

# Conducting Demonstration Testing of Automated Driving Bus inside the Restricted Area of Haneda Airport

—Aiming at implementation from 2020, verification of driving in the peculiar airport environment—

Aichi Steel Corporation (President: Takahiro Fujioka, hereinafter Aichi Steel), SB Drive Corp. (President & CEO: Yuki Saji, hereinafter SB Drive), Advanced Smart Mobility Co., Ltd. (President: Keiji Aoki, hereinafter Advanced Smart Mobility), ALL NIPPON AIRWAYS CO., LTD. (President: Yuji Hirako, hereinafter ANA), NIPPO CORPORATION (President: Yoshikazu Yoshikawa, hereinafter NIPPO), with NEC Corporation (President & CEO: Takashi Niino, hereinafter NEC), a six company cooperation has worked together to conduct a demonstration testing of an automated driving bus in the restricted area of Haneda Airport from January 15 to 25, 2019.

## 1. Demonstration Testing Background

ANA and SB Drive are aiming at implementation of automated driving buses in the airport from 2020, and have been conducting demonstration testing since February 2018 in Haneda Airport's new maintenance ground area to verify vehicle driving control technology and remote operation control system.

For the demonstration testing this time, as the next step aimed at implementation, the aforementioned six companies cooperated to verify necessary environmental arrangement for the travel of the automated driving bus in the peculiar airport environment where aircraft and special vehicles run, in addition to identifying issues for the implementation.

Furthermore, this demonstration testing is conducted as part of the first automated driving demonstration testing in Japan, that the Ministry of Land, Infrastructure, Transport and Tourism is conducting at four domestic airports, aiming to promote aviation innovation, labor saving and automation of ground support operations.

## 2. Details of Demonstration Testing

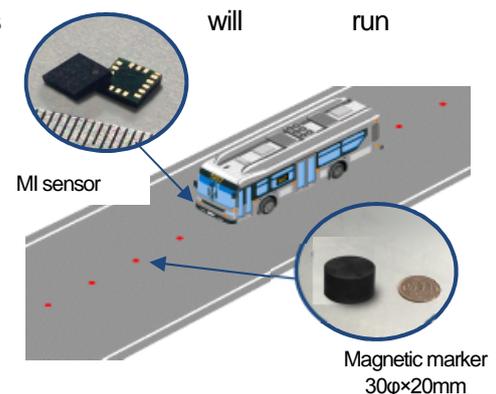
In this demonstration testing, commercially available small buses that have been remodeled by Advance Smart Mobility are used. A Level 3<sup>\*1</sup> driving will be tested; the bus between Haneda Airport Terminal 2 main building and satellite (separate building) while mainly carrying out the following verifications. This demonstration testing will be conducted with involved personnel only, and no customer transportation will take place.

### **(1) Lane position control that utilizes Magnetic positioning system**

Since the travel route for this testing, is one actually utilized by dedicated vehicles for passenger transport or cargo conveyance, travelling with a



Automated driving bus used in the demonstration testing



high-precision lane position adjustment is sought, although there are areas where reception of GPS radio waves is impossible due to obstructions in the surroundings. To that end, high sensitivity magnetic sensors (MI Sensor), installed on the bottom of the vehicle, are used to detect magnetic markers laid underground along the travel route so that the vehicle position is automatically and stably adjusted even in environments where GPS radio waves do not reach. Furthermore, since the magnetic markers used in the testing are equipped with newly developed RFID Tag<sup>2</sup> to respond to the IoT/big data age, for the first time domestically, the reading efficiency of next generation magnetic markers buried in an airport restricted area was verified.

**(2) Operation control using the “Dispatcher” remote operation control system**

An operator in a remote location controls bus operations using the “Dispatcher” remote operation control system from SB Drive. At the bus stops, the staff informs the operator that embarking or disembarking operations have been completed, and the operator confirms that it is possible for the bus to depart.

Moreover, on the route there is a stop line for the travelling vehicles to avoid the blast<sup>3</sup> from the aircraft engines, and after the bus stops there, the operator can restart travelling, once they have confirmed the blast situation from “Dispatcher”.

**(3) The automated driving bus cruising inside the restricted area of the airport**

In the restricted area of the airport, where there is traffic of aircrafts and special vehicles and the ground support operations take place, it is a very different environment from ordinary public roads. In such an environmental setting, the testing verifies the travelling technology of the automated driving bus using the magnet marker system and Dispatcher and identifies issues, aiming to promote aviation innovation, labor saving and automation of ground support operations.

**3. Demonstration Testing Overview**

(1) Period: January 15 to 25, 2019

(2) Place: Inside the restricted area of Haneda Airport (Tokyo International Airport) (Route: about 600 m one-way)

(3) Vehicles used: Automated driving bus, modified from the base “Hino Poncho” bus of Hino Motors, Ltd.

(Main devices equipped: automated steering gear, automatic braking control unit, GPS receiver, LiDAR, traveling control ECU, sensor unit for magnetic markers)

(4) Main operation contents

- Verifying Level 3 driving of the automated driving bus in the peculiar airport environment where aircraft and special vehicles run

- Identifying issues and verifying necessary environmental arrangement for the implementation of automated driving bus in the airport

(5) Duties of each company

Company	Main duties
Aichi Steel	Installation of magnetic markers, control/management of Magnetic positioning system
SB Drive	Provision of “Dispatcher”, verification of evasion of blast by grasping position of aircraft remotely
Advanced Smart Mobility	Provision of automated driving bus, verification of technology regarding traveling
ANA	Various operation coordination with the parties involved, drivers’ dispatch, identification of issues for implementation
NIPPO	Installation and removal of Magnetic markers
NEC	Control/management of Magnetic positioning system, design and manufacture of reading equipment

\*1 By SAE International definition (J3016), Level 3 driving is indicated when all the driving tasks are carried out by an automated driving system (inside limited areas). If the continuation of operation is difficult, the driver is expected to give adequate response to the system's intervention demand. (Source: Public and private ITS vision, Roadmap 2017)

\*2 A tag in which an IC chip for information exchange by short distance radio communication utilizing electromagnetic fields or radio waves has been embedded

\*3 High temperature and high pressure exhaust gushed out by the aircraft jet engine

- Dispatcher is a trademark of SB Drive Corp. (Trademark registration application pending)
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