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FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

Agenda Item 2: Timely and safe use of new technologies
2.1: Evolving aircraft technologies contributing to LTAG

CIVIL AVIATION AIRPORT VEHICLE RUNWAY INCURSION SURVEILLANCE AND WARNING SYSTEM INTRODUCTION

(Presented by China)

EXECUTIVE SUMMARY

The runway serves as the lifeline for the safe operation of an airport. During aircraft take-off or landing, the incursion of vehicles onto the runway poses a significant safety hazard, representing the greatest risks to the operation of every airport. The civil aviation airport vehicle runway incursion surveillance and warning system is a technical prevention system designed to prevent incidents of vehicle incursion onto airport runways, utilizing spatial positioning and computing technologies. This system operates around the clock, automatically monitoring the real-time status and positions of vehicles and runways, as well as vehicles and aircraft. Upon detecting the risk of a vehicle intruding onto the runway, the system automatically warns vehicle drivers and tower controllers before the incident occurs, efficiently guiding relevant staff to the scene for intervention. This system effectively enhances the runway's safety protection capabilities, thereby increasing safety margins and playing a crucial role in enhancing airport safety.

Action: The Conference is invited to agree to the recommendation in paragraph 3.2.

1. INTRODUCTION

1.1 Current status of traditional runway incursion prevention systems:

a) The status indication relies on lights and signs, making it susceptible to adverse weather conditions. The passive warning approach is usually adopted.

b) There is insufficient means to actively alert drivers in scenarios where they lose situational awareness or make human errors.

c) Upgrading existing lights and signs requires complex installations, long construction periods, and significant investments.

[1] Chinese and English versions provided by China.

The civil aviation airport vehicle runway incursion surveillance and warning system can effectively address these issues.

1.2 Compared to traditional runway incursion prevention technologies, this system requires smaller investment, yields quick results, and is not affected by weather conditions. It also directly alerts drivers and tower controllers, thereby enhancing evacuation efficiency.

2. DISCUSSION

2.1 Advantages of the civil aviation airport vehicle runway incursion surveillance and warning system

2.2 The system employs spatial computing technology to monitor aircraft through automatic dependent surveillance – broadcast (ADS-B), monitors vehicles using vehicle-mounted satellite positioning technology, and issues audio-visual alarms. The technology used is mature, and the procurement and installation costs of the related equipment are significantly lower than those of traditional systems, resulting in a smaller investment.

2.3 The system digitizes the airport runway without the need for construction or major earthworks. Compared to traditional technologies that require extensive construction within the movement area, this approach minimizes both the management costs and risks associated with the construction while keeping the flights in operation. Furthermore, it significantly shortens the deployment time and enhances efficiency. Consequently, the system can be deployed and applied in a relatively short period, ensuring rapid effectiveness.

2.4 The system focuses on the three core positions in runway incursion prevention: vehicle drivers, tower controllers, and the runway safety team. Firstly, for vehicle drivers, the system automatically provides early warnings to them after identifying risks, ensuring vehicles evacuate the protection area within 3 to 7 minutes. Secondly, for tower controllers, the system automatically issues flight estimated landing times and proactively identifies conflict risks. Thirdly, for the runway safety team, similar functions are set up at flight zone monitoring seats, reinforcing the third line of defence.

2.5 Preventing unauthorized vehicle incursions onto the runway. By digitizing the ground protection area, the system creates digital virtual fences for early warning and warning areas, and calculates real-time vehicle-runway status. When a vehicle enters the early warning or warning area, the system synchronously issues audio-visual alarms to tower controllers and vehicle drivers within 600 milli-seconds.

2.6 Preventing unauthorized vehicles from entering the vicinity of the ground protection area. In accordance with operational standards, a prompt area is established for applying permit to cross the perimeter roads around the manoeuvring area. An entrance warning area is set up to ensure that drivers, driving at speeds of up to 70 km/h, receive warnings and apply brakes to stop without intruding into the ground protection area.

2.7 Preventing incursions into the ground protection area in the “last kilometre” of aircraft landing, thereby achieving conflict warnings between authorized vehicles and aircraft. Based on the airport’s flight procedures, an early warning zone in the air is established. If vehicles do not evacuate promptly after an aircraft enters the zone, the system automatically warns the vehicle driver and tower controller based on the aircraft’s altitude and distance. The zone below the decision height is designated as the warning zone. When the aircraft descends below the decision height, audio-visual warnings are promptly issued to the vehicle driver and tower controller. This effectively reminding the vehicle driver to evacuate the runway immediately.

2.8 Currently, this system has been effectively applied to prevent vehicle incursions on airport runways. It has been deployed and put into operation at 19 airports, including Nanchang Airport, Qinhuangdao Airport, Chifeng Airport, Changbaishan Airport, and Daqing Airport. It assists vehicle drivers in maintaining clear situational awareness, enabling them to make timely and correct decisions.

3. CONCLUSION

3.1 The civil aviation airport vehicle runway incursion surveillance and warning system can assist runway safety management. It requires a small investment and yields quick results, enabling airports to quickly implement technical prevention measures. It effectively enhances runway safety protection capabilities, increases safety margins, and plays a crucial role in enhancing airport safety.

3.2 The Conference is invited to agree on the following recommendation: encourage other countries to share their experiences in runway incursion prevention to collectively enhance the safety of airport operation worldwide.

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