White paper: Safe, cost-efficient contingency operations for airports

Create a full standby tower and apron-control solution for contingency, training, and modernisation

As air traffic volumes continue to rise, many airports are seeking to increase capacity safely and cost-effectively. They must typically also invest in modernisation in order to tackle new challenges such as growing volumes of unmanned aerial vehicle (UAV) traffic. Given these demands on already tight budgets, maintaining effective contingency arrangements can seem like a costly distraction—not least because the conventional approach to contingency is a huge investment in an additional tower, which then cannot handle the full capacity of the main tower or airport operations centre.

This paper presents a safe, cost-efficient contingency option for air traffic control (ATC) and airport operations, eliminating the need to build, equip and continually upgrade a duplicate secondary tower. When not in active use, a flexible modern contingency tower based on digital tower technology can be used as a training and simulation centre, and as a way to test new technologies and functionality before upgrading the main tower. Elements of the digital tower technology can also act as enhancement tools for the existing main tower—for example, to cover blind spots or to provide digital-binocular capabilities. In other words, rather than simply acting as a limited fallback position when necessary, a modern contingency option can also be used as a full functional replacement whenever convenient—for example, to manage operations without interruption or loss of capacity during system upgrades or tower refurbishment. Moreover, the approach to contingency described in this paper can also be used by airport operations for apron control, providing enhanced situational awareness in the operations centre.

Air Traffic Management

FREQUENTIS

Cost pressures on airports

As passenger numbers grow and airlines replace high-capacity aircraft with smaller, more efficient ones, air traffic volumes will keep rising. The projected dramatic growth in UAV traffic will add to the operational pressure on airports, and yet profit margins in commercial air travel will remain small, which ultimately means that airports will continue to face tight budgetary constraints.

In the face of these constraints, both airports and ANSPs need to invest heavily in modernisation—for example, building new runways and deploying new systems to increase the maximum ATC capacity. For airport operations, there are opportunities to use the latest technology to gain unrestricted views of the apron for increased efficiency and safety.

However, making changes is also challenging in practical terms: modernisation must take place without disrupting existing operations or impacting on safety. This thought naturally leads to considerations around contingency plans. If the main tower or airport operations centre is unavailable, what is the cost—both financial and reputational—of closing the airport and diverting flights?

The price of contingency

Running a duplicate second tower with the capacity to handle normal operations is a costly exercise. It also represents a moving target, because airports must maintain the same technologies in both primary and secondary sites, doubling all investments. Contingency towers and operations centres are therefore typically based on older technology, offer lower capacity, and may offer reduced view coverage due to the limited height of the building that houses them. As such, they are used only when absolutely necessary.

A better approach would be to make use of the contingency option whenever convenient—for example, when refurbishing the primary tower or updating apron-control equipment—but this has historically been prohibitive in cost terms.

A related consideration is the need to provide ATC controllers with access to convenient and effective training and simulation facilities. These facilities must be kept separate from daily operations, but they must also very closely replicate the experience in the primary tower. For the majority of airports, training staff or refreshing their existing skills therefore requires the use of third-party facilities at some distance from the primary site, implying additional cost and travel time.

Improved capabilities, lower cost

By introducing an onsite contingency tower based on the latest digital tower technology, airports can ensure uninterrupted operations, supported by improved capabilities, all at lower cost. This new concept for a contingency tower unites high-tech visualisation technologies with combined air and ground surveillance, flight data handling, and voice communication in a flexible and fully integrated controller working position.

By providing comprehensive capabilities at a fraction of the cost of a traditional secondary tower, the new approach enables airports to run at full capacity during a contingency scenario, protecting against disruption and loss of income.

The proposed approach to contingency includes modular components for visualisation and smart augmentation, situation display, and integration with other ATC systems. The software design is based on service-oriented architecture throughout, separating the layers for greater resilience, flexibility and security. The entire system is designed to meet the toughest regulatory requirements around redundancy.

[1] http://www.sesarju.eu/approach/cost

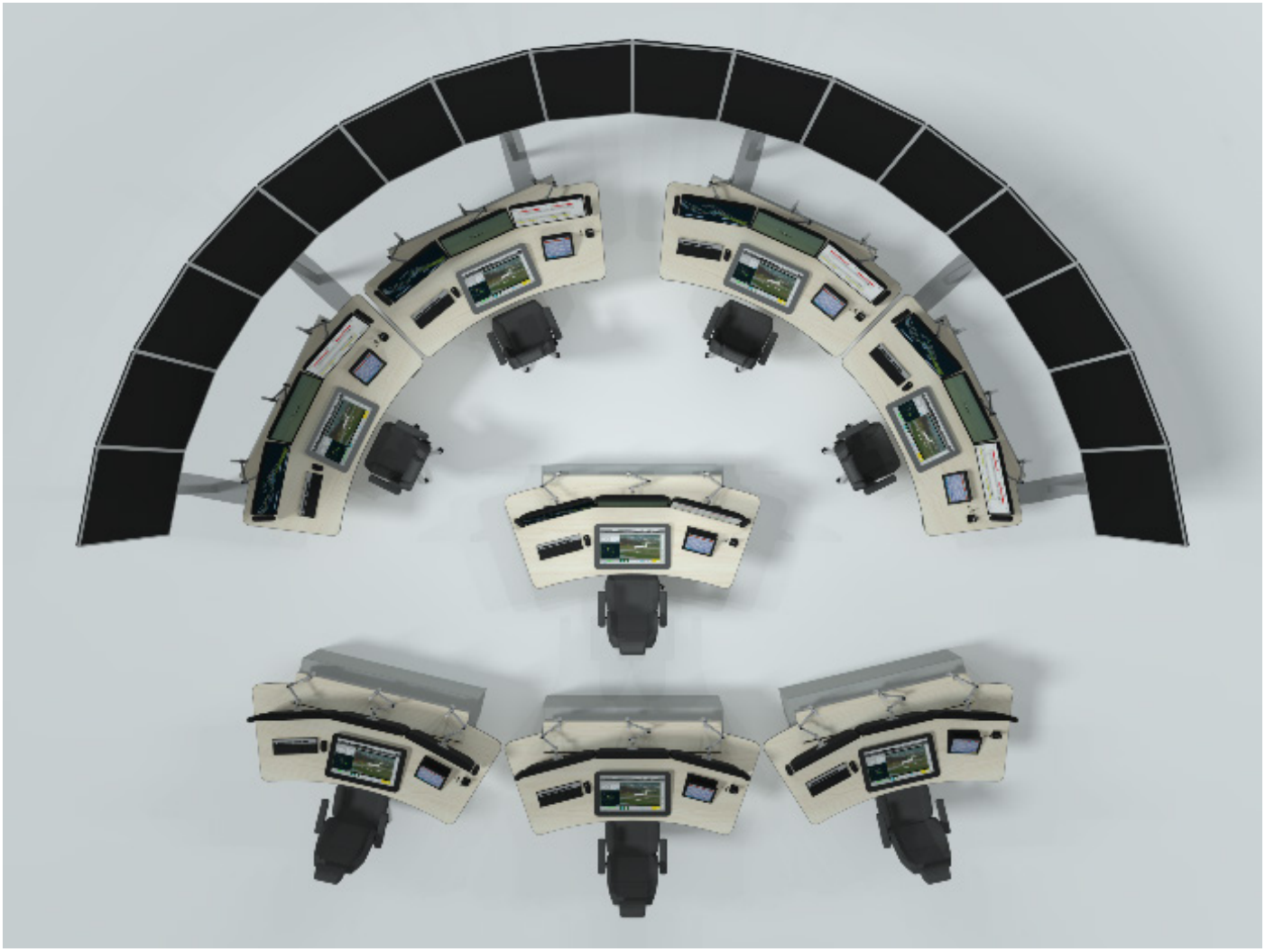
ATC-grade video for real-time panoramic views

The use of high-fidelity, ATC-grade video feeds eliminates the need for a tall tower with 360-degree windows, significantly reducing the cost of building and maintaining the contingency tower. This approach can deliver reliable, real-time, high-definition panoramic view stitched together from multiple video feeds, together with close-up views of hotspots and other points of interest. The latest panorama camera systems can provide 360-degree horizontal and more than 45-degree vertical views with a resolution that exceeds human eye performance. They can also generate multiple panoramas from different viewing points, improving the visibility of ground and air traffic for larger airports.

With decentralised processing and a redundant camera architecture, airports can achieve a highly dependable solution. Advanced monitoring can be used to detect and mitigate safety-related issues such as loss or delay of video frames.

Live video can be overlaid and augmented with dynamic meteorological, surveillance and flight data, and with static information such as runway outlines, taxiway designators, restricted areas and glide paths. In this way, the use of video improves situational awareness for controllers and eliminates the need to keep switching focus between computer displays and external windows. Displays can be integrated with any existing flight strips solution to synchronise flight data and clearance information, enabling the highlighting of strips and allowing clearances to be assigned.

Figure 1: Innovative digital tower technology



There are further benefits in replacing direct views of the world with live ATC-grade video. For example, controller-operated dynamic Pan-Tilt-Zoom (PTZ) cameras can act as smart binoculars, giving controllers intelligent tracking functions and high zoom capabilities, all accessed through intuitive touchscreen controls and virtual joysticks. Infrared and Wide Dynamic Range (WDR) cameras can augment vision, providing enhanced views of air and ground traffic even in low light conditions or during bad weather.

Finally, sophisticated video analytics can identify and track moving objects, providing on-screen status information and alerting controllers when collisions or incursions are detected. Automatic object detection functions provide the ability to detect unknown moving objects and highlight them with on-screen boxes. The same video technology can be reused in the airport operations centre to enhance situational awareness in apron control facilities.

The new approach to contingency therefore not only provides a backup option but can actually improve operations by augmenting human capabilities.

Familiar surroundings

During a contingency scenario, stress levels are likely to be higher than during standard operations, so the emphasis should be placed on providing systems that are familiar, intuitive and user-friendly. By basing the control room design on human factors, airports can ensure that controllers can easily and comfortably transition between the primary ATC tower and the contingency tower. For a seamless takeover of operations, highly flexible and customisable user interfaces enable airports to ensure that the user experience in the primary and backup towers is almost identical.

Figure 2: Real-time, high-definition digital panoramas

Figure 3: Digital panorama with information overlays at Auckland International Airport

Smoother modernisation

Thanks to the smooth transition that a digital tower solution enables, disruption can be minimised to the point at which an airport may view the contingency tower as equal to the primary tower in status and capabilities—opening up the possibility of switching at will between towers in order to undertake upgrades or maintenance.

Indeed, for ANSPs seeking to modernise their ATC capabilities, the latest digital tower technology can provide not only a contingency solution but also a "test pad". By choosing a digital tower solution that is modular and open for integration with other technologies, airports can plan and execute step-by-step modernisations of their existing technology stack, validating the proposed new environment in their contingency tower before deploying it in their primary tower. Modernising in this way can significantly reduce risk, disruption and technology costs.

Enhanced situational awareness

The view from a conventional ATC tower is fixed, and there will always be blind spots, particularly as new buildings are added. By deploying flexible, low-cost, high-grade video technology as part of a contingency solution, airports can also improve situational awareness in the primary tower by presenting clear and augmented views of all relevant locations at any time and in any weather.

Equally, digital tower solutions provide additional support functions such as improved safety net and data gathering via video analytics—which can be used as add-ons during normal tower operations as well as during contingency scenarios.
Static and dynamic augmentation technology can be tightly integrated into each controller working position and overlaid with data—keeping controllers informed about relevant topics without swamping them in unnecessary and confusing detail. Equally, the integration of voice communication with visualisation and metrics within a single interface simplifies operations for controllers and helps them to focus on the most important elements.

Given the transformational potential of the latest visualisation technologies, airports may even choose to create a new contingency tower and then switch roles between the new tower and the original primary tower. This could also be a source of significant cost savings, as out-of-support proprietary technologies in the original tower are replaced by modern, open technologies.

Flexible usage scenarios

When not required for contingency purposes, a secondary tower based on the latest digital approaches can be used as an advanced simulation suite for training existing or new staff. This can save significant time, cost and effort versus using a third-party offsite training suite.
A secondary tower could also be the foundation for a low-cost remote tower centre, in which smaller airports are remotely controlled by ATC personnel located in the contingency centre.

Conclusion

Already facing budgetary challenges, airports are now tasked with undertaking costly modernisation exercises, all while managing rising volumes of traffic. At the same time, they must bolster operational continuity by ensuring that they have a contingency option in case the ATC tower is unusable.

Frequentis offers cost-effective contingency operations based on using digital tower technology to enhance the existing ATC tower, providing advanced visualisation that augments human vision and boosts situational awareness.

In addition to providing a lower-cost contingency option for ATC and airport operations, a digital tower can be used for training and simulation, and as a test-bed for new equipment, software and processes. The open and modular Frequentis solution integrates with existing and future technology, enabling it to support a step-by-step modernisation strategy in which new technologies are proven first in the secondary tower before deployment in the primary tower.

The Frequentis product portfolio for digital tower solutions includes:

- smartVISION for digital "out of the window" views
- smartSTRIPS for data-link-enabled arrival and departure management
- smartTOOLS for access to critical flight-related information including weather, airport status and aeronautical charts
- smartATIS for digital ATIS information using multi-lingual speech synthesis or data links.

With a digital tower solution from Frequentis, airports can improve safety through enhanced situational awareness, and can streamline air traffic control, reducing costs and maximising capacity.

To find out more about successful deployments of digital tower solutions for the Ports of Jersey or at Auckland International Airport, please see the Frequentis website.

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