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AGENDA ITEM 3: AVIATION SAFETY

SAFE IMPLEMENTATION OF AUTONOMOUS VEHICLES AT THE AIRSIDE

(Presented by Japan and Singapore)

SUMMARY

This paper presents Japan and Singapore's experiences in the implementation of Autonomous Vehicles (AV) at the airside and highlights the need to develop Guidance Materials (GM) and/or Standards and Recommended Practices (SARPs), as necessary, to facilitate the safe and efficient implementation of AV at the airside.

To meet the manpower challenges and improve operational productivity at the airside, many countries are beginning to explore the use of AV for the transport of baggage, cargo, passengers and workers at the airport. While AV technology has its potential benefits, the use of vehicles with high or full autonomy is still in the experimental stage. Development of international requirements to standardise visual aids, rules of engagement, and processes would significantly help to facilitate safe AV operations at the airside.

SAFE IMPLEMENTATION OF AUTONOMOUS VEHICLES AT THE AIRSIDE

1. INTRODUCTION

1.1 Ground handling is a manpower-intensive domain that involves a multitude of vehicles, equipment and ground personnel working together in tandem near an aircraft. The ground handling sector is facing several severe challenges. Not only is there an increasing number of ground servicing equipment and larger-sized aircraft, there is also increasing pressure to achieve shorter turnaround time with less available manpower amidst a sharp increase in post-pandemic air traffic. All these challenges compound the safety risks to ground handling personnel and aircraft operations.

1.2 The deployment of autonomous vehicles (AVs) at the airside can help to improve ground handling safety and productivity. It would also allow the re-design of airside ground handling jobs, e.g. taking over physically demanding and time-consuming tasks and reducing labour reliance.

1.3 The airside is also a complex and dynamic environment where careful planning and coordination are necessary to ensure that AVs can integrate safely and effectively into ground handling operations with existing manned equipment.

1.4 Many airports are working independently to trial the use of AVs at the airside and develop their own safety measures and concept of operations. The airside is a complex and dynamic environment where careful planning and coordination are necessary to ensure that AV operations can integrate safely and effectively into ground handling operations with existing manually driven and operated equipment. The establishment of international standards and guidance materials to create a trusted and safe ecosystem can help the safe and efficient implementation of AVs at the airside.

2. DISCUSSION

2.1 The AV sector is developing and evolving rapidly, with diversifying detection and analysis technologies being applied to different types of AV. However, the airside is a complex and dynamic environment that involves simultaneous operations of many manned vehicles, equipment, personnel, and aircraft. Ground handling service providers would consider their unique situations to determine the most suitable AV that would work best for their operations and environment.

2.2 AVs would also need to be suitably equipped to operate safely at the airside – these include capabilities such as obstacle detection for various types of airside equipment, secure and low latency communications with a remote operator or fleet management system, and operating algorithms customised for the airside environment.

2.3 AVs have the potential to bring many benefits, such as reduced human errors, lower reliance on manpower, enhanced efficiency, improved ground handling safety, and carbon reduction. Many airports are working independently to introduce AVs to the airside. On the other hand, it is important to recognise that an AV operates differently from manned vehicles and equipment. The existing regulations, processes, and practices might not be suitable for AV operations. New regulations or guidance materials should be developed to ensure safe and efficient operations when AVs share the same space with airside workers. This may include:

a) Standardisation of AV movements in the airside, e.g. ingress and egress of AV at aircraft stands;

b) Additional visual aids to facilitate AV operations, e.g. road signs and markings to indicate areas reserved for AV;

c) Training of airside workers and personnel involved in AV operations to safely integrate AV into existing ground handling operations; and

d) Rules of engagement and processes, e.g. integration of AV into ground handling

procedures.

2.4 The following paragraphs present the safety oversight experiences from Japan and Singapore in deploying AV at the airside.

Japan

2.5 In Japan, where strengthening airport functions is part of the government's tourism promotion measures, the declining working-age population and labor shortages are major challenges, and as one solution to these issues, the public and private sectors have been working together since 2018 to utilise advanced technologies such as Internet of Things (IoT), Artificial Intelligence (AI), and automation technology for aviation innovation. As part of this effort, the government has decided to promote labor-saving and automation of airport ground handling operations, and a government goal has been set to introduce Level 4, meaning unmanned operation under limited conditions, by 2025.

2.6 Based on the above, the Japan Civil Aviation Bureau (JCAB) established a study committee consisting of airlines, ground handling service providers, manufacturers developing AVs, aerodrome operators, and experts on this field to promote and support the development of this technology in 2018. The committee has supported the activities of groups wishing to conduct demonstration tests with a focus on bus-type vehicles and tow tractor-type vehicles, which have the highest potential for benefit from the introduction of automated technology.

2.7 In the early stages of development, the group conducted demonstration tests at airports with easy travel routes, such as Saga and Sendai airports, to determine vehicle performance and identify issues, and gradually settled on checkpoints and rules necessary for the operation of AVs while incorporating the opinions of experts.

2.8 In March 2021, a Level 3 towing tractor, which runs automatically with a driver who can take over driving in case of emergency, was introduced for actual operation at Narita Airport. Since then, under the study committee, the introduction of Level 4 AV has continued to be studied with the goal of actual operation in 2025, and development has been steadily progressing, with demonstration tests being conducted at Haneda Airport, Narita Airport, Chubu Centrair International Airport, and several other airports.

2.9 In the process of the demonstration tests to date, it has become clear that some functions need to be augmented in the introduction of AVs through infrastructure improvements and rule revisions based on their characteristics, that remote monitoring is necessary to respond quickly in the event of an accident, etc., and that aerodrome operators need to play a significant role in the introduction of AVs.

2.10 JCAB is sharing information with Singapore and other States that have taken similar initiatives and is working to make this a movement toward the establishment of international standards and guidance materials as part of ICAO's activities.

Singapore

2.11 The Civil Aviation Authority of Singapore (CAAS), Changi Airport Group (CAG, the aerodrome operator of Changi Airport), and ground handling service providers have been exploring the use of AVs at Changi Airport airside since 2014. The organisations have collaborated to design and conduct several trials to demonstrate proofs of concept of autonomous shuttle buses, tractors, and cargo dollies. Recently, CAAS has also supported CAG and ground handling service providers to trial autonomous tractors serving live flights at Changi Airport Terminal 3 from August 2021. About 10,000 hours of trials involving three types of autonomous baggage tractors have since been conducted with a safety driver onboard, with no incidents caused by AVs.

2.12 In June 2023, the trials advanced to the next stage. The onboard safety driver was removed from the vehicle, and the supervision of the AV operations was conducted remotely from a separate location. This marked a significant milestone in the AV trials. Following a period of continued

trials and further refinements to the concept of operations, Changi Airport targets to drive deployment of a small-scale AV fleet of 3 – 5 vehicles by 2024, moving beyond the trial stage to deployment to support live flights.

2.13 Recognising that new measures are necessary for safe AV trials and deployment, CAAS published an Advisory Circular (AC) in March 2023 to provide guidance for the safe operation of AVs at the airside. In developing the AC, CAAS took reference from the local technical materials for AV operations on public roads, explored frameworks implemented by other States and airports, and conducted industry consultations.

2.14 The AC recommends that the aerodrome operator establish a framework to ensure the safe operation of AVs at the airside. The framework would require an evaluation and approval of the AV operations, including the safety assessment of the AV system, training and assessment of personnel involved in AV operations, maintenance of the AV, ensuring compliance with the existing requirements, and monitoring the progress of the AV operation.

2.15 As more AV operations are introduced to the airside, we recognise that training and education of all levels of stakeholders and airside workers is critical to safe and successful deployment of AVs at the airside. In this regard, CAAS has also regularly kept the workers' unions engaged and updated on the progress of AV trials and developments and how they could enhance the working environment and the nature of jobs at the airside.

2.16 CAAS aims to gather airside community's feedback and safety data relating to the performance of the AVs and its impact to airside operations from the AV trials to help develop a robust safety oversight framework. The information would enable us to establish and verify the minimum capabilities of AV, develop expectations on control and monitoring systems, and optimise the concept of operations for the various use cases of AV.

2.17 In addition, CAAS recognises that wide-scale implementation of AVs would entail a significant change in concept of operations at the airside, impacting all airside stakeholders, and at the infrastructure level, key enabling systems and technologies such as 5G network connectivity and cybersecurity systems and controls would also need to be established. As the AV trials have advanced over the last two years, CAAS and CAG are now establishing key workstreams to bring all stakeholders on board to work together towards the vision of automated airside operations across the areas of i) Technology, ii) Concept of Operations, iii) Workforce Training and Upgrading, iv) Infrastructure and v) Regulations and Liabilities. In this regard, CAAS looks forward to sharing and exchanging insights and experiences with other civil aviation authorities and airport operators involved in AV trials and operations.

Conclusion

2.18 AVs offer an opportunity to increase operational efficiency and enhance safety. The key is to build a robust safety framework for AV operations and to facilitate the adoption of AVs at the airside. This would require ICAO, States and industry to work together to develop guidance and standards, considering the knowledge and experience gained from the trial and operation of AVs in various States.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to:

a) Encourage States/Administrations to share the experience and information about AV trials and operations at the airside;

b) Encourage ICAO to consider the development of guidance materials and/ or SARPs, as necessary, to facilitate the safe and efficient deployment of AVs at the airside.

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