow only passengers who have attended safety training[23] to board the UAM aircraft.

4–2–7. UAS Service Supplier

UAS Service Suppliers provide support for traffic management and flight safety of unmanned aircrafts from low altitudes (elevation below 150m).

UAS Service Suppliers provide support for safe flight of UAMs by sharing and adjusting flight schedules of unmanned aircrafts passing through UAM corridors, allowing cooperation with UAS Service Suppliers, and sharing flight related information on unmanned aircrafts (flight preparation, take–off, flight, landing, circumstances, breakdowns, defects, etc.)

4–2–8. Other Airspace System Users

Other Airspace System Users are users who operate aircrafts other than UAM aircrafts within the airspace. Other National Airspace System Users must be cognizant of and fulfill related requirements for usage/passage or evasion of UAM corridors.

19) Areas that restrict unauthorized persons from entering, such as core areas for safe operation of UAM aircraft, etc.
20) Separation wall, one-way door, open/close door after confirming ID, remote open/close door, etc.
21) The VPO may perform various types of passenger security check in order to provide a rapid security check service. Simple security check procedures such as identification, automatic personal inquiry, and boarding pass verification through applications (iris recognition, facial recognition, etc.) can be applied to pre-registered passengers and security check capabilities can be concentrated on unregistered and suspected passengers.
22) Searches such as work schedules and drug (alcohol) tests are conducted.
23) Essential training done by UAM air operators for safe boarding and disembarking of passengers and traveling.

4-2-9. Other Stakeholders

Other stakeholders are organizations or parties that are able to access UAM operation information for public interest such as confirmation of safety information, prevention of invasion of privacy, and securing public safety and security.

4-2-10. Future Policy Directions

UAM related stakeholders proposed in this section are not mutually exclusive. For example, UAM air operators, Vertiport operators, and UATMSP are extremely interconnected so it might be more efficient for one of them to be in charge of two or more roles or to entrust/adjust some of the work. Even more so during the initial stages when each role isn't decided. In order to establish an efficient work system, it is necessary to institutionalize in a way that meets each other's requirements while not causing problems for safety and public interests.

4-3 K-UAM Corridor

4-3-1 UAM Corridor

Unlike existing aircrafts (manned and unmanned aircrafts), UAM aircrafts fly just above the city, (average altitude of AGL (above ground level) 450). Depending on UAM's flight route, risk factors to safe flights such as building heights and noise standards per region may differ, so it is necessary to strictly manage flight routes rather than allowing free flight. UAM corridors are limited airspace permitted to fly UAM aircrafts in, and it should be set and managed to maximize its efficiency while minimizing the negative impact on UAM operations.

4-3-2 Decision of Corridor

Tactical separation service is not provided by air traffic controllers within UAM corridors. The structure and operation type of UAM corridors may be expanded or changed depending on increases in UAM operations. The set range of UAM corridors is the route from the departing

Vertiport to the arriving Vertiport, and the set altitude ranges from the departing Vertiport altitude and the arriving Vertiport altitude to UAM operation altitude per corridor.

When other airspace system users wish to operate or pass within the UAM corridor, they must meet operational performance requirements of the corridor such as flight performance, sharing flight plans, and linking access with UATMSP.

When selecting and designing UAM corridors, the following points must be considered.

- Implement requirements of direct and indirect stakeholders.
- Meet public requirements such as local environment, noise, safety, and security.
- Minimize impact on existing air traffic management (ATM) and UAS traffic management (UTM) operations.
- Consider redundancy between existing and new corridors and minimize impact on factors like flight safety.

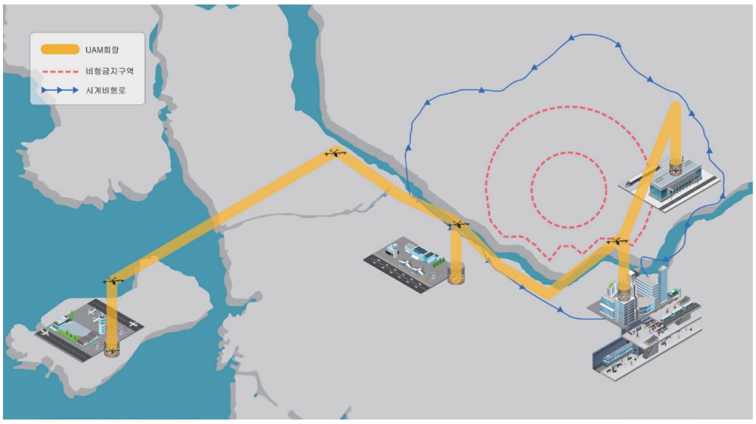
4-3-2-1 Initial Corridors

Initial corridors are designed for movement between the outskirts of the city like airports, and the city center. Initial corridors can use preexisting helicopter corridors after consultation with related stakeholders.

Initial corridors are reviewed based on an altitude of AGL 450±150m. Stable information and communication services should be provided based on commercial mobile communication networks, and performance-based navigation methods should be applied on routes.

If a UAM corridor intersects with airspace provided by air traffic management, the UAM corridor should be excluded from controlled airspace. UAM corridors should be set up and operated in a way that minimizes the impact on existing aircraft operations, and they should be kept safely apart from existing aviation airspaces.

[Example] 2024 UAM demonstration route using Han River Helicopter Corridor (Suggestion)



4–3–3 Corridor Capacity Management

Low density UAM traffic volume management of initial corridors is managed based on the capacity of the destination Vertiport. When developing into a high density UAM traffic situation, increasing traffic volume is managed through expanding existing corridors such as adding altitude separation corridors and horizontal separation corridors.

The capacity of the destination Vertiport is used to control low density UAM traffic volume management of initial corridors. The increasing traffic volume is managed by expanding existing corridors, such as adding altitude separation corridors and horizontal separation corridors, when a high density UAM traffic condition develops.

4–3–4 Corridor Separation and Conformance Monitoring

Initial corridors are established at altitudes capable of providing steady communication ser–vice, taking into account the current state of existing helicopter corridors and prohibited area. Operation safety is secured through altitude separation (vertical separation, review based on ± 150m) from the existing helicopter corridor. UAM aircrafts in operation are monitored in real time for conformance in initial corridors to prevent encroachment into the prohibited area. The conformance monitoring is managed by reviewing the level of essential navigation perfor–mance (RNP), and the specific level considers the results of the Korean UAM demonstration project (K–UAM GC).

4–3–4–1 Separation by Corridor

Initial corridors are operated separately from existing helicopter corridors. This can be revisit–ed if horizontal separation becomes essential in specific portions of the corridor.

4–3–4–2 Separation within Corridor

Basic route separation within UAM corridors is achieved through strategic deconfliction, such as flight plan sharing and approval, and if changes the approved flight plans are required, (weather change above route, Vertiport capacity change, aircraft failure, etc.), then tactical separation is achieved by cooperation between UAM air operators and UATMSP.

4–3–4–3 Conformance Monitoring

UAM aircrafts are monitored in real time to see if they are adhering to the course in order to prevent encroachment into the no–fly zone. Through networks and communication across UATMSP, an alert is sent to the PIC and stakeholders if the aircraft becomes non–conformant with the flight path. More detailed conformance monitoring is conducted in the case of corri–dors within the no–fly zone. The level of essential navigation performance (RNP[24]) is used to manage conformance monitoring, and the specific level takes into account the outcomes of the Korean UAM demonstration project (K–UAMGC).

4–3–5. Future Policy Directions

Because corridors have high demonstration results at the beginning of the introduction of UAMs, it is preferable to place them around policy authorities. A more flexible approach will be possible once the safety of corridor operations has been established and adequate know–how has been secured. For example, if a private business operator discovers and

24) (PBN) Performance-based navigation standards established in the designated airspace (navigation requirements including requirements for performance monitoring and warning). New methodologies, such as EASA U-Required space's U-space Navigation Performance (RUNP), are needed to apply RNP concepts to K-UAMs.

offers a corridor with sufficient demand and safety, it may be conceivable to consider granting the private business operator temporary authority to operate the corridor (private investment in roads, railroads, etc.)

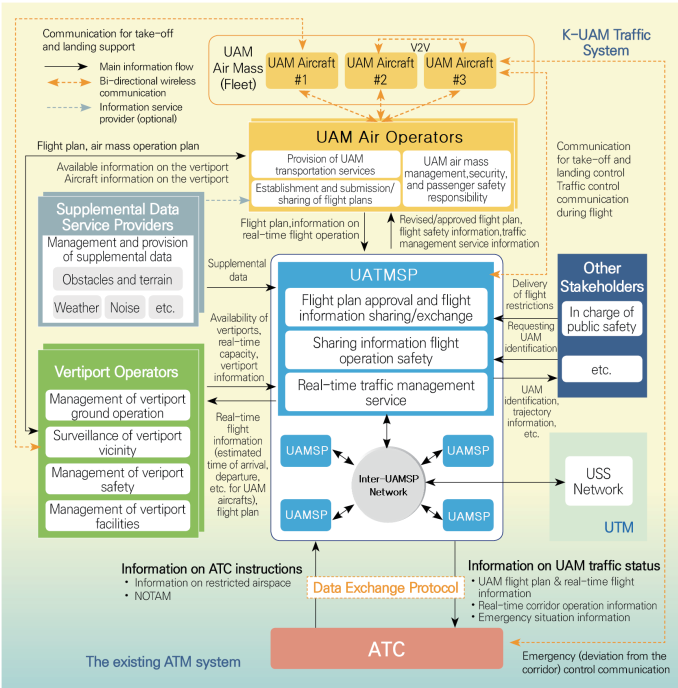
4-4 Structure and Information Flow of K-UAM Air Traffic Management System

This explains the flow of information between stakeholders and the structure of K-UAM air traffic management systems, as well as the roles and duties of each stakeholder. Details of the main roles and responsibilities of each stakeholder are in Section 4.2. The goal of the information flow description is to define the structure of the K-UAM transportation system by describing the providers, users, and purpose of the key information. The types of information shared between each stakeholder are limited to those described in this section.

4-4-1 Structure and Flow of Real Time Information of K-UAM Air Traffic Management System

The figure shows the structure of the initial K-UAM transportation system by representing the flow of necessary information by the main roles performed and responsibilities of each stakeholder.

[Figure 2] Structure of Initial K–UAM Air Traffic Management System



The flow of information for UATMSP and Vertiport operators, which are major service provid–ers for UAM aircraft operations, is as follows.

4–4–1–1 Major Information Flow Centered on UATMSP

UATMSP exchanges relevant information with UAM air operators, SDSP, PICs, other stake–holders, and air traffic control agents in order to provide air traffic management services.

UAM air operators secure flight information (corridor availability, availability of Vertiports) and flight safety information (weather, limited airspace information, etc.) from UATMSP, SDSP, and Vertiport operators.

UATMS Pconfirms the safety of the newly submitted flight plan by the UAM air operator by a comprehensive analysis of other approved flight plans and flight support information, or adjusts the flight plan in collaboration with UAM air operators.

UATMSP combines UAM surveillance information, UAM aircraft real-time flight information, and other national airspace system user information to provide real-time air traffic management services and, if necessary, share information with stakeholders.

For the purposes of public interest, other stakeholders can have access to UAM operating information (such as UAM aircraft identification information or movement trajectory). This information is provided by UATMSP.

If other stakeholders in charge of public affairs need to temporarily restrict UAM operations over specific areas to ensure public safety for fire suppression or large outdoor activities, they must notify UATMSP of the restrictions.

Networks are formed across UATMSP. UAM traffic is controlled in real time through this, allowing for safe separation between UAM aircrafts receiving different UAM services by providing any relevant information.

It is feasible to share airspace use information with UAS Service Suppliers who provide services in the same region via UATMSP networks. UATMSP networks should be operated with the security of shared information, as well as the equity of the target, scope, and level of sharing in mind, and shared data should be managed in a standardized manner.

UATMSP and UAM air operators receive information about Vertiport availability, UAM aircraft operation status, real time capacity adjustments, and the monitoring status of Vertiport areas from operators. This information is used to establish flight plans for UAM air operators, approve UATMSP flight plans, manage take off and landing operations, and provide separation services.

4-4-1-2 Key Information Flow Centered on Vertiport Operators

By integrating Vertiport's real time capacity change information into demand capacity management, UATMSP can provide more efficient air traffic management services.

Flight plans or real time flight information (estimated arrival time, etc.) from UAM air operators and UATMSP can be received by Vertiport operators and used for optimal Vertiport operation.

For a safe and efficient UAM operation, Vertiport operators can communicate directly with the PIC within the Vertiport (including during the take off and landing procedure).

4-4-2 Sharing and Connecting Information with Air Traffic Management System

UAM service information exchange should be carried out independently from existing air traffic management information networks to reduce the load of work on air traffic controllers and the impact on existing air traffic management systems. On the other hand, the following methods are examined and responded to in the event of abnormal conditions, such as UAM aircrafts not in conformance within corridors.

When the air traffic controller's instructions and regulation information (flight restricted airspace, NOTAM, etc.) are sent to UATMSP, the information is either used directly by UATMSP or delivered to UAM air operators and PICs. UATMSP immediately reports to the air traffic controller if the relevant instructions and regulations are unimplementable.

UAM flight-related information (UAM flight plan, real time flight information, corridor information, etc.) can be obtained in the air traffic management system by requesting it from UATMSP. In accordance with the information exchange protocol, UATMSP must report the requested emergency situation information. A system for this may be implemented separately in the future.

UATMSP provides relevant information to the air traffic management system in the case of a situation that could affect air traffic management. The air traffic management system combines the information and, if necessary, develops orders and regulations, which are then distributed to the UATMSP.

If necessary, the K-UAM transportation system exchanges information with the military, security conditions, etc. Information exchange and connection should be promoted in harmony with the National ATM Reformation and Enhancement (NARAE).

4-4-3 Future Policy Directions

As the frequency of UAM aircraft operations increases, it becomes more important to maintain an uninterrupted flow of information, so it is necessary to minimize human intervention and enable each stakeholder to obtain necessary information in real time via systematic and advanced information networks. In this ConOps, UATMSPs are at the center of information flow, and networks among UATMSP play a key role in the distribution and spread of information. However, UATMSP networks are yet only presented conceptually, and further detailed research is required. In the future, the development path should be determined by taking into account both air traffic management and UAS traffic management.

4-5 K-UAM Communication, Navigation, Surveillance, Information (CNSi)

4-5-1 Communication

Stable information and communication services must be supplied within UAM corridors for safe operation of K-UAMs, and the use of commercial mobile communication networks would be considered first for this purpose. Voice communications, as employed in existing air traffic control services, can be used in the initial stages. A UAM aircraft that has departed from the corridor due to a situation that does not satisfy the required navigation performance of the corridor (such as failure of the aircraft or related support system) must be under the direct control of the air traffic controller, so the relevant stakeholders must have an appropriate communication system in advance.

4-5-2 Navigation

The navigation system for K-UAM operation is based on GNSS. For the application of performance-based navigation, SBAS can be used on the route and DGNSS (Differential GNSS) can be used when approaching the Vertiport landing. In addition, the installation (establishment) of an auxiliary navigation system to prepare for a situation where GNSS cannot be used may be additionally considered.

4-5-3 Surveillance

Surveillance information is obtained from the UAM aircraft flight information reporting system based on commercial mobile communication. ADS-B OUT should function in case it leaves the corridor due to a situation that does not satisfy the required navigation performance of the corridor (failure of the aircraft or related support system, etc.).

4-5-4 Information

Status information of major aviation components related to flight safety of UAM aircrafts in operation is delivered to UAM air operators. UAM air operators can accumulate maintenance information on the aircraft and assess and determine the necessity for emergency maintenance based on this.

Individual UAM aircraft operation status and other aircraft safety-related information are delivered to UAM air operators and used for conformance monitoring. If necessary, this information can also be delivered to UATMSP to respond to emergency rescue or emergency situations.

UATMSP provides essential information for safe operation to the UAM PIC, such as emergency NOTAM issued by aviation authorities.

During the flight, passengers can use their mobile devices to access various infotainment services such as web surfing, watching videos, and purchasing tickets for their next mode of transportation.

4–5–5 Considerations and Future Policy Directions

UAM aircrafts require communication, navigation, monitoring, and information systems, but because there are no certified aircrafts available yet, considerations for specific technical elements required for the aircraft itself are not reflected. It is vital to develop such material when approved aircrafts that can be used are produced.

5 K–UAM Use Case and Scenario – Initial Phase (2025–2029)

This chapter covers operation scenarios in both normal and abnormal circumstances.

This is based on normal and abnormal scenarios during the initial phase of K–UAM commercial operations (2025–2029).

The main stakeholders involved in UAM operations will need to develop and prepare appropriate manuals or contingency plans in the future to respond to abnormal situations, as well as obtain approval from safety authorities before launching commercial services.

5–1 Nominal Flight Scenario

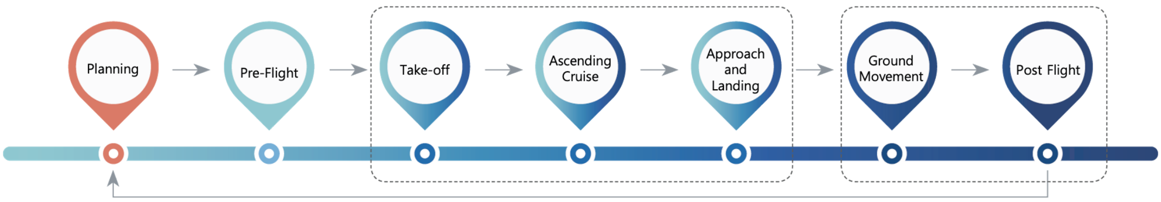
The normal operation scenario assumed that UAM corridors, UATM, CNSi, and weather conditions were all functioning normally with stakeholders such as PICs, UAM air operators, Vertiport operators, UATMSP, UAS Service Suppliers, and air traffic control agents.

The UAM operation procedure is presented below. This procedure represents the typical flight scenario. UAM air operators develop commercial service operating procedures and approve them with the approval of safety authorities.

In order to describe the normal flight scenario, it was divided into four stages (planning, preflight, flight, and postflight) and detailed steps were added when needed.

5-1-1 Planning Phase

[Figure 3] Flight Planning Phase



1. Daily inspections of UAM aircraft are carried out in collaboration with Vertiport operators, etc.

2. Vertiport operators examine the Vertiport's availability (including emergency landing locations) and notify UATMSP and UAM air operators of the results.

3. UAM air operators establish flight plans [25] based on information such as weather and environment provided by SDSP, corridors provided by UATMSP, and Vertiport availability information provided by Vertiport operators.

4. After reviewing the flight plan (proposal) from Vertiport operators, UAM air operators request approval from UATMSP.

5. UATMSP and UAM air operators are notified of the flight plan25) by Vertiport operators and the results are reviewed (proposal

6. UATMSP checks information such as corridor availability, Vertiport status and capacity, emergency landing availability, weather, and NOTAM to review the suitability of the flight plan and, if necessary, take appropriate steps for strategic deconfliction.

7. After careful consideration, UATMSP approves all conditions related to the flight plan and transmits it to the approved flight plan UAM air operators and Vertiport operators. Additionally, if necessary, approved flight plans can be shared with air traffic controllers and UAS Service Suppliers.

8. Vertiport operators (and, if necessary, UAM air operators) prepare ground service in

25) This would be established as a 4D flight plan that includes the departure and arrival time and travel time.

accordance with the flight plan.

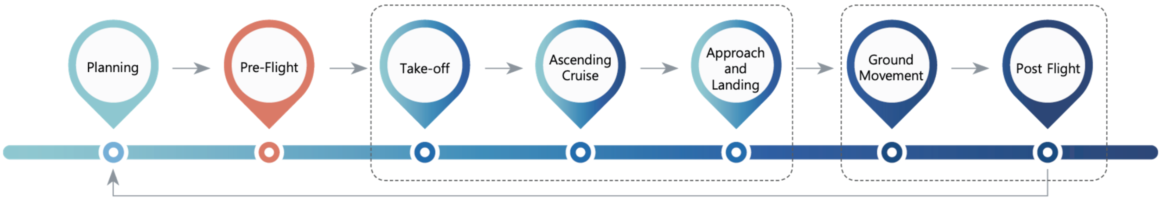
9. UATMSP approves the flight plan, which UAM air operators then provide to the PIC along with a list of passengers and cargo.

10. The PIC checks the approved flight plan and the list of passengers and cargo

25) This would be established as a 4D flight plan that includes the departure and arrival time and travel time.

5–1–2 Pre–Flight Phase

[Figure 4] Pre–Flight Phase



1. The approved flight plan is checked and the aircraft is prepared for operation. At this point, the aircraft and the list of passengers and cargo are checked, and the corridor, desti–nation, and flight time is familiarized. The PIC notifies UAM air operators and Vertiport opertors that they are ready for boarding.

2. Vertiport operators conduct a security check on passengers and cargo, direct pas–sengers to wait safely in the isolated waiting room, and monitor the status of the isolatedwait ing room.

3. Passengers who have completed security checks and guided boarding are given flight safety training[26]) by UAM air operators.

4. Vertiport operators (and, if necessary, UAM air operators) work with the PIC to assist with departure preparations as well as passenger movement and boarding when boarding begins.

5. The PIC notifies UATMSP of the completion of the departure preparation and requests approval for ground movement after confirming the completion of passenger (cargo) boarding (loading).

6. Passengers are briefed on flight plans (paths, times, etc.) either directly or through a medium by the PIC (infotainment system, etc.).

7. UATMSP examines the flight plan, corridor availability, and destination Vertiport availa–bility, and requests that the ground movement be approved based on the departure plan

26) Safety education for UAM usage and screening related videos on emergencies, etc.

(FATO, departure direction[27]), departure order, time, etc.)

8. Vertiport operators review the departure plan, Vertiport availability (FATO, ground movement route, other flight schedules, Vertiport area, etc.), approve the ground movement (including the ground movement route), and notify UATMSP.

9. UATMSP notifies the PIC of the departure plan and ground movement approval, and transmits it to UAM and Vertiport operators.

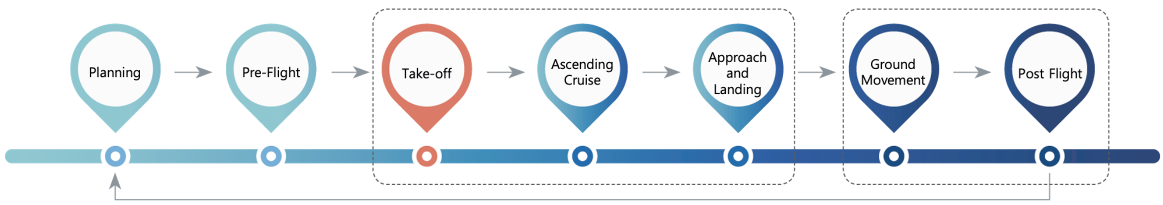
27) 1 FATO may have two starting directions (entry and exit sides) when considering wind directions, etc.

5–1–3 Flight Phase

The flight phase is divided into ground movement and take–off, ascending and cruising, and approach and landing phases.

A) Ground Movement and Take–off

[Figure 5] Ground Movement and Take–off Phase



1. The PIC moves to their designated FATO[28]) along the ground movement route and requests approval for takeoff while maintaining communication with UATMSP.

2. UATMSP reconfirms the departure plan and corridor availability, notifies the PIC of the take–off approval, and informs Vertiport operators and UAM air operators.

3. The PIC performs take–off procedures in accordance with the departure plan after receiving notification of take–off approval, while maintaining communication with and notifying UATMSP.

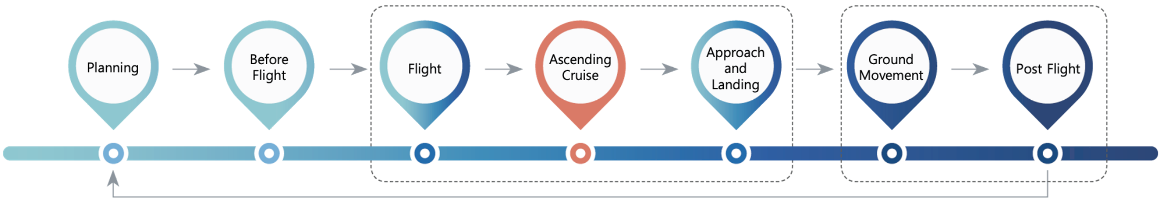
4. Vertiport operators regularly monitor the UAM aircraft's ground movement and take–off, sharing this information with UATMSP and UAM air operators and maintaining communication with the PIC in the event of abnormal circumstances.

5. UATMSP transmits the latest flight plans (expected arrival time, etc.) that reflect the take–off time to related stakeholders.

B) Ascending and Cruising

28) Ground movement methods may vary depending on the aircraft type and situation

[Figure 6] Ascending and Cruising Phase



1. The aircraft ascends and cruises in accordance with the flight plan. For safe flight, the PIC monitors aircraft and weather conditions and relays them with UATMSP and UAM air operators.

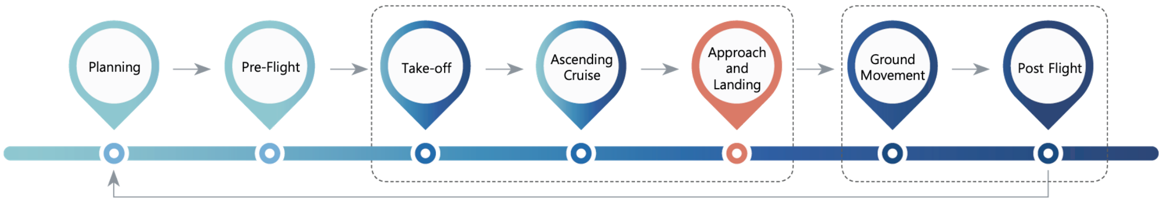
2. UAM air operators monitor the flight plan and make sure it matches the aircraft's condition during the flight, as well as providing weather data for the PIC.

3. The UATMSP monitors the consistency of flight plans (location, time, navigation performance, and so on) in order to share the information through a network among UATM–SPs and to ensure safe flight by monitoring flight support information on the flight route on a regular basis. At the PIC's or UATMSP's request, UAM air operators adjust the flight plan as needed, and UATMSP coordinates, approves, and transmits it.

4. Vertiport operators continue to monitor the Vertiport area while the UAM aircraft ascends and share this information with UATMSP.

C) Approach and Landing

[Figure 7] Approach and Landing Phase



1. Vertiport operators continuously check the Vertiport area and the Vertiport's availability and relay this information with UATMSP and UAM air operators.

2. UATMSP continuously monitors aircraft operation information (location, status, etc.). After analyzing the state of the Vertiport and external circumstances, tactical separation is supported if necessary (weather, other aircraft, etc.).

3. The PIC approaches the destination Vertiport and requests landing permission from UATMSP.

4. UATMSP examines flight plans, corridor availability, other UAM aircraft waiting to land, and Vertiport availability and then requests Vertiport operators to approve the landing according to the landing plan (FATO, approach direction, landing time, etc.).

5. Vertiport operators review the landing plan, Vertiport availability (FATO, ground movement route, below, other flight plan), and Vertiport area status before notifying the UATMSP of landing approval (including ground movement route and disembarking area designation) and preparing ground services.

6. UATMSP notifies the PIC of the landing plan and approval of the landing, and informs UAM air operators and Vertiport operators.

7. The PIC performs the landing procedure according to the landing plan after being notified of the landing approval, while maintaining communication with and notifying P UATMSP.

8. UATMSP and UAM air operators monitor aircraft conditions while sharing the safe flight data.

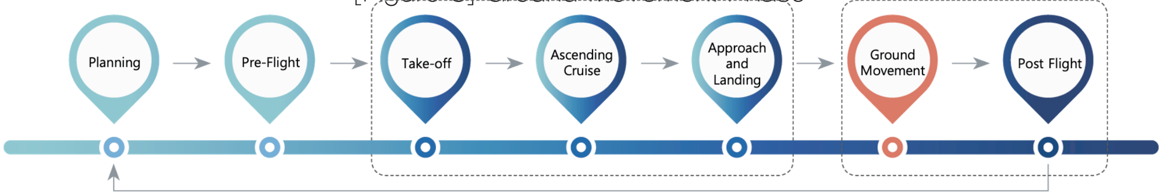
9. Vertiport operators continuously monitor the aircraft landing and relay this information with UATMSP and UAM air operators.

5-1-4 Post-Flight Phase

The post-flight phase includes ground movement and after stopping phases.

A) Ground Movement

[Figure 8] Ground Movement Phase

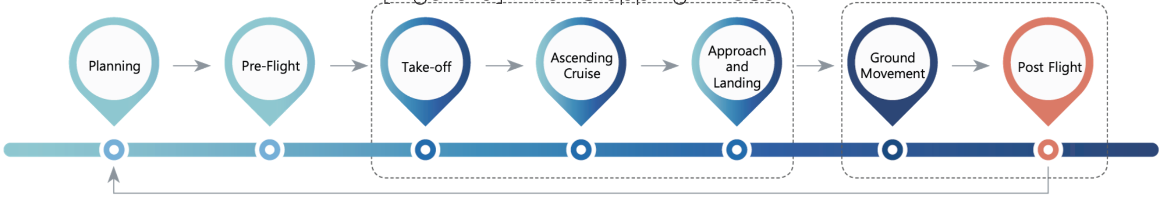


1. The PIC maintains communication with UATMSP after landing at the FATO and moves to the designated site along the ground route.

2. Vertiport operators continue to monitor the UAM aircraft's landing and ground movement, sharing this information with UATMSP and UAM air operators and maintaining communication with the PIC in the event of any abnormal circumstances.

B) After Stopping

[Figure 9] After Stopping Phase



1. The PIC notifies UATMSP of the completion of passenger disembarking preparation and alerts UAM air operators after arriving at the specified disembarking area.

2. After confirming the completion of the aircraft stopping and passenger disembarking preparations, UAM air operators declare the end of the flight.

3. UATMSP notifies Vertiport operators of the completion of passenger disembarking preparations, organizes, and stores the operation results.

4. After notifying them of the completion of passenger disembarking preparation, Verti-port operators (UAM air operators if needed) support the safe disembarking (unloading) of passengers (cargo), and conduct or support ground services (charging, inspection, cleaning, etc.).

5-2 Operation during Off-Nominal Situations Scenario

This is when any component, external factor, or operating environment related to UAM operation is abnormal. This can happen at any time throughout the procedure, so it's critical to be prepared. For any abnormal event, each stakeholder must create an emergency response manual or contingency plan and obtain approval from safety authorities.

The table below shows the distinction between norminal and off norminal situations during UAM operation.

[Table 3] Concept Explanation of Off–Nominal Operation Classifications

Condition		Situation Explanation
Nominal	Normal Operation	All systems related to UAM operation remain normal
Off–Nominal	Abnormal Operation	If flight to the originally planned destination is possible, but some systems and environments are abnormalengagement.
	Contingency	Cases where the planned desti–nation cannot be reached due to the occurrence of a dangerous level of factor. Needs to be dealt with using contingency plans, etc.
	Emergency	Aircraft control is impossi–ble due to fatal factors

In this section, off–nominal situations are classified as emergency situations, situations in which the flight plan can be complied with, and situations in which the flight plan cannot be complied with. Even in off–nominal scenarios, if compliance with the flight plan is possible, the flight plan can be completed with responses like modifying the flight route and waiting during the flight, etc. If the flight plan cannot be followed in an abnormal situation, responses such as airspace modification, emergency landing, and Balked Landing can be performed. Finally, emergency situations occur when an aircraft crashes, necessitating emergency rescues as well as post–accident handling.

For UAM operation, quick information sharing and transmission to related stakeholders is essential during off–nominal situations.

5–2–1 When compliance with the flight plan is possible

Flight to the originally planned destination is possible under abnormal situations when compliance is possible. Some systems and environments are considered to be abnormal situations but have no impact on flight safety.

This also includes situations where, despite the fact that it compromises flight safety, it is possible to continue operations by replacing and switching to alternative factors that do not compromise flight safety. UAM aircraft manufacturers and UAM air operators must develop a response manual in advance of this situation, and their response knowledge and ability must be reflected in the PIC's, UAM air operators', and UATMSP's qualification conditions.

Examples of minor abnormal situations are as follows.

- (Unrelated to flight safety) Air conditioner malfunction or failure
  - o Continue normal operation after asking for understanding from passengers
- (Affects flight safety, overcome using alternative methods) Navigation S/W error or failure
  - o Continue normal operation by using a substitute S/W
- (Affects flight safety, overcome using alternative methods) 5G communications network connection error
  - o Continue normal operation after maintaining communication network by switching to an alternative communication method
- (Affects flight safety, overcome using alternative methods) Sudden appearance of uncooperative aircraft within the corridor
  - o Continue safe normal operation after tactical collision avoidance maneuvers (including waiting during flight)
- (Affects flight safety, overcome using alternative methods) Occurrence of sudden bad weather on flight path
  - o Continue normal operation through flight route change

5–2–2 When compliance with the flight plan is not possible

An incompliable off–nominal situation is a contingency situation in which the planned destination cannot be reached due to an occurrence of a dangerous level of factor. This includes situations where even alternative elements planned to assure flight safety fail or operate abnormally, or where compliance with the flight plan is impossible due to other factors.

In the event of a contingency, landing procedures must be completed simultaneously with the quick communication of the situation. Because a UAM aircraft leaving a corridor may impact other users, UAM air operators should develop contingency plans so that PICs, UAM air operators, and UATMSP can respond swiftly.

After an urgent landing, UAM air operators and aviation authorities should inspect the aircraft and analyze flight data to identify the cause of the accident.

Examples of contingencies are as follows.

- (Affects flight safety, no alternative methods available) Flight–related component failure due to collision with bird
    - o Emergency landing based on the PIC's judgement
- (Affects flight safety, alternative methods also abnormal) Navigation S/W error or failure
    - o Error or failure when using substitute S/W
    - o Emergency landing based on the PIC's judgement
- (Affects flight safety, alternative methods also abnormal) Sudden bad weather on flight route
    - o Not possible to assign alternative flight route
    - o Emergency landing with cooperation between PIC, UATMSP, and UAM air operators
- (Other reason unrelated to flight safety) Forced landing order of the aircraft or prohibition of landing
- (Other reason unrelated to flight safety) Occurrence of emergency patients such as cardiac arrest
    - o Emergency landing at landing site designated by UAM air operator or UATMSP (shortest distance from a medical institution)

5–2–3 Emergency Situation

Emergency situations are situations in which aircraft control is impossible due to fatal factors. In the event of an aircraft crash, the PIC, UATMSP, and UAM air operators must quickly share information and transmit emergency situations to related stakeholders. When a situation like this arises, emergency rescue and response measures involving the local communities must be taken. Aviation authorities should secure the accident aircraft's flight data, investigate and analyze them, and identify the cause of the accident.

5–3 Considerations and Future Policy Decisions

The initial K–UAM's operation scenario will be verified[29]) and developed by the K–UAM GC, which is being developed by the government as a demonstration project. The first stage of the K–UAM GC will take place in open areas, while the second stage will take place in urban areas, and because elements of the second stage's demonstration in urban areas have not yet been not adequately examined while developing this operating scenario, more elements may be added in the future.

Furthermore, the current operational scenario is designed from the perspective of the service provider, with little consideration for the consumer's perspective when using the UAM. In the process of developing the UAM, the plan is to review operating scenarios so that consumers can use it more safely and conveniently as well.

29) Division of work related to Vertiport between operators and UATMSP will be verified through K-UAM GC in the futur

6 Closing Remarks

This is a new mode of transportation that was created to alleviate traffic congestion and allow people to move more quickly in UAM metropolitan areas. It differs from existing aviation in that it provides mid- and short-distance services centered on city centers, and it also differs from ground transportation services such as roads and trains in that it utilizes airspace. To deliver such UAM services, a new industrial ecosystem, including production, transportation, operation, infrastructure, and transportation management, must be established that differs from the previous ones.

A rough sketch shared by related participants is required to establish a new industrial ecosystem. The basic policy directions for this, the K-UAM policy roadmap and the K-UAM technology roadmap, were announced by the government. This ConOps is a detailed blueprint for defining the service sector. The basic concept is based on the two roadmaps and revolves around the UAM service when commercial services are introduced in 2025. This ConOps specifies who are the primary participants, what each participant's roles and responsibilities are, and how UAMs are operated.

This ConOps serves as a blueprint for the national UAM service and will serve as a starting point for future UAM discussions. The government will move forward with policies and plans to enact and reflect various institutionalizations in order to actualize this ConOps with various stakeholders. Based on this ConOps, the private sector will be able to materialize its business model and prepare for commercialization in 2025.

This ConOps will continue to evolve. In the process of establishing this ConOps, there have been a lot of discussions and the opinions of various stakeholders such as experts and companies interested in UAM have been collected and reflected, but there are various uncertainties because it is a path that has not been explored yet. There may be limitations because there may be things that have not been considered. However, the government will continue to check changes in the UAM industry and collect opinions from stakeholders. The plan is to continue to develop and refine this ConOps through continuous R&D projects and demonstration projects such as K-UAMGC.

We would like to express our gratitude to UAM Team Korea's secretaries (Korea Aerospace Research Institute, Korea Institute aviation safety technology , Korea Aerospace Research Institute), participating institutions, various experts, companies, and research institutes, and ask you to continue to be with us in developing this ConOps.

Attachments

A. Terms and abbreviations

AGL	Above Ground Level
ATC	Air Traffic Control
ATM	Air Traffic Management
ConOps	Concept of operations
CNSI	Communication, Navigation, Surveillance, Information
C2 LINK	Command and Control Data Link
DGNSS	Differential GNSS
eVOTL	electric Vertical Takeoff and Landing
FATO	Final Apporach and Take Off Area
GNSS	Global Navigation Satellite System
NOTAM	Notice to Airmen
PBN	Performance–based Navigation
PIC	Pilot in Command
PSU	Provider of Services for UAM
RNP	Required Navigation Performance
SBAS	Satellite Based Augmentation System
SDSP	Supplemental Data Service Provider
UAM	Urban Air Mobility
UATMSP	UAM Air Traffic Management Service Provider
UAS	Unmanned Aircraft System, Unmanned Aerial System
USS	UAS Service Supplier
UTM	UAS Traffic Management
VFR	Visual Flight Rules

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