経済産業省

Headed towards “Air Mobility Revolution”

January 2019

Manufacturing Industries Bureau

Ministry of Economy, Trade and Industry

Drastic Reform in Mobility

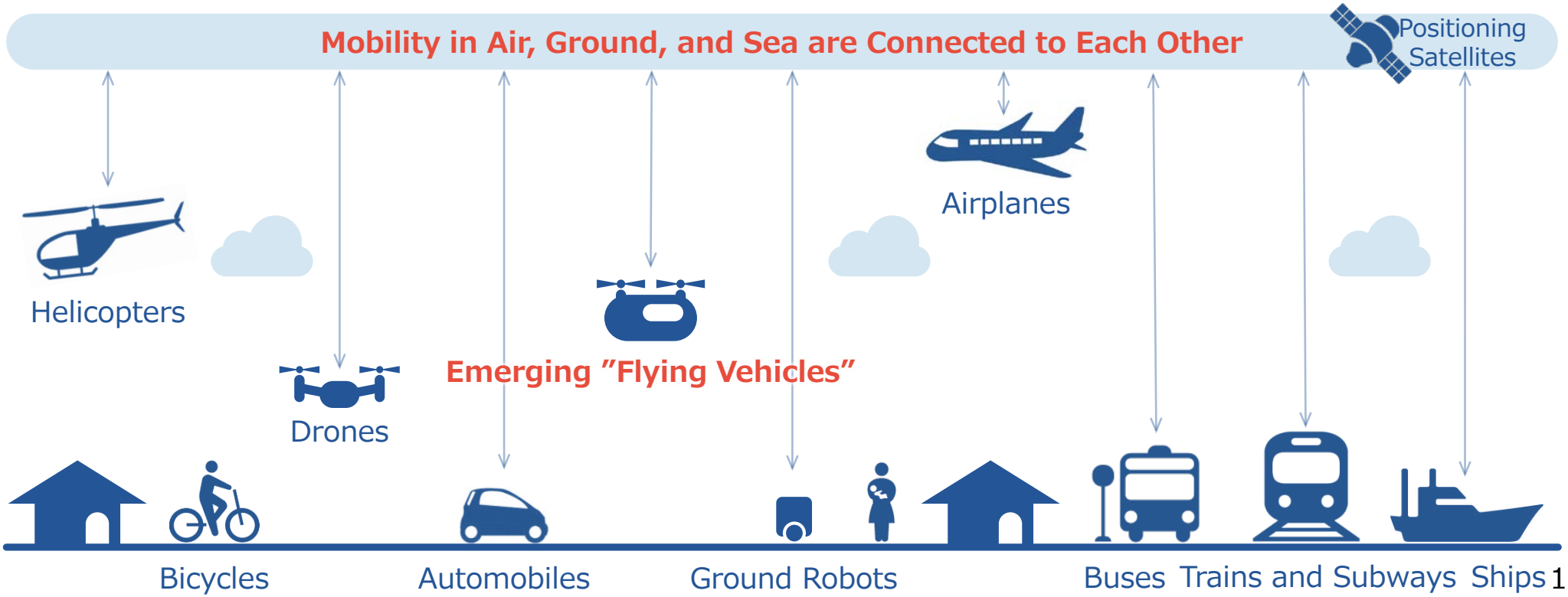
- The field of mobility has been confronted by a revolutionary change due to emergence of drones and autonomous driving.

1. Total Mobility Services: Connecting Air, Land, and Sea Mobility

"Hedges" among players and regulations of each mobility will be removed. The society will be established in which mobility in air, ground, and sea become seamless. Diverse services will be introduced to meet with customers' needs.

2. Air Mobility Revolution: Emerging "Flying Vehicles"

"Flying Vehicles" have emerged to take a role between airplanes and drones. The tide of electrification and automation have already taken place not only on the ground but also in the air. The substantial use of the "sky" in the world is still limited. Competition surrounding ***air mobility*** should be fiercer in the near future.

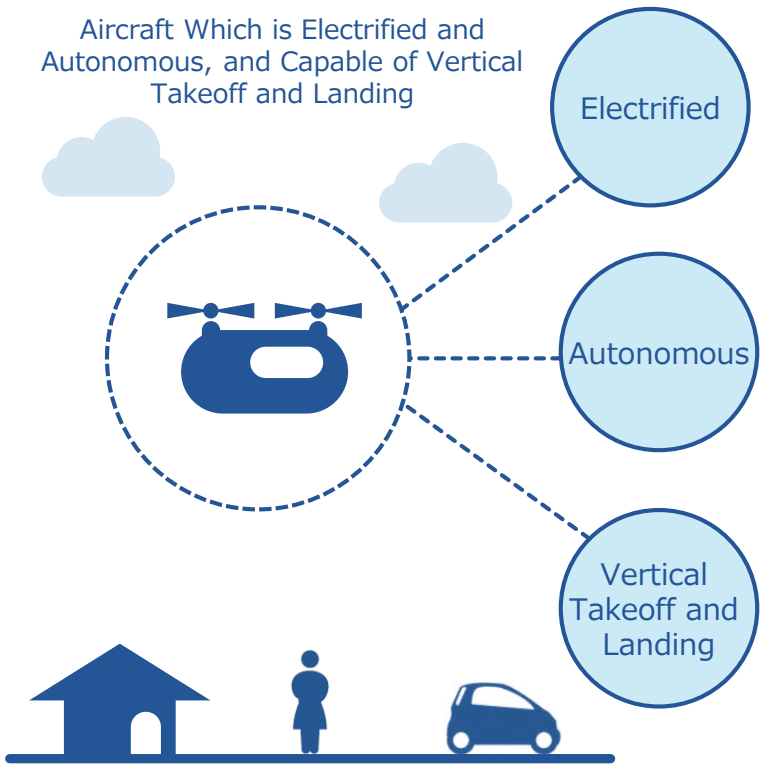


What is “Air Mobility”?

- Amongst various definitions, “air mobility” includes “flying vehicles”, whose typical features are “electrified”, “autonomous”, and “vertical takeoff and landing”. Flying vehicles require less costs for production, operation, and infrastructure, thus enabling “popularized air mobility”, that is, fast and convenient mobility of people and goods with less cost.
- By realization of such advanced mobility society with “flying vehicles” which offers rides to people and goods “at any time” and “to anywhere from point to point”, development of Japanese industries and overcoming social issues inside and outside Japan would be expected.

“Flying Vehicles”

Aircraft Which is Electrified and Autonomous, and Capable of Vertical Takeoff and Landing



”Air Mobility Will be Popularized”

Comparison to Helicopter

Number of Components: Fewer

Maintenance Cost: Lower

Noise: Lower

Compatibility with Autonomous Drive: Higher

↓

Human Pilots: Not Required

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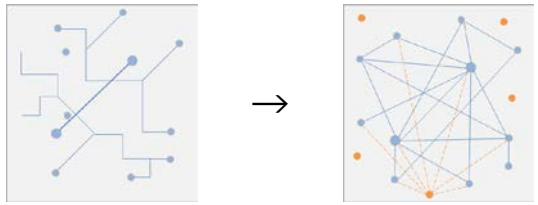
Operational Costs: Lower

“Flying vehicles” offer mobility with optimum speed and distance without relying on existing infrastructures

Concept of Mobility Will be Changed

Linear Mobility → Point to Point Mobility



※ Features of “flying vehicles” should not be limited to ”electrified”, “autonomous”, and “vertical takeoff and landing”; there are already flying vehicles being developed to be equipped with capabilities such as “hybrid”, “human-piloted”, and “horizontal takeoff and landing”.

Global Trend in “Air Mobility”

- Various players from venture companies to large enterprises in Europe, the United States, and China have launched projects pertaining to “air mobility”, and have conducted a number of research and development as well as feasibility study projects. Governments of countries such as Dubai and Singapore have been active towards implementation of “flying vehicles” to overcome social issues such as traffic congestion.

<Private Companies in EU, US, China, and Japan>

Uber

- By cooperation with NASA, aiming for ride share services including “Sky Area” by 2023 (initially human-piloted)

CART!VATOR

- An aspired organization supported by TOYOTA, and planning to release their “SkyDrive” by 2020.


Airbus

- Announcing various concepts: a four-seater flying vehicle called “City Airbus” will be put on practical use by 2023


Ehang

- Chinese drone maker. Developing a one-seater vehicle “184”. Having conducted test flights in China and Dubai.


<Governments>

Dubai

- RTA (Roads and Transport Authority) leads air mobility projects to autonomize 25% of all vehicles by 2030
- RTA leads the “air mobility” projects, providing test fields to Volocopter and Uber

Singapore

- Actively promoting “Air Mobility“ implementation project to address social problems, as Singapore having limited land being faced with population increase
- Airbus is conducting feasibility studies under cooperation with Ministry of Transport, Singapore

Expected Use Cases

Urbanized Areas

Speedy and Comfortable Transportation
(Eliminating Ground Traffic Congestion without Vast Investment to Infrastructures)

Disaster Sites

Prompt Provision of Rescue as Well as Supply of Emergency and Disaster Relief Goods
(Enabling Rescue and Support without Relying on Ground Infrastructures to be Recovered)

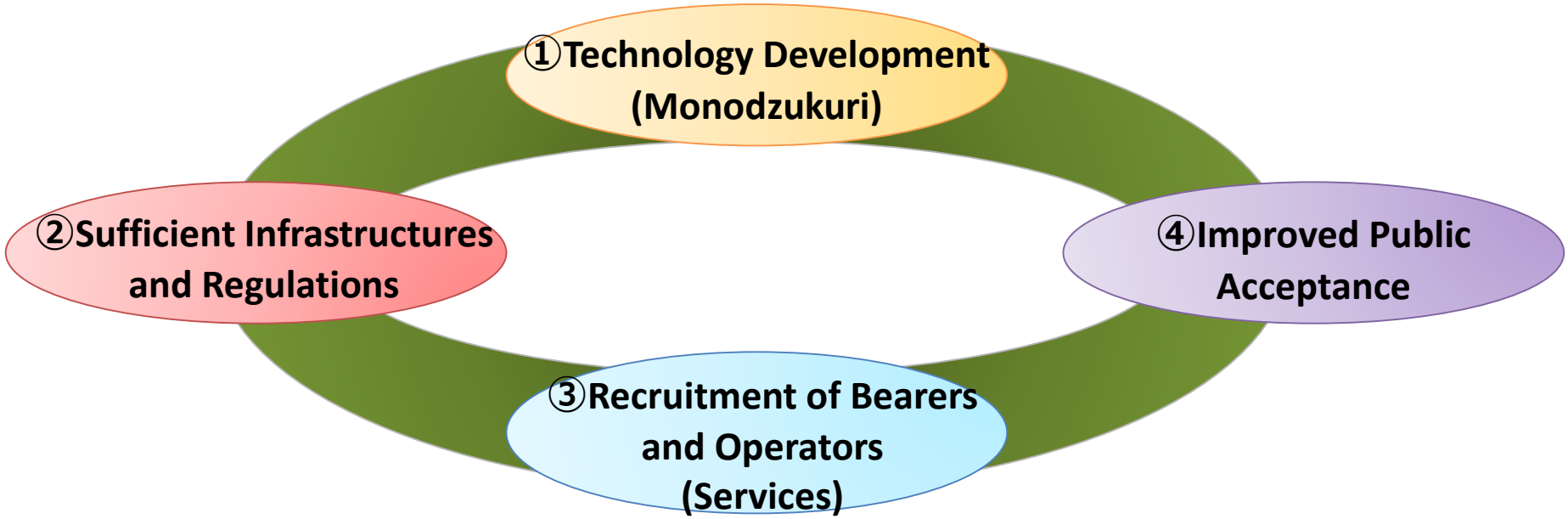
Remote Islands and Mountainous Areas

Offering Easier Access to Rural Areas Which are Inconvenient and Difficult to Access
(Creating Use to Revitalize Depopulated Areas for Sightseeing and Other Recreational Purposes)

Issues Surrounding "*Air Mobility*"

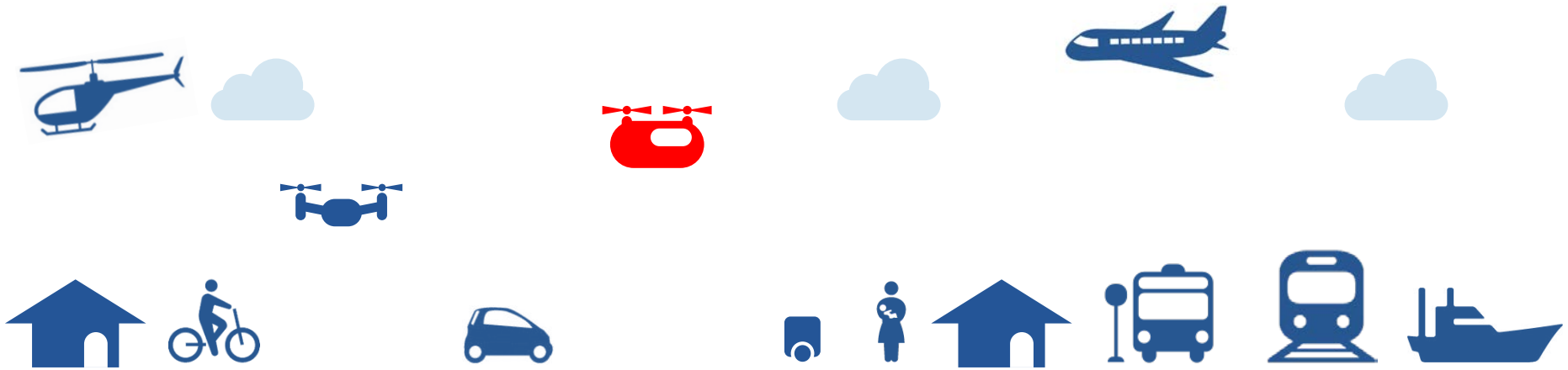
- In order to realize "***air mobility***" ahead of the world, the following main issues should be addressed.

①Technology Development - Electrification and Autonomization
②Sufficient Infrastructures and Regulations – Operation Management and Airworthiness Certificate Based on Feasibility Studies
③Recruitment of Bearers and Operators – Establishment of Basis for Social Implementation
④Improved Public Acceptance – Increased Understanding on "*air mobility*"



Headed towards “Air Mobility Revolution”

- Effective full use of the “grand sky” with “flying vehicles”, that is, “air mobility”, has substantial potential to create a totally new society and at the same time to overcome numerous social issues with innovation, as it happened with the post-war automobile diffusion (motorization) in Japan.
- In spite of trends in overseas that vast numbers of players having been participating in manufacturing and services related to ***“air mobility”***, **almost any of such trends has currently been observed in Japan.**
- In order to invite potential domestic players to participate in the market while generating “a centripetal force” to attract overseas players, for Japan to thereby lead global innovation,
  - **the elements ① - ④, that are, ①Technology Development (Monodzukuri), ②Sufficient Infrastructures and Regulations, ③Recruitment of Bearers and Operators (Services), and ④Improved Public Acceptance, should be progressed simultaneously**, under ensured public-private cooperation and international cooperation.
  - In order to attain that, the Japanese government determined in the “Future Investment Strategy 2018” **“to establish a council for public and private sectors to discuss necessary technology developments and regulations and to formulate a roadmap by the end of this year (2018)”** (Cabinet Decision on June 15, 2018), and the council was established on August 29, 2018.



Public-Private Council for Air Transportation Revolution

Public

- Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry
- Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism
- Observers : Divisions in MIC, FDMA, MLIT

Private

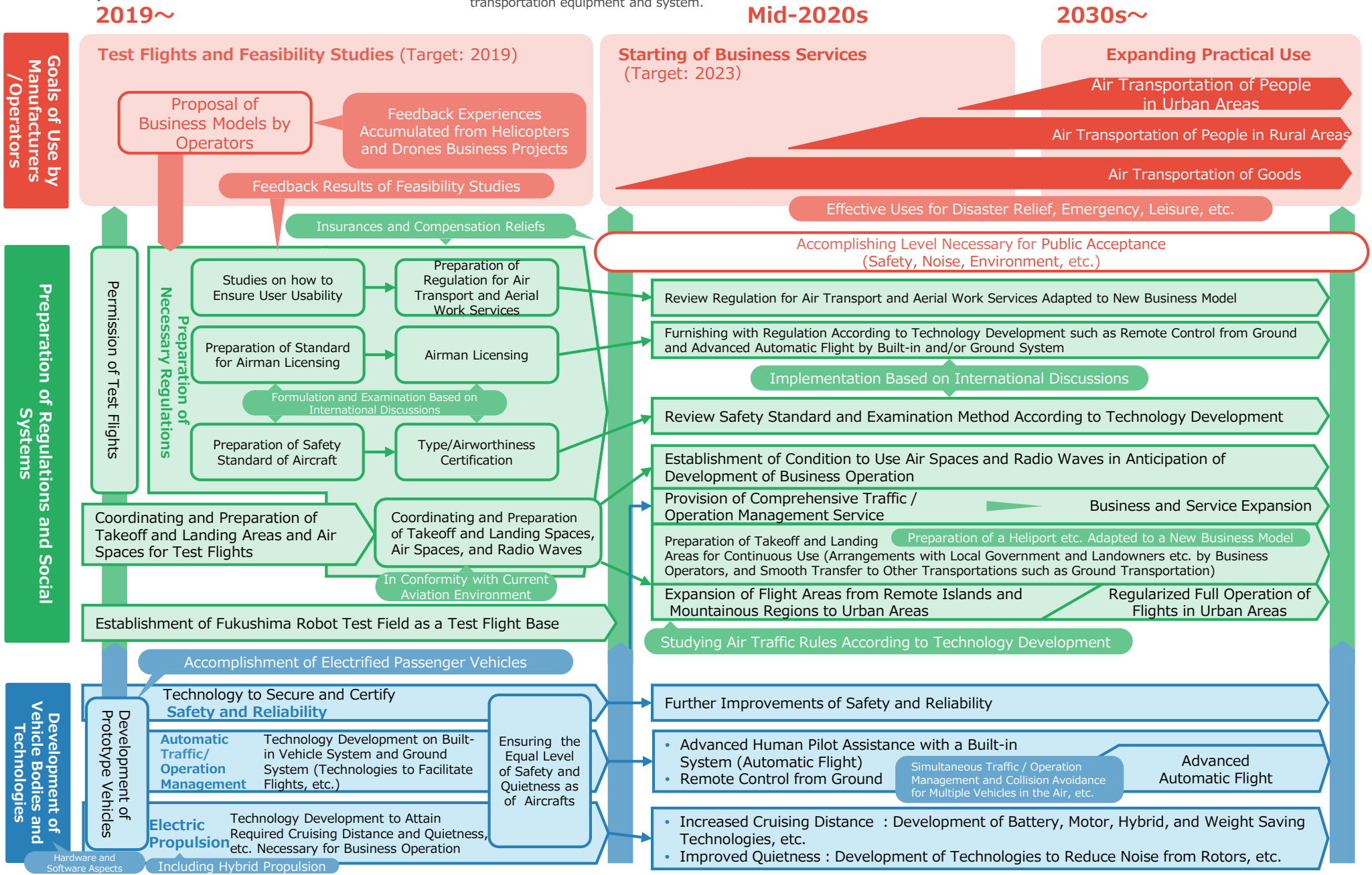
- Shinji Suzuki, Professor, Department of Aeronautics and Astronautics, Graduate School of Engineering, University of Tokyo
- Masaru Nakano, Professor, Graduate School of System Design and Management, Keio University
- Gaku Minorikawa, Professor, Faculty of Science and Engineering, Department of Mechanical Engineering, Hosei University
- Hisashi Sano, Vice President, Director General, Aeronautical Technology Directorate, Japan Aerospace Exploration Agency
- Toshinori Ogure, Vice President, Helicopter Chairperson, All Japan Air Transport and Service Association
- Kosuke Imashimizu, President, The Society of Japanese Aerospace Companies
- Kiwamu Tezuka, CEO, AirX Inc.
- Matsuoka Yuhiro, Vice President, Strategy & Marketing, Airbus JapanK.K.
- Toyoyuki Nagamine, Member of the Board of Directors, Senior Executive Vice President, ANA HOLDINGS INC.
- James Masao Toyama, Director, Public Policy and Government Relations Japan, Uber Japan Co., Ltd.
- Tsubasa Nakmura, Representative, CARTIVATOR
- Keiichi Nagayama, Associate Officer, General Manager, Helicopter Project Division, Aerospace Systems Company, Kawasaki Heavy Industries, Ltd.
- Ohta Hiroaki, President, Autonomous Control Systems Laboratory Ltd.
- Fukuzawa Tomohiro, President, SkyDrive Inc.
- Shoichiro Tozuka, Aerospace Company President, SUBARU Corporation
- Tasuku Nakai, CEO, teTra aviation corp.
- Hiroji Hukui, CEO, Temma Inc.
- Kotaro Chiba, Founder/ Managing Partner, Drone Fund
- Nishihata Tomohiro, Executive Officer Innovation, Japan Airlines Co., Ltd
- Norihiko Ishiguro, Senior Executive Vice President and Member of the Board, NEC Corporation
- Masakazu Kono, CEO, PRODRONE Co., Ltd.
- Takuya Masamura, Regional Sales Manager, Bell
- Miwa Kobayashi, Director, Government and Corporate Affairs, Boeing Japan, The Boeing Company
- Shinji Makiura, Managing Executive Officer, Yamato Holdings Co., Ltd.
- Koji Ando, Group Managing Executive Officer, Rakuten, Inc.

Roadmap towards Air Transportation Revolution

20 December 2018 Public-Private Council for Air Transportation Revolution

This Roadmap depicts a flow of technology developments and establishment of regulations which should be progressed with public-private cooperation. The Roadmap focuses on possibility that realization of more familiar and convenient air transportation means by so-called "a flying vehicle" – an electrified, vertical takeoff and landing, and pilotless aircraft – will lead to solve issues in both urban and regional areas.

(Note) It should be recognized that a grand design pertaining to use of the sky will be necessary under developmental trends of other transportation equipment and system.

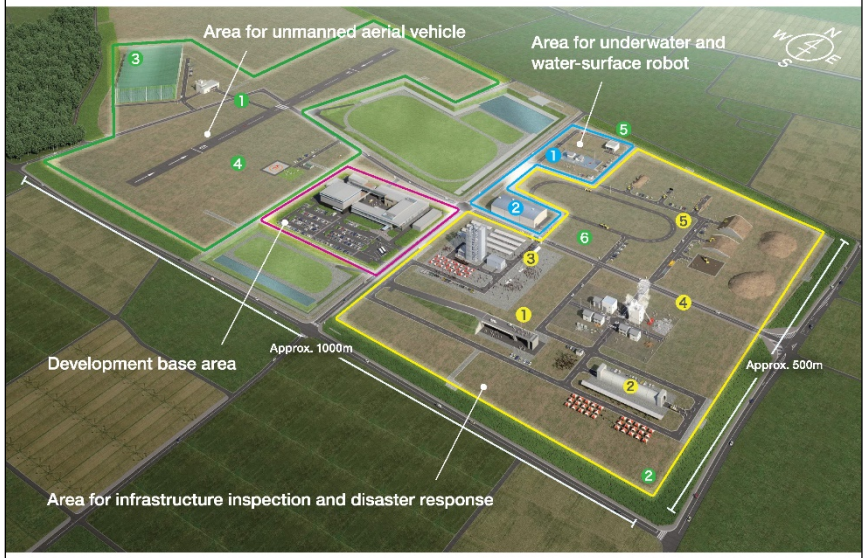


Future Images

Fukushima Robot Test Field

Fukushima Robot Test Field

"Fukushima Robot Test Field" to be developed based on Fukushima Innovation Coast Concept is one of the largest research and development bases in the world, where R&D, verification test, performance evaluation and maneuver training can be carried out while reproducing the actual use environment within the base, mainly for the field robots of land, sea and sky such as unmanned aerial vehicles, disaster response robots, underwater exploration robots that are expected to be utilized for logistic, infrastructure inspection, large-scale disaster time, and etc. This base is planned to develop a runway for long distance flight test in Namie-machi Tanashio industrial complex, as well as to establish "Area for unmanned aerial vehicle area", "Area for infrastructure inspection and disaster response", "Area for underwater/water-surface robot area" and "Development base area", securing the area of approx. 1000m east-west and approx. 500m north-south within the Restoration industrial complex site in Minamisōma city, and will be opened sequentially after FY 2018.



Fukushima Innovation Coast Concept

The Fukushima Innovation Coast Concept aims at building a new industrial base in this region, in order to restore industries in Hama-dori and other areas that have been lost due to the Great East Japan Earthquake and nuclear disasters. We are working on industrial clusters, human resource development, and expansion of interaction population, as well as promoting the implementation of projects relating to decommissioning of reactor, robots, energy, agriculture, forestry and fisheries.