



New Business Domains

November 15, 2024

Japan Airlines Demonstrates Single Remote Pilot Simultaneously Operating Five Drones Nationwide
~ Effectiveness and Challenges of Multi-Drone Operations Control Systems ~

Japan Airlines Co., Ltd. (JAL), in collaboration with the New Energy and Industrial Technology Development Organization (NEDO) and KDDI Corporation (KDDI), conducted a demonstration test in which one remote pilot simultaneously operated a total of five drones at four sites across Japan from October 28 to 31, 2024 (hereinafter "demonstration"). This demonstration was conducted as part of NEDO's "Development of Element Technologies for Drones or Unmanned Aircraft and Systems Enabling One-to-Many Drone Operations" (hereinafter "the Project") under the "Realization Advanced Air Mobility Implementation Project (ReAMo Project)".

In this demonstration, KDDI developed an operations control system for simultaneous multiple-drone flights, while JAL conducted a risk assessment based on its flight safety expertise and technology, and established operational procedures. A particular feature of the system is the addition of voice notification and operation support functions for irregular operations to the operations control system to prevent human error. As a result, a single pilot operated a total of five drones safely and efficiently at four sites across Japan in different weather conditions and other operating environments, confirming the effectiveness of the flight safety system and operations control procedures. On the other hand, issues that arise when irregularities such as drone aircraft and system problems and environmental changes occur simultaneously were also confirmed, and data that will contribute to improving system functions and operations control quality in the future was obtained.

The findings of this experiment will be utilized in the system for the simultaneous operation control of multiple drones to be designed by public and the private sectors together, thereby contributing to the social implementation of drones.

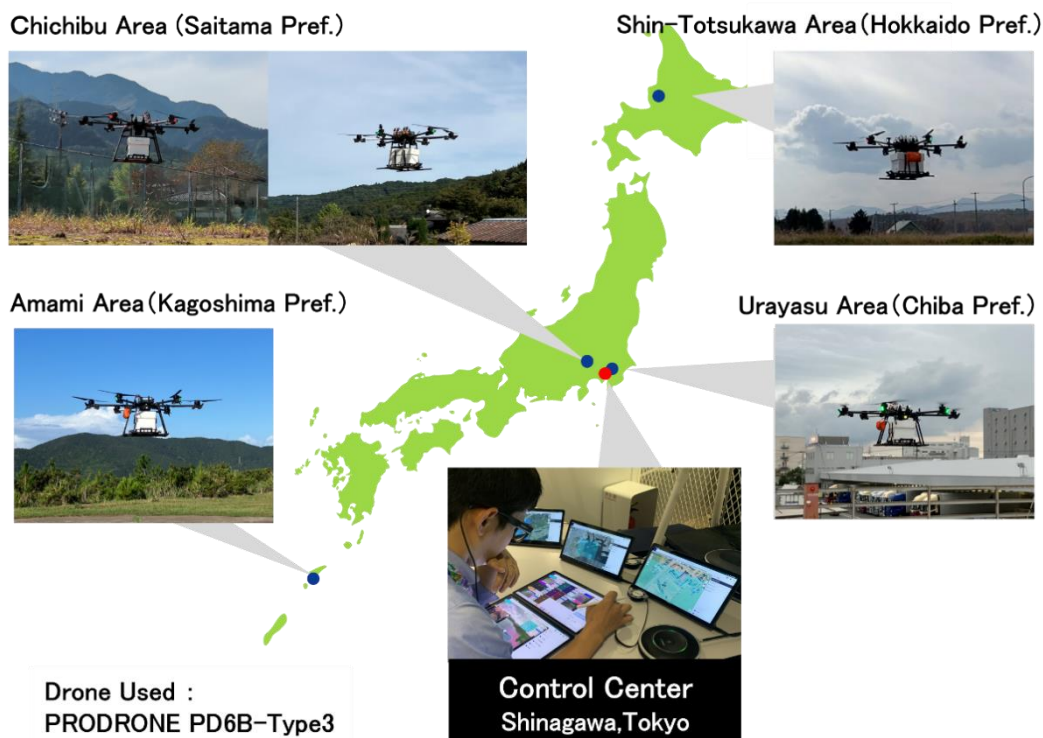


Figure 1: Simultaneous operation of five drones by a single pilot

1. Background

Drones are being further implemented and commercialized to solve various social issues in Japan, such as the 2024 logistics problem, labor shortages due to the decrease in the working-age population, aging social infrastructure, and depopulation and aging of local communities. In order to realize this goal, in addition to the establishment of remote, automated, out-of-sight technologies that require accurate understanding and judgment (monitoring) of flight conditions based on limited information, advanced operations control is required, including simultaneous operation of multiple drones, which contributes to further labor savings and efficiency. It is necessary to clarify the technical requirements and operational procedures for operations control systems through risk assessment and mitigation measures in accordance with such assessment.

Against this background, NEDO has been working on the following R&D items since FY2022 in this project*1 to formulate operational requirements and develop an operations control system to realize the simultaneous operation of multiple drones.

- (1) Examination of system requirements and operational requirements for one-to-many operations
- (2) Development of an operations control system for one-to-many operations
- (3) Obtaining approval for flight verification
- (4) Flight demonstrations of multiple drones flying simultaneously in multiple airspaces
- (5) Verify the business potential of one-to-many operations

In the FY2024 demonstration, the number of flight sites was expanded to four, and simultaneous operation of five drones at four sites was achieved by one pilot operating remotely.

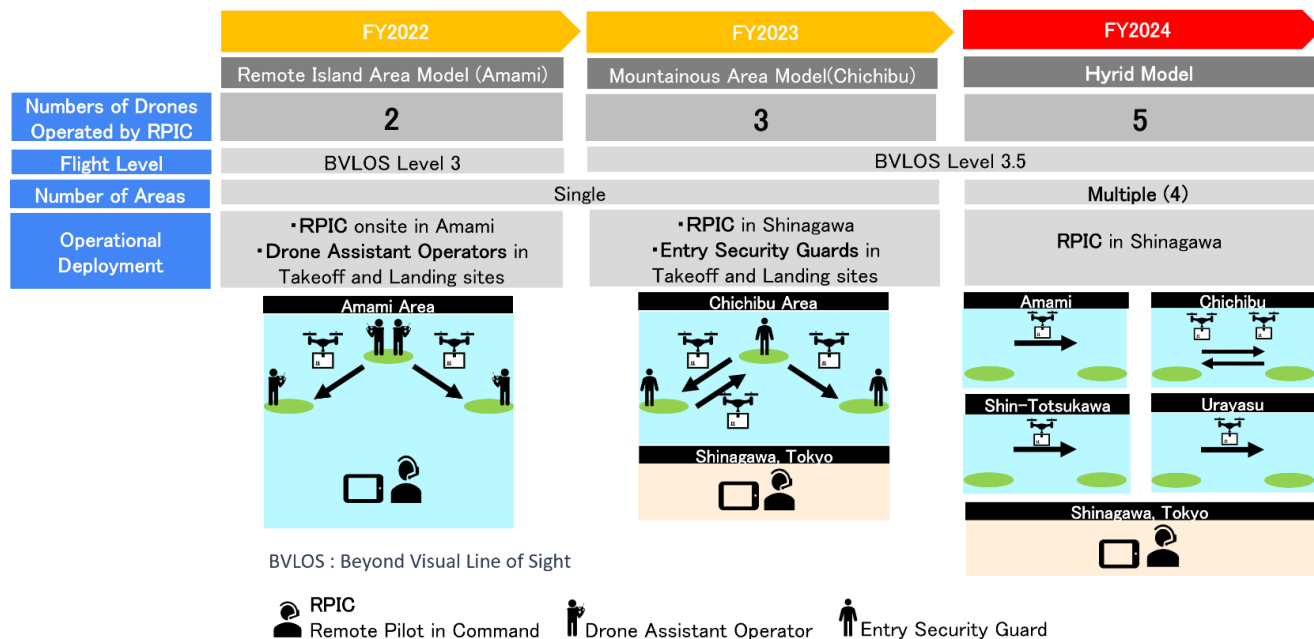


Figure 2: Operational frameworks for one-to-many

2. Results of this project

Remote autopilot operation of drones requires advanced operations control, which involves real-time and precise monitoring of the aircraft's flight status and weather conditions through a monitor display, and manual operation when necessary. In this demonstration, a safety and flight information system were automated and integrated for the simultaneous flight safety of a large number of drones (five in this demonstration), and a safety control system was established to clarify the division of roles between the pilot and the system (man-machine interface).

The operations control system has a new function that notifies the pilot of irregularities, such as the unexpected approach of another drone or a low battery, through on-screen pop-ups and voice messages, and provides advice on how to deal with the situation. This system has been verified to ensure that even in the event of irregularities, the pilot can complete flight safety in accordance with the predetermined operations manual with the support of the system.

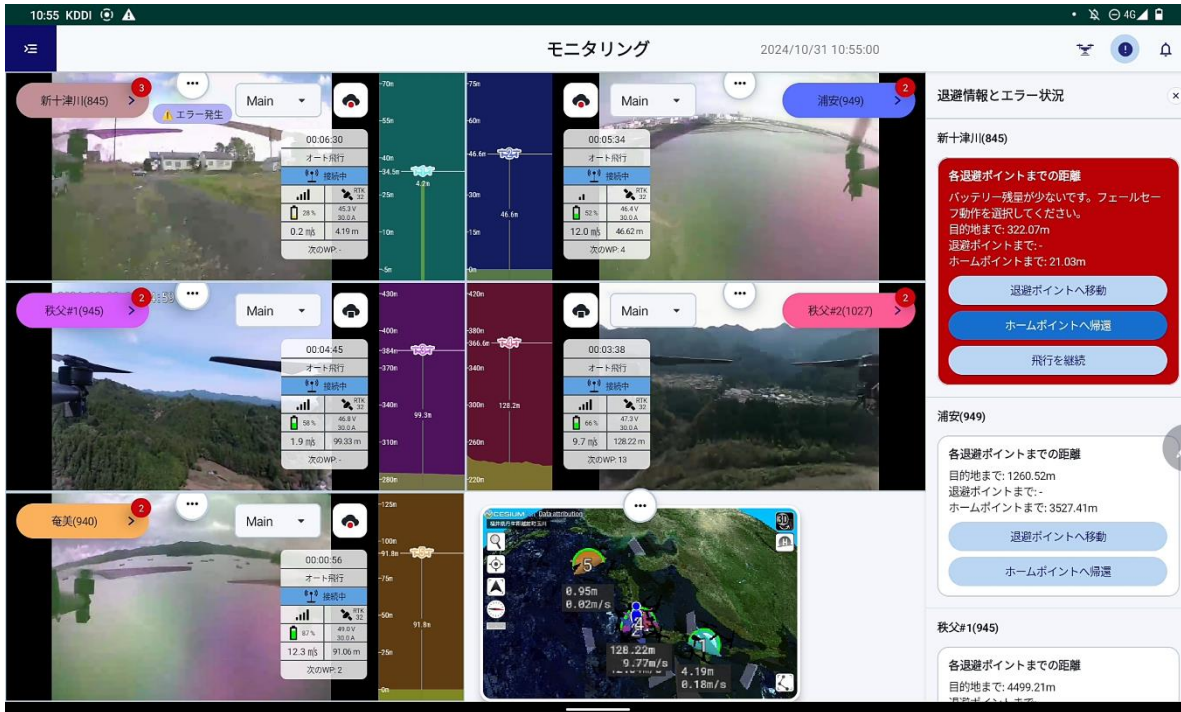


Figure 3: Monitor display of operations control system for simultaneous multiple drones (during irregularity)

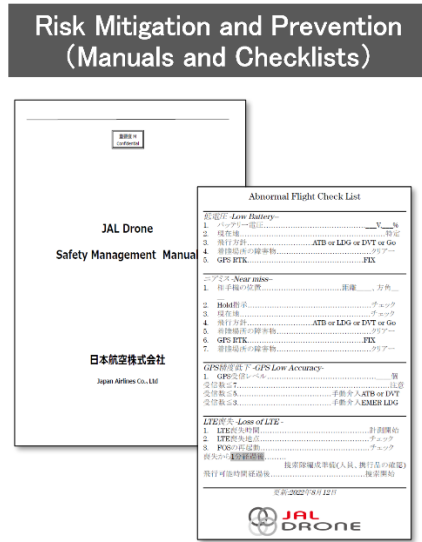
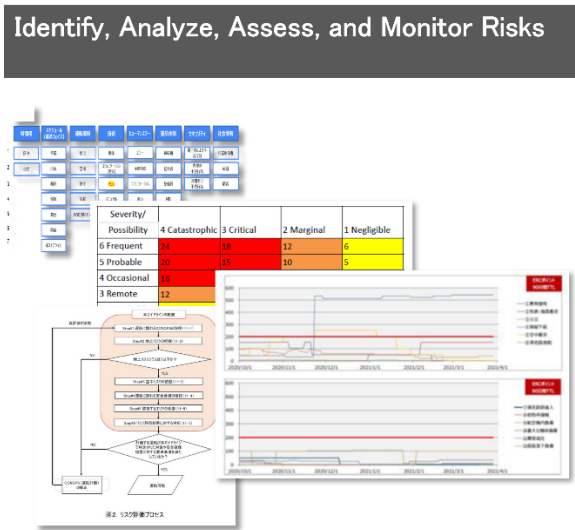


Figure 4 Risk assessment and response procedures (image)

3. Future Plans

Through this demonstration, JAL, KDDI, and NEDO have confirmed the effectiveness of the operations control system and operational procedures, including irregularity handling, as well as the issues involved. In the future, in order to systematically define requirements, JAL, KDDI, and NEDO will accumulate and verify data using a virtual environment in addition to the trial. The findings of this demonstration will also be utilized in the design of a system for the simultaneous operation of multiple drones, thereby contributing to social implementation of drones.



Note

*1. Project

Project name: Realization Project for Social Implementation of Next-generation Air Mobility (ReAMo Project) / Establishment of operational requirements and development of operations control system to realize simultaneous operation of multiple drones

Project period: FY2022 - FY2024

Defining operation requirements and development of flight operation system toward the simultaneous operations of multiple drones

https://reamo.nedo.go.jp/en/introduction/introduction_1_1_4_1

Demonstration in FY2023:

JUL 03, 2024: KDDI and JAL Achieve Simultaneous Operation of Three Drones with a Single Remote Pilot

<https://press.jal.co.jp/en/release/202407/008164.html>