Concept of Operations for Advanced Air Mobility （ConOps for AAM)

First Issue Revision A Summary

(English version)

※The Japanese version is the original and the English version is for reference purposes only.

Revision History

First Issue	
All Pages	• New Issue
First Issue Revision A	
Overall	• Updated on domestic and international activities, and corrections to the descriptions were made.
Chapter 1 Introduction	• New Section 1.4 “Activities for the Introduction of AAM Operations” was newly added.
Chapter 2 Overview of Advanced Air Mobility	• Section 2.1 "AAM Phases" was moved from the latter section and the subsequent section numbers were forwarded in order. • “Transportation of personnel during disasters” was added as use case #9 in Section 2.3.1 “Passenger Carrying.” • The document by the Use Case Review Meeting was assigned as APPENDIX 2 (new) and referenced from Section 2.3 "Use Cases " • Deleted the description of Vertiport airspace and UAM Routes & UAM Corridors from Section 2.5.2 "AAM use of Low-level airspace," and moved them to the newly added Chapter 3. • Deleted the detailed description of UATM Services from Section 2.5.3 "Air Traffic Management," and moved it to the newly added Chapter 3. • Chapter 2.7, "AAM Operation Flow," was newly added to refer to APPENDIX 3.
Chapter 3 Key Challenges for Advanced Air Mobility	• New Chapter 3 was added to describe key challenges for AAM. The subsequent chapter numbers were forwarded in order.
Chapter 4 Phases of Advanced Air Mobility Introduction	• Section 4.1 "AAM Phases" was deleted and moved to Section 2.1 at the beginning of this document. • Challenges to be addressed in each phase were noted.
APPENDIX 2 AAM Use Cases	• The document by the Use Case Review Meeting under the Public-Private Council for the Air Mobility Revolution is attached and assigned as APPENDIX 2. The subsequent APPENDIX numbers were forwarded in order.

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Purpose

- This document presents **a Concept of Operations (CONOPS) for realization and further expansion of the scale and operations of the Advanced Air Mobility (AAM) in Japan**, which is expected to become the next generation of air mobility. It outlines the key components and stakeholders, and describes the phases of gradual implementation.
- AAM is **an accessible and sustainable next generation means of air transportation, made possible by aeronautical technologies such as electrification and automation, as well as vertical take-off and landing and other modes of operation**[*1]. A distinction is made between AAM operations in urban areas over short distances and at low altitudes which is referred to as Urban Air Mobility (UAM) and AAM operations over longer distances which is referred to as Regional Air Mobility (RAM).
- To enable the development and growth of AAM operations, active discussion among stakeholders on regulations and system design and specifications for AAM operations is needed. Therefore, this document **aims to provide industry stakeholders who are considering entering the AAM industry in Japan with necessary information and shared awareness**.
- This document is expected to constantly evolve based on technological advances, overseas trends, and feedback from stakeholders.

*1 AAM does not include drones.

Scope / Activities for the Introduction of AAM Operations

Scope

- In order to promote the development of AAM industry in Japan through steady progress in environmental and technological development as outlined in the roadmap by the Public-Private Committee for Advanced Air Mobility, this document describes the overall ecosystem while focusing on the main components of AAM: the aircraft, ground infrastructure and air traffic management. It also introduces relevant use cases for Japanese AAM operations, including passenger carrying and cargo transport operations that use Electric Vertical Take-off and Landing (eVTOL) aircraft as well as the roles and responsibilities of the parties involved and key challenges. In addition, it describes the likely phases of AAM operations from initial introduction to mature, high-density and autonomous operations.
- This holistic approach is important for the development of AAM operations. It is important to consider both short- and long-term objectives to minimise the amount of rework and cost that could arise at a later stage due to initial decisions.
- This document also considers air traffic management mechanism that AAM needs to achieve harmonized flight with other low-level airspace users. Other low-level airspace users include drones, general aviation aircraft, and commercial operations on approach or departure, etc.

Activities for the Introduction of AAM Operations

- The Public-Private Committee has been discussing the approach to set standards for aircraft, take-off/landing areas, airmen competence certifications, aircraft operations and air transport services, and from FY2023, the government has been establishing standards in turn.
- The details of traffic management methods will continue to be discussed, taking into consideration harmonization with other countries' schemes, by the public and private sectors, and a second edition reflecting these discussions will be published when available.

Phases of Advanced Air Mobility Introduction

Phase	Maturity Level	Timeframe
Phase 0	**Test flights and proof of concept flights prior to commercial operations**	
Phase 1	**Commencement of commercial operations** - **Low density operations** - **Pilot on board , cargo transport with remotely piloted operations**	Around 2025
Phase 2	**Scaled operations** - **Medium to high density operations** - **Pilot on board and/or remotely piloted**	Late 2020’s or later
Phase 3	**Establishment of AAM operations which include autonomy** - **High density** - **Integrated with automated / autonomous operations**	2030’s and beyond

Aircraft

Initial Stage	Future
• eVTOLs powered by rechargeable batteries , hybrid. • A pilot on board operate manually or automatically. Remotely piloted mainly for cargo transport • Operate under Visual Flight Rules (VFR)	• Hydrogen fuel cell-powered aircraft may also provide AAM operations • Automated flight operations or autonomous operations • Operate In more severe weather

Aircraft Concept Types ※

Multirotor

This concept provides the main lift and propulsion by means of three or more electric powered rotors rotating around a nearly vertical axis. By changing the “rotation speed” of these multiple motors, each rotor blade (rotor) generates thrust and counter-torque in accordance with its rotation speed, which becomes torque in various directions depending on structural factors such as rotor positioning, direction of rotation, and positive or negative rotor pitch. These combined forces change the aircraft's attitude to achieve flight. Due to a high battery drainage for the cruise phase, these aircraft are limited to short-distance journeys.

Lift + Cruise

This concept has multi rotors, but also fixed wings for cruise, with one or more propellers for thrust. It uses different electric propulsion systems for vertical take-off and landing and for cruise. During take-off and landing, multi rotors are used to generate upward thrust. During cruise, the upward rotors turn off and one or more forward-facing propellers are used for level flight and wings create the necessary lift. This concept can enable greater energy efficiency than multirotor AAM aircraft in cruise due to the use of wing-based lift and is therefore suited to longer distances.

Vectored Thrust

This concept has fixed wings for cruise and uses some or all of the electric propulsion systems in common for vertical take-off and landing and for cruising. At take-off and landing, the vertically positioned propulsion system (e.g. propellers or fans) generate lift. During cruise, the propulsion systems tilt to generate forward thrust and lift is generated by the wings. This concept is suited to longer distances than multirotor AAM aircraft. It can potentially enable higher cruise speeds and distances than other concepts.

Under the Civil Aeronautics Act, for the time being, lift+cruise type and vectored thrust type aircraft that fly with fixed wings which provide the main lift will be classified as "airplanes" and multirotor type aircraft that obtain their main lift and propulsion from rotor blades will be classified as "rotorcraft.

※ Definitions and meanings of terms used in this section include those given for ease of reading. Formal terms used in the evaluation for type certification are determined by consideration of individual design features.

Use Cases

Passenger Carrying	
Airport shuttle	Transporting passengers from/to airport and their onward destination.
Intra-urban	Transporting passengers within urban areas.
Routes to suburban areas	Transporting passenger from urban centres from/to suburban/remote areas.
Entertainment	Excursion flights around recreational facilities and tourist destinations.
Access to tourist areas	Transporting tourists, etc. from/to recreational facilities and tourist destinations.
Routes connecting remote islands or mountainous areas	Transporting passengers between remote islands and the mainland, between islands and between mountainous and urban areas.
Emergency Medical Transport (EMT) (for doctors)	Transporting doctors for emergency medical purposes over urban and rural areas in the event of a disaster or sudden illness, etc.
EMT (for doctors and patients, etc.)	Emergency transport of doctors who have provided initial treatment and patients in the event of a disaster or sudden illness, etc.
Transportation of personnel during disasters	Transporting personnel from isolated areas due to disasters such as earthquakes.
Cargo Transport	
Emergency transport of goods	Transporting required goods when disaster event occurs.
Inter-facilities	Transporting goods or products between facilities owned by a company/organization.
Cargo delivery (sea and mountainous areas)	Transporting cargo along routes over the sea and within mountain areas (incl. remote medical care).
Cargo delivery (urban areas)	Transporting cargo in urban areas.

※ In addition to the above, AAM is expected to include use cases in which companies independently introduce and use for their own purposes as well as, in the future, private ownership and use by individuals for their own personal use.

【Expected Benefits】

Passenger/Logistics Company ： Increased availability (locations and frequency), time saving (compared to other transport modes), quieter comfortable cabin, potentially lower cost, simple boarding procedure, improved multi-modal transport connectivity

Community/Society ： Lower noise, lower emissions, larger network of operations, vitalization of local economy, improved remote area access, increased emergency response capability, reduced infrastructure costs (compared to other ground/surface based transport modes)

On-ground Infrastructure (Vertiports)

【Definition/Overview】

- A “vertiport” is considered **an "airport, etc." under the Civil Aeronautics Act, as a type of "heliport" dedicated to AAM**. In the AAM operating environment, it is anticipated that there will be vertiports of various sizes with single or multiple Final Approach and Take-Off Areas (FATOs).
- In the beginning, AAM operations are expected to utilize existing rules, including for the use of existing aerodromes/airports (referred to hereinafter to include heliports.) and permissions for off-site take-off and landing. Existing aerodromes/airports can be used for eVTOL operations if the necessary requirements are met, however there is a possibility that additional facilities, for instance, electrical chargers, battery swapping equipment and fire extinguishing equipment for battery fires will be needed.

【Facilities/Configuration】

- For vertiports, the infrastructures appropriate to the size, performance, and operating conditions of the anticipated AAM aircraft will be required. Vertiports may be required to establish instrument flight procedures and/or to install air navigation facilities and other equipment to ensure safe operations during night-time and/or inclement weather conditions. But, it is not expected that operations during such conditions will be included in the early stages of AAM implementation. Some vertiports may have dedicated spaces for AAM aircraft to park (Stand).
- Vertiports have various configurations, and in addition to facilities that must be maintained, such as FATOs, TLOFs, and markings, there are other facilities such as stands, taxiways, and charging facilities that are maintained depending on site conditions and operational methods, and the processing capacity, such as the number of flights that can be realized, varies. It is anticipated that vertiport capacity will affect the capacity of the whole AAM network, especially in the early stages when there are expected to be few vertiports available.

【Non-public/public】

- Like existing heliports, there are public (available for unspecified operators) and non-public vertiports. For public use, the specifications must in principle be able to accommodate any AAM aircraft that is expected to be operated, and it is assumed that an entity independent from AAM aircraft operators will operate them. On the other hand, for non-public use vertiports, a few models of operation are envisioned such as an aircraft operator operates a vertiport directly, a vertiport operator enters into a contract with specific AAM aircraft operators only, and others.

【Charging Equipment】

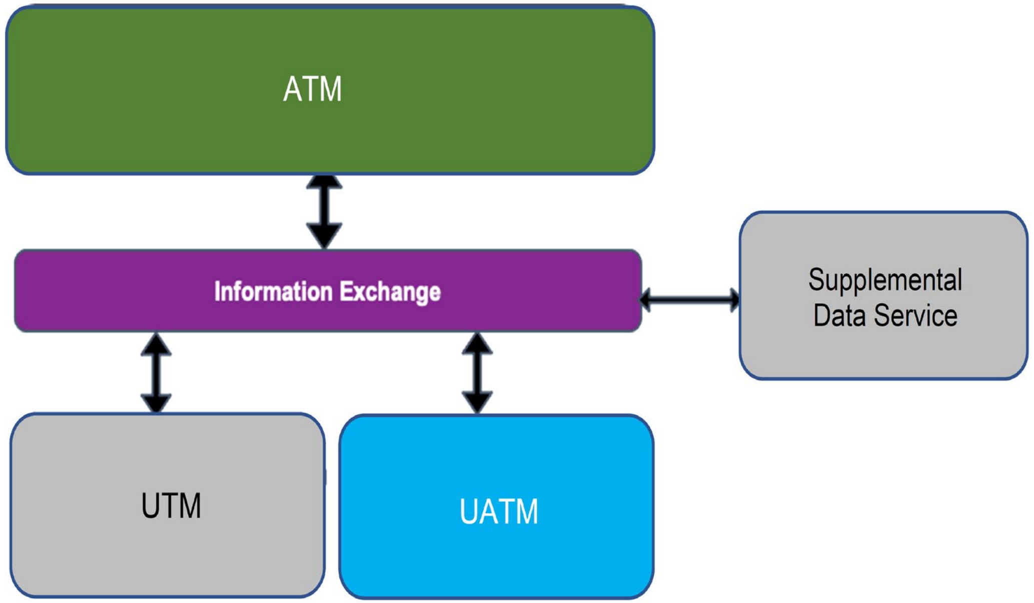
- There are currently two known methods of charging of AAM aircraft: (1) battery replacement and (2) direct charging, and the requirements on charging facilities are different.
  - Battery replacement : It may require space in the vertiport for battery charging facilities and storage. There is also an operational need to locate these facilities close to the aircraft stand for fast swapping to enable fast AAM aircraft turnaround.
  - Direct charging : It requires charging equipment to be installed at aircraft stands to facilitate fast charging during AAM aircraft turnaround.

AAM Use of Low-level Airspace

- UAM are required to fly at an altitude at or above the minimum safety altitude specified by ministerial ordinance, except when taking off or landing. Therefore, the airspace in which drones and UAM cruise is considered to be separated to a certain degree. However, there are cases where drones fly at or above 500 ft (150 m) with permission, and UAM flights for search and rescue to which Article 81-2 of the Civil Aeronautics Act applies and UAM flights based on permission under the proviso of Article 81 of the Civil Aeronautics Act may fly at altitudes below the minimum safety altitude. Also, UAM aircraft will operate in the same airspace as drones around aerodromes and vertiport locations.
- When drones are flown in the airspace around airports, etc., permission must be obtained in advance pursuant to Article 132-85 of the Civil Aeronautics Act. However, it should be noted that until standards for the design of vertiports are established and a vertiport with permission is constructed, this provision on drone flights will not be applied.
- In the future, there will be more variety in the types of aircraft, operators and missions in the low-level airspace, including a mix of piloted and autonomous aircraft, etc. No single category of operators will have exclusive use of airspace, and it is envisioned that all operations will need to be integrated.
- Considering that UAM operations will expand significantly due to urban traffic, etc., and the remote control or automated/autonomous operations are envisioned, etc., only the current safety measures with VFR will eventually reach its limits. Therefore, in order to respond to the increasing scale and upgrading operation configuration of UAM, a new concept of airspace and traffic management is needed to ensure safe and smooth air traffic by coordinating operations in certain airspace from the planning phase. The airspace in which new traffic management services (UATM services) will be provided based on the expected UAM traffic conditions is defined as **"UATM Service Area (UASA)"**. UASA may include both controlled and uncontrolled airspace. The UASA is determined by ANSP on a flexible basis, based on the density and frequency of UAM operations and surrounding traffic conditions, and is not limited to the urban area.
- Long-range RAM operations are expected to fly at higher altitudes than UAM operations. Due to the operational characteristics and scale of operations, it is expected that existing airspace and traffic management concepts are used for RAM operations for part or all of their flight.

Air Traffic Management

- Existing aircraft flight has been increasing in sophistication and refinement in response to the need for segregation of airspace and appropriate separation distances between aircraft due to the increase in number of aircraft, and the subsequent increase in the number of users and diversification of operations.
- Initially, AAM aircraft are expected to operate within the requirements of the current ATM operating environment in accordance with existing procedures and/or concessions. As the AAM industry matures, various aircraft with varying levels of automation/autonomy (including piloted, partially automated and fully autonomous operations) are expected to operate within the low-level airspace. Increased density of operations, development of automation/autonomy, and the diversity of airspace users in the UASA are expected to require upgrading of the current ATM system.
- New **<u>"Urban Air Traffic Management (UATM)"</u>** systems and services will be needed to support the operation of AAM aircraft in the UASA. UATM services will support AAM aircraft operators in meeting AAM operational requirements that enable safe, efficient, and secure use of the UASA.
- It will be important to define a framework for the integration and information management between ATM, UATM and UTM services. A common information exchange system will need to be used to share information between ATM, UATM and UTM systems.



<u>UATM, ATM and UTM Interfaces</u>

Roles & Responsibilities

AAM Aircraft Maker	Design and manufacture safe AAM aircraft. Obtain type certification and ensure the continued airworthiness.
AAM Aircraft Operator	Manage their respective AAM aircraft operations. Pilot-in-Command (PIC) holds “final authority and responsibility for the operation and safety of the flight” of an AAM aircraft.
Vertiport Operator	Responsible for ground operations at the vertiport. Also responsible for overseeing ground safety, security such as entry/exit control and charging or refuelling, although these responsibilities could sit with AAM aircraft operators or other third parties. Provides information regarding the operational status of their vertiport.
Maintenance and Ground Services Provider	Similar to those at today’s commercial airports and Fixed Base Operators (FBOs, Operator of flight support services) including charging, aircraft inspection/maintenance, aircraft servicing (food/beverage), deicing, passenger guidance and safety, security screening.
Japan Civil Aviation Bureau (JCAB)	Serves as both the regulator and the ANSP, although there is a clear distinction between the two roles. The regulator is responsible for certification of all safety-related elements and develops or modifies regulations to support operations of AAM aircraft. UATM services are planned to be provided by ANSP. However, it will continue to be investigated how to specifically ensure a high level of safety, given that in the future AAM aircraft are expected to operate at unprecedentedly high frequencies and densities.
USS （UAS Service Supplier）	Support drone operations under the UTM (UAS Traffic Management) system.
SDSP（Supplemental Data Service Provider）	AAM aircraft operators and UATM services can use SDSPs to access supporting data including, but not limited to, terrain, obstacle, aerodrome availability, and specialized weather.
Other Regulators	Govern other related laws and regulations such as noise, land planning, environmental assessment, electric power grid and telecommunications.

Key Challenges for AAM

- To ensure that concepts for AAM are effective in the future, it is important to identify the key challenges associated with the introduction and growth of AAM operations.
- Many of the challenges need to be addressed by the initial phase (Phase 1) of the implementation of AAM operations, and it is important to begin working on them at an early stage.
- Responses to the challenges must take sustainability into consideration, including the introduction of new billing services.

Key Challenges	
Social Acceptance	Safety & Security
	Noise & Visual Impact
	Privacy
	Environmental Sustainability
Aircraft & Operations	Type certification
	Operations
	MRO, Services, Charging / Refuelling, Hanger and Overnight Parking Area
	Safety Management & Assurance
Traffic Management in Low-Level Airspace	Airspace & Procedures Design
	UATM Services
Urban Integration	Land Planning
	Vertiport Design Requirements and Permissions
	Multi-modal Integration

Key Challenges for AAM (Social Acceptance)

- Social acceptability is one of the most important elements both before and after the introduction of AAM, and should be considered both for the introduction and predicted future growth.
- Social acceptance is a prerequisite for establishing a profitable and sustainable AAM market.

Safety & Security

- ✓ For AAM, safety relates to both the occupants of an aircraft as well as people on the ground. The primacy of safety in aviation will always remain.
- ✓ Public perception of safety is not always the same as a statistical level of safety and can be influenced by other factors such as the novelty of technology.
- ✓ Successful, thorough verification, validation and pilot programs along with the successful gradual deployment of AAM aircraft in low density operations that occur through Phase 1 will enable the society to gain greater confidence in the safety of AAM.
- ✓ Having a collaborative process among regulators, aircraft manufacturers, AAM operators, other stakeholders and the community to ensure safety objectives and requirements remain appropriate through introduction, changes and growth of AAM operations will support the development of an AAM safety culture.
- ✓ It is also important to demonstrate an acceptable level of security.

Privacy

- ✓ Mitigating privacy concerns occurs by obtaining sufficient understanding from community and, where appropriate, using privacy policies for AAM aircraft.

Noise & Visual Impact

- ✓ It will be important to ensure that there are effective national and local processes to engage and consult communities, consider and, where appropriate, address concerns associated with the implementation, operation and growth of AAM.
- ✓ Continued advancements in technology, operational procedures, and community engagement techniques will more effectively balance local community concerns with broader societal benefits of AAM (e.g., noise abatement.)
- ✓ Means to mitigate noise and visual impacts can include urban land planning and operational techniques (flight routes, operational procedures, operating restrictions, etc.) as well as lower noise aircraft technology.

Environmental Sustainability

- ✓ Potential measures to minimise impact could be the establishment of wildlife protection areas and the implementation of bird avoidance systems.
- ✓ Concern relates to the environmental and climate impacts of the manufacture and production of AAM aircraft and their batteries could be mitigated through the use of renewable energy, recycling, etc.

Key Challenges for AAM (Aircraft & Operations)

- It will be needed to consider how risks will be identified and mitigated as AAM aircraft evolve from operations with a pilot on board, toward autonomous operations.

Type certification	Operations
✓ AAM aircraft will require criteria and means of conformance demonstration in new technical areas such as VTOL/low altitude flight, electrification and no pilot on board, in comparison to traditional aircraft. ✓ It will be necessary to establish airworthiness standards for the safe operation taking the diversity in design and operation of AAM aircraft into consideration. Where possible, approaches to type certification should be internationally harmonized. **MRO, Services, Charging / Refuelling, Hanger and Overnight Parking Area** ✓ The electrical facility are needed to recharge AAM aircraft batteries. Standardization of battery recharging equipment will be important for numerous reasons. ✓ Mechanics who intend to perform legal confirmations after maintenance and/or alteration will need to obtain a license. ✓ In urban areas, securing hangars and overnight parking areas may also be a challenge. **Safety Management & Assurance** ✓ It will be important for AAM to define appropriate safety management practices and for AAM operators to implement effective safety management systems. ✓ A good AAM safety culture will require sharing of information about safety occurrences by industry participants. It is important to create a system for sharing safety information among stakeholders.	✓ For AAM operations, it will be necessary to set standards and limits from various perspectives such as safety, environmental impact, noise, etc, because their characteristics are different from those of existing aircraft. ✓ In later phases, new flight rules which relate to the advanced technology, performance and piloting capabilities of AAM aircraft and their operations will be needed. It is expected that new flight rules will be internationally harmonized. ✓ **<u>Pilot Training</u>**：Pilot requirements for AAM aircraft operations may vary from existing airplane or helicopter pilot requirements. There may be challenges related to the increased demand for pilots. ✓ **<u>Remote piloting & autonomy</u>**：It will be necessary to define how the pilot role varies between an onboard pilot and remotely piloted operations. It will include a new concept for passenger carrying operation by a Remote Pilot-in-Command (RPICA training and licensing framework for remotely piloted AAM operations will be needed. To achieve remotely piloted and autonomous flight, new requirements may arise for methods and technologies of existing Detect and Avoid (DAA) and communication with traffic control . ✓ **<u>Security</u>**：[Cyber Security] Cyber security measures should prevent the hacking (or other malicious actions) of AAM communications or information to avoid the malicious use or control of AAM. [Physical Security] Security screening of passengers and/or AAM workers could reduce the risk of malicious passenger or worker actions relating to AAM.

Key Challenges for AAM (Traffic Management in Low-Level Airspace)

- In addition to piloted, remotely piloted and fully autonomous AAM aircraft, existing aircraft and drones should be able to operate in the same low-level airspace. A safe rule of operation must be established that allows all of these users to coexist while maximizing performance in the airspace.
- Traffic management in low-level airspace may become more complex due to factors such as the variety in aircraft, the need to support on-demand operations, and increasing obstacles such as buildings, and the coordination of ATM, UTM, and UATM will be critical to meeting these challenges in the future.

Airspace & Procedures Design

- ✓ **Vertiport Airspace**：Around a vertiport, airspace will need to be structured to enable aircraft to transition between departure/arrival and cruise phases of flight.
- ✓ **UAM Route**：UAM routes are established to connect airports/vertiports and provide routes connected to vertiport airspace entry and exit points, but it may be set as part of a path. In combination with position reporting points, they have benefits for the pilot and Air Traffic Control through improved awareness of AAM aircraft location. Route design can reduce on ground safety risk and noise impact. To enable access and equity, UAM routes can be used by aircraft other than UAM. Key advantages of using UAM routes is the early adoption and the ability for them to be used with current other types of routes and airspace users.
- ✓ **UAM Corridor**：The UAM corridor is a dedicated airspace which connects airports/vertiports. Aircraft use them complying with specific rules, procedures, and performance requirements. Like UAM routes, it may be set as part of a path. In the case that UAM corridors connecting two points increase, the shape may be changed based on airspace conditions. This type of airspace makes it mandatory to follow UATM services, and could be used where specific performance requirements are required to enable increased capacity of airspace.

UATM Services

- ✓ **Information Exchange/Sharing**：Exchange timely and accurate data among low-altitude airspace stakeholders including ANSPs, to support the safe and efficient operation of AAM aircraft.
- ✓ **Airspace Management**：Maximize the use of low-level airspace as needs shift. Implementation of UATM and/or route/corridor. Consideration will be given to introducing dynamic airspace management as the scale of operations expands.
- ✓ **Conflict Management**：Ensure that demand for AAM is met to the greatest extent practicable in the context of the limited resources in the airspace and vertiports. Manage arrival and departure times and slots.
- ✓ **Flight Plan Confirmation/Authorisation**：As the scale of operations increase, authorize flight plans submitted by operators or pilots after reviewing it and making necessary adjustment.
- ✓ **Conformance Monitoring & Coordination**：Ensure that AAM aircraft within the UASA are flying in compliance with the confirmed/authorized flight plan. In order to achieve a higher level of AAM operations, the parties concerned will continue to discuss the specific services required to avoid conflicts in real time, including spatial and temporal deviations from the planned flight path, altitude, and estimated time of passage.

Key Challenges for AAM (Urban Integration)

Land Planning	Vertiport Design Requirements and Permissions	Multi-modal Integration
✓ Strategic site selection for the vertiport is important considering various factors such as social acceptability, community impact, airspace design, economic/demand perspective, integration with existing transportation modes, etc.	✓ Establishment of vertiports will be required to have permissions from the regulator in the future. In Japan, until standards for the development of vertiports are established, the Vertiport Design Guidelines is established that provide ideas and considerations regarding standards, obstacle limitation surfaces, etc. required for vertiport facilities. For actual take-off and landing, AAM operators need permission to take-off and land at locations other than airports, etc. ✓ Over time, the design guidelines/standards should be iterated where necessary to reduce unnecessary physical requirements and optimize the operating requirements using aircraft maker's performance data.	✓ AAM is a new form of urban transportation that will need careful planning and integration with existing form of transportation. ✓ The public and private sectors will need to work together to coordinate the integration of vertiports and their operations with existing urban transport means such as subways, bus, and private cars. ✓ Operational procedures would be required to seamlessly and safely integrate vertiport operations into the urban ground transport movement area.

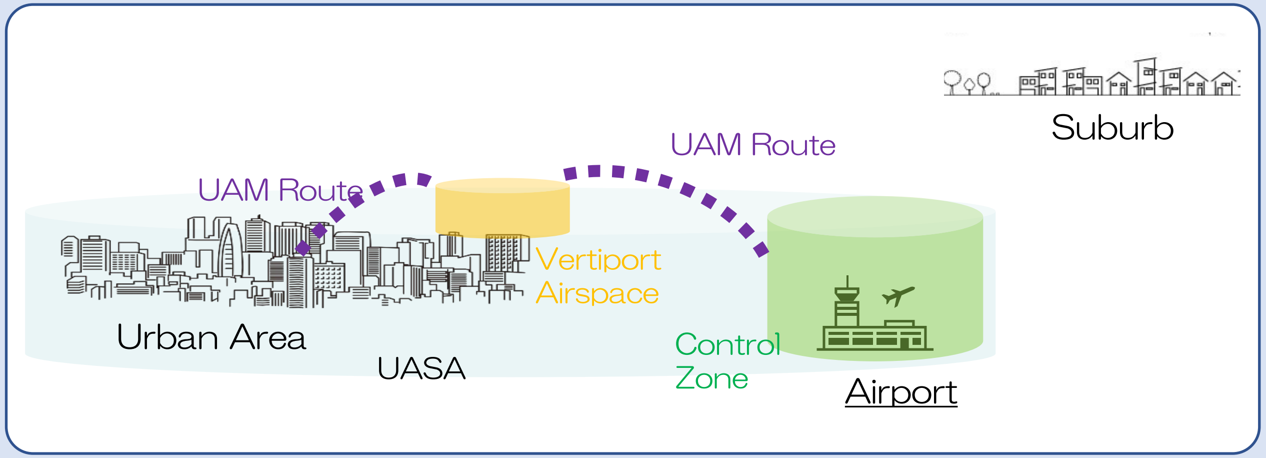
Phases of AAM Introduction (Phase 0 / Phase 1)

Phase 0 :

- Trials and proof of concept flights will occur prior to commercial services. Test flights and proof of concept flights will require appropriate approval by JCAB following the safety standards of Civil Aeronautics Act.

Phase1 :

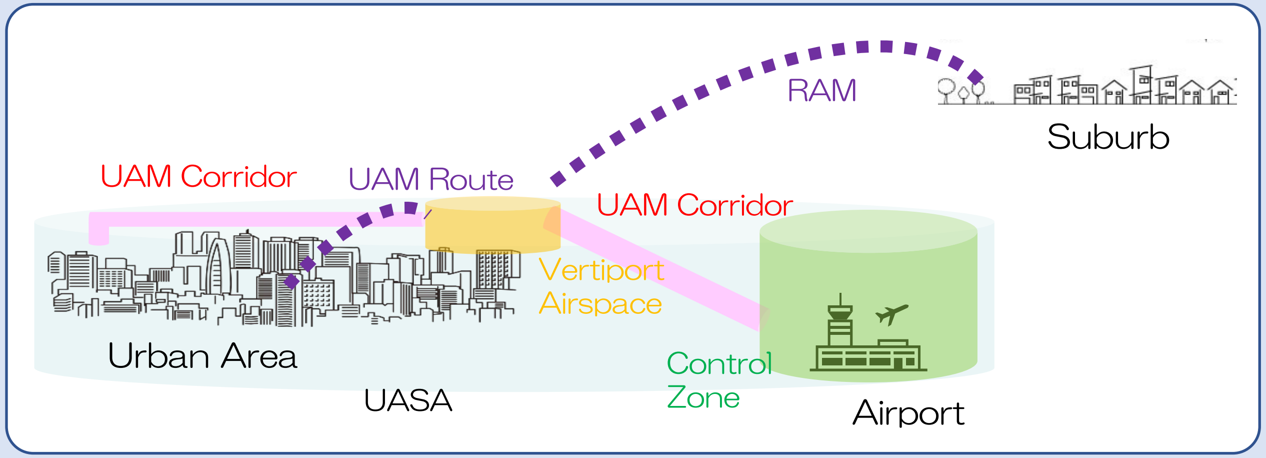
- The initial introduction of commercial AAM operations in Japan will occur. In Phase1, for passenger carrying AAM operations, initial operations are expected to occur in low density and be piloted under VFR, similar to existing aircraft operations.
- Initially, it is anticipated that existing airports and other existing rules such as off-site takeoff/landing permits will be utilized, but relatively small-scale vertiport developments are also envisioned.
- The low density will allow for the initial introduction of UATM services, which will operate based on existing ATM concepts but will not require significant regulatory changes or technological innovation.
- UATM services in Phase 1 may include:
  - Information Exchange/Sharing (Providing information by voice in the vertiport airspace and the UAM route)
  - Airspace Management (Implementation of vertiport airspace, UAM route, etc.)
  - Conflict Management (Capacity management of congested ports)
  - Confirmation of Flight Plan
  - Conformance Monitoring & Coordination (Obtaining location information using ADS-B, providing information by voice, etc.)



Phases of AAM Introduction (Phase 2 / Phase 3)

Phase 2 :

- AAM operations will be scaled up. Medium-to-high density, piloted operations (including remotely piloted) are expected.
- Larger and more complex vertiports will be developed including in complex urban environments, e.g. on top of buildings.
- New airspace concepts and advanced UATM services will be implemented where required to support the scale and nature (e.g., remote piloting and IMC) of AAM operations.
- UATM services in Phase 2 may include:
  - Information Exchange/Sharing (Information provision and exchange through data)
  - Airspace Management (Implementation of UAM corridors and dynamic airspace management are included)
  - Conflict Management (Advanced coordination including capacity management of airspace and flow management)
  - Flight Plan Authorisation
  - Conformance Monitoring & Coordination (Real-time deconfliction will be also considered.)



Phase 3 :

- Japanese AAM operations will be scaled up including high-density operations. Operations in the UASA will include a mix of piloted and remotely piloted operations. Operations may become more sophisticated as autonomous operations commence.
- It is expected that, at some point, all airspace users in the UASA will use UATM services. UATM concepts may be expanded to other airspace outside of the UASA and integrated with ATM and UTM.