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AGENDA ITEM 4: AIR NAVIGATION

REGULATORY CHALLENGES ON APPROVAL OF NESTED UAS OPERATIONS

(Presented by the Civil Aviation Authority of Malaysia)

INFORMATION PAPER

SUMMARY

In March 2021, the Civil Aviation Authority of Malaysia (CAAM) issued a series of Civil Aviation Directives on Unmanned Aircraft, one of them on Beyond Visual Line of Sight (BVLOS) operations. Eager to put the new requirements to test, CAAM takes on the challenge to certify a Nested Unmanned Aircraft System (UAS) operation in Malaysia. The project's aim is to prevent illegal encroachment into Petronas Gas Berhad pipeline infrastructure using UAS deployed from strategically located nest stations. The project utilizes the Specific Operations Risk Assessment (SORA) framework to assess ground and air risks, ensuring operational safety. Mitigation measures, such as limited flight ceiling, defined operational volume, and real-time monitoring, are implemented. Lessons learned highlight the need for adaptability to evolving regulations and investment in training and resources. The project sets a benchmark for future UAS operations in terms of safety and technical capabilities.

REGULATORY CHALLENGES ON APPROVAL OF NESTED UAS OPERATIONS

1. INTRODUCTION

1.1 The nested UAS project was proposed as a solution to address illegal encroachment into Petronas Gas Berhad (PGB) pipeline infrastructure spanning over 2000 KM across Peninsular Malaysia. This project deploys Unmanned Aircraft Systems (UAS) from strategically deployed nest stations within the PGB gas pipeline to detect and monitor encroachment activities. The operations are conducted in Beyond Visual Line of Sight (BVLOS) from a Command-and-Control Center located in Cyberjaya, Selangor.

2. DISCUSSION

Operational overview

2.1 The nested UAS operations involve deploying DJI Mavic 2 enterprise and Matrice 300 drones from Hextronic Nests strategically positioned within the Petronas Gas Berhad premises. The drones are equipped with visual and thermal sensors and operate within the approved geographical area and legal radio frequency transmission output. The operations are time-limited, typically lasting between 5 to 15 minutes per flight.

Integrated traffic management

2.2 The Flytnow Unified Traffic Management system ensures the safe integration of UAS into the airspace region. It provides a guest sharing platform to regulatory bodies, displaying real-time UAS tracking and telemetries for monitoring purposes.

Sensor system and flight planning

2.3 A Distributed Acoustic Sensing (DAS) sensor system is installed along the PGB Pasir Gudang Main Line, utilizing sound wave technology to detect vibrations caused by encroachment activities along the existing fibre optics network infrastructure. When triggered, the Flytnow Software receives the coordinates from the sensor system and generates a flight plan for the UAS to conduct pre-programmed surveillance missions at the detected location.

Nested UAS infrastructure

2.4 The nested UAS project comprises three phases, covering over 100 KM of the gas pipeline. Each nest station is equipped with a UAS docking platform, automated recovery and charging system, hyperlocal proximity sensors, communication links, environmental monitoring systems, and weatherproof enclosures

Approval process

2.5 CAAM follows a five-stage approval process for special UAS projects, including pre-application, formal application, document evaluation, demonstration and inspection, and certification. The process involves reviewing the Concept of Operations (CONOPS) and engaging with the UAS committee, which consists of several regulatory bodies responsible for reviewing various requirements such as Radio Frequency (RF) class assignment, aerial videography permits, and restricted/prohibited areas. The documentation review phase includes operational procedures documents, such as the Specific Operations Risk Assessment (SORA), operation manual, safety management system, and emergency response plan.

2.6 An intriguing aspect of the nested UAS operations is the need for remote pre-flight checks, as the remote pilot is located 300km away from the drone. To address this challenge, a unique solution was developed. A new set of checklists, specifically tailored for remote pre-flight inspections,

were created. Additional cameras were installed to provide comprehensive visual coverage for the operator. Furthermore, the maintenance review timeline was adjusted to ensure the integrity of the UAS system. To enhance reliability, the operator is now required to provide a detailed reliability report after a certain number of flights. This innovative approach ensures meticulous attention to safety protocols and sets a precedent for remote pre-flight procedures in UAS operations.

SORA framework and SAIL

2.7 The approval process utilizes the Specific Operations Risk Assessment (SORA) framework, developed by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) and adopted by the European Union Aviation Safety Agency (EASA). The SORA framework assesses ground risk (GRC) and air risk (ARC) to determine the Safety Assurance Integrity Level (SAIL) and operational safety objectives (OSOs) for the UAS operations.

Mitigation measures and ARC reduction

2.8 To address identified risks, mitigation measures were proposed by the operator and accepted by CAAM. These measures include limiting the flight path ceiling altitude within very low-level airspace, confining the flight operational volume to the gas pipeline's geographical boundaries, conducting operations only during daylight hours, issuing Notice to Air Mission (NOTAM), enabling geo-positioning and tracking capabilities, and monitoring activities via a third-party service. These measures led to a reduction in the Air Risk Class (ARC) from ARC-c to ARC-b, resulting in a manageable SAIL number.

Challenges and lessons learned

2.9 The approval process for the nested UAS project presented various challenges, including limited operational volume, airspace coordination with civil and military air traffic controllers, competency requirements, human-machine interface, system integration, and overall system performance. Overcoming these challenges required proactive adaptation to new regulatory requirements, investment in training, technical capabilities, and financial resources.

2.10 In conclusion, this discussion paper sheds light on the regulatory challenges and ground-breaking achievements in nested UAS operations in Malaysia. The insights shared highlight the progressive steps taken by the CAAM and PGB to overcome hurdles and establish a benchmark for future UAS operations. Noted are the valuable experiences, lessons learned, and innovative approaches discussed in this Paper, which may inspire further collaboration, knowledge sharing, and advancements in UAS regulations and technologies, ultimately shaping a safer and more efficient airspace for all.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to note the information contained in this Paper.

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