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Bangkok, Thailand, 3 – 7 August 2026

Agenda Item 5: ATM and CNS Systems Modernization

VISUAL SURVEILLANCE SYSTEM FOR MANEUVERING AREA

(Presented by Australia)

SUMMARY

This paper presents the design, development and implementation of an electro-optical system providing an electronic visual presentation of the maneuvering area to maintain situational awareness at an aerodrome.

1. INTRODUCTION

1.1 Traditionally, aerodrome control relies on direct visual observation from the tower. But new physical infrastructure, or distance of new taxiway and aprons from the tower can present line-of-sight (LoS) obstructions. Brisbane airport expansion and development is one such example.

1.2 By providing high-resolution video coverage of the affected part of the maneuvering area, the Visual Surveillance System - Maneuvering area (VSS-M) gives controllers a clearer, more complete operational picture, improving situational awareness and supporting better decision-making in real time.

2. DISCUSSION

Background

2.1 Brisbane Airport introduced changes in accordance with the airport master plan that resulted in a number of LoS obstructions for the control tower, impacting Air Traffic Control (ATC) ability to maintain visual coverage of all service areas.

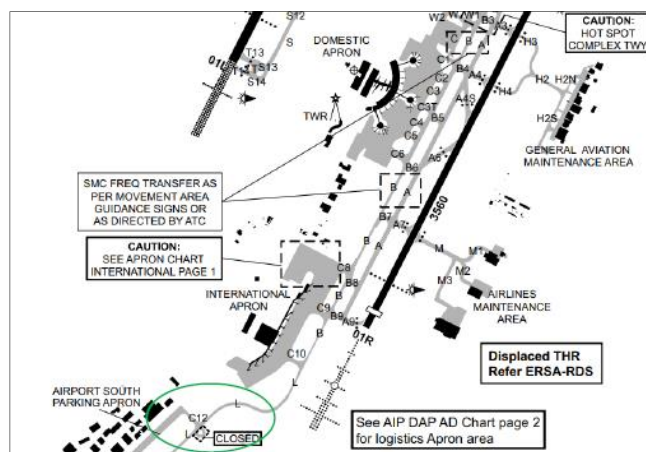


Figure 1. Brisbane LoS Obstructed Area

2.2 To maintain safe operations, Airservices operated under an exemption issued by the Civil Aviation Safety Authority (CASA) allowing procedural controls to be used in areas where direct visual observation was not possible. While safe, this was not considered a permanent solution.

Visual Surveillance System – Manoeuvring Area

2.3 The Visual Surveillance System – Manoeuvring Area (VSS-M) project was established to provide a long-term solution through camera technology that restores visibility of the obstructed areas. The VSS-M operates under the ‘Visual Surveillance System in Aerodrome Control Service’ provisions (PANS-ATM – 7.12) supporting compliance with aviation regulations.

2.4 PANS-ATM - 7.12.1.1, requires that a Visual Surveillance System has an appropriate level of reliability, availability and integrity. Given the characteristics of the affected area, the design scope of the system specification was not intended to apply to aircraft in flight and as such, does not meet Airservices required specifications for use in observation of airborne aircraft, or application of runway and HLS separation. Appropriate operational procedures needed to be developed to limit the use of the system and exclude the runway strips and helicopter operations.

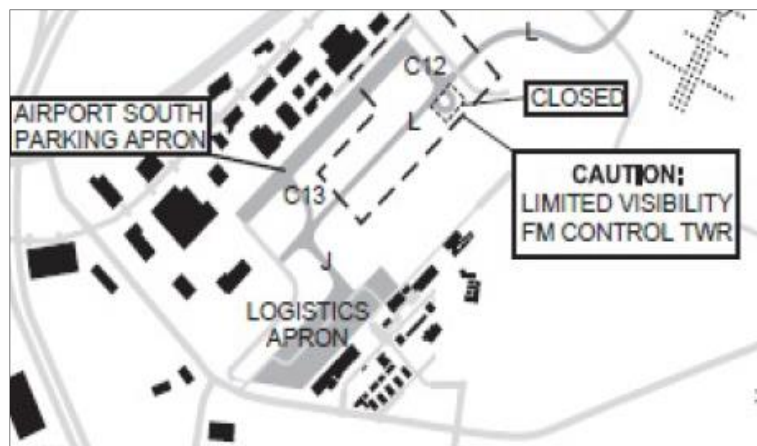


Figure 2. Brisbane LoS Obstructed Area Detailed View

System design and integration into Aerodrome Control Service

2.5 VSS-M capabilities were defined to provide a visual presentation on control position screens no worse than the naked-eye as per the out-the-window view, as well as support night operations. The system also has Pan, Tilt, Zoom (PTZ) functionality, and infra-red capability to enhance visual observation during low visibility conditions.

2.6 The VSS-M is required to be capable of displaying an image quality such that objects can be recognised and identified by the operator in all lighting and weather conditions. The camera siting position was selected to replicate, to the maximum extent possible, the out-the-window view to minimise controller cognitive dissonance risk. Similarly, the screens at the Controller Working Position (CWP) are positioned between the controller and the obstructed areas wherever possible to support the controllers mental model using their typical scan to augment information presented by the VSS-M.

2.7 User Acceptance Testing (UAT) was conducted during the design phase using pre-defined scenarios to validate the system performance with detection and recognition criteria. These test activities were conducted in scenarios including first light, transition to dawn and to day light, transition to dusk and to night operations, all sun positions, most types of cloud cover, poor visibility, heavy rain and strong wind.

2.8 Within the tower cab, screen position, illumination and brightness adjustability, along with affects of sun glare at different times of day were evaluated. Screen usability assessments were performed to ensure the tilt and swivel of the mounting equipment could be easily accessed and adjusted to ensure no additional LoS issues were introduced.

2.9 The UAT team conducted additional testing beyond the scope of the formal UAT procedure to validate the detection and recognition criteria during transitional lighting conditions (i.e. dusk and dawn). These extra evaluations provided additional confidence that the system can satisfy the fundamental requirements for equivalency to the out of the window view under a wider range of operational scenarios than originally specified.

2.10 A task analysis was conducted which considered a variety of scenarios to assess the situational awareness, workload and system/procedural use to achieve a pilot request. Additionally, a controller workload analysis was completed using the Projective Subject Workload Assessment Technique (Pro-SWAT) to ensure the addition of another information source in VSS-M positively aids controllers. Considering existing mitigations available to controllers.

Outcomes

2.11 Feedback confirmed screen size, clarity and position are suited to the typical CWP. Placement in the selected locations minimizes interruption to existing working practices and disruption to existing sight lines, and controller feedback was that placement is acceptable.

2.12 Through verification and validation activities, system performance has demonstrated to meet or exceed the normal out-the-window view in all weather and lighting conditions. Human Factors activities and controller feedback indicate there was no negative effect on controller's task capacity, mental or stress load, is no more physically or mentally fatiguing, and the controller can accurately perceive the operational environment. It was commented VSS-M eases workload when compared to the procedural solution, as opposed to increasing it.

2.13 These outcomes indicate the system is acceptable to address the LoS issues affecting Brisbane Tower and a successful system implementation into service has been completed.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.

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