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AGENDA ITEM 4: AIR NAVIGATION

**DIGITAL TOWER IMPLEMENTATION IN MALAYSIA:
ENHANCING SAFETY, EFFICIENCY AND SITUATIONAL
AWARENESS AT PENANG INTERNATIONAL AIRPORT**

(Presented by Malaysia)

INFORMATION PAPER

SUMMARY

This paper highlights Malaysia's experience in implementing Digital Tower operations at Penang International Airport (PIA), the country's first Remote, Digital and Virtual Tower deployment. This initiative was undertaken as part of airport expansion and capacity enhancement efforts, while providing opportunities to modernise air traffic service delivery through advanced digital technologies.

DIGITAL TOWER IMPLEMENTATION IN MALAYSIA: ENHANCING SAFETY, EFFICIENCY AND SITUATIONAL AWARENESS AT PENANG INTERNATIONAL AIRPORT

1. INTRODUCTION

1.1 Malaysia commenced implementation of its first Remote, Digital and Virtual Tower (RDVT) project in February 2025 at Penang International Airport (PIA) as part of broader airport development and capacity enhancement initiatives. An accelerated implementation approach was adopted to address critical operational and infrastructural constraints: the existing control tower occupies land required for terminal expansion, and conventional line-of-sight limitations restrict visibility and safety oversight.

1.2 RDVT overcomes these challenges by providing air traffic controllers with a 270°–360° panoramic, high-definition digital view—enhancing situational awareness without dependence on a fixed-height physical structure. With land availability severely constrained at PIA, RDVT eliminates the need to construct a new tower, thereby freeing up valuable space for essential capacity upgrades to accommodate projected traffic growth.

1.3 This approach also advances national objectives to centralise air traffic management, optimise resource utilisation, and future-proof Malaysia’s aviation infrastructure in alignment with ICAO’s digital transformation roadmap.

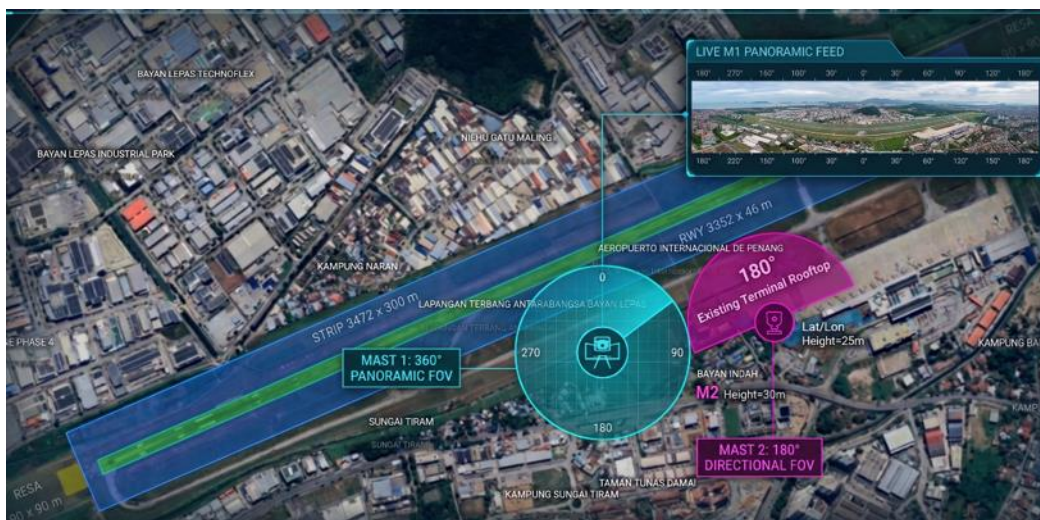


Figure: Camera Masts Location at PIA

1.4 The airport expansion programme created an opportunity to modernise the provision of aerodrome control services through digital tower technology while maintaining operational continuity during infrastructure development.

1.5 A new digital operations facility was established to replace the traditional out-the-window view provided by the conventional control tower. The facility utilises two strategically located camera masts equipped with high-resolution digital cameras, providing comprehensive visual coverage while mitigating existing blind spots.

1.6 At present, the implementation is currently undergoing air traffic control (ATC) validation together with the Operational Readiness and Airport Transfers (ORAT) phase.

2. DISCUSSION

2.1 Malaysia adopted phased implementation approach for its first Remote, Digital and Virtual Tower (RDVT) project at PIA.

2.2 The project commenced in February 2025. The RDVT facility (building) was completed on 4 April 2026, followed by system installation, Site Acceptance Test (SAT), User Acceptance Test (UAT) and Final Acceptance Test (FAT), which were completed on 15 June 2026.

2.3 Operational training for air traffic controllers commenced on 19 June 2026 and was completed on 10 July 2026.

2.4 Following the completion of training, a ghosting and parallel operations phase commenced during the week of 13 July 2026, with monitoring of the conventional tower's operation from the new RDVT facility. This phase is expected to continue for a minimum observation period of approximately two months to validate operational performance and controller familiarity within the new environment. Upon successful completion of this phase, aerodrome control services will progressively transition to the RDVT facility while operations continue to be monitored from the conventional control tower.

2.5 Subject to satisfactory operational assessment and validation activities, Malaysia expects the ghosting phase to be completed by November 2026, after which aerodrome control services are planned to be progressively transitioned to the RDVT facility.

2.6 The existing conventional ATC tower at PIA will be unavailable from December 2026 due to the airport expansion programme. This redevelopment affects the tower's operational suitability and provides an opportunity to implement modern digital tower capabilities.

2.7 Malaysia expects the RDVT implementation to introduce enhanced visual coverage, digital surveillance integration and advanced monitoring capabilities that support improvements in situational awareness, operational efficiency and operational resilience.

2.8 Several important considerations were identified throughout the implementation process:

- a) provision of adequate network redundancy;
- b) timely regulatory coordination;
- c) human factors assessment activities; and
- d) comprehensive operational readiness programmes.

2.9 The experience also highlighted the value of close collaboration among operational, technical, engineering, airport, and regulatory stakeholders throughout all project phases, from design and construction through validation and operational transition.

3. ACTION BY THE CONFERENCE

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