

CANSO

Think

ASIA PACIFIC (APAC) ATM MODERNISATION

White Paper



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ACKNOWLEDGEMENTS

This paper was produced by CANSO and Think Research to help Asia Pacific Full Members quicken the pace of ATM modernisation by leveraging digital solutions and new opportunities for collaboration. The process involved surveys and interviews with Asia Pacific Full Members and the industry, culminating in a brainstorming retreat in Bali in July 2023 involving the senior management of the Asia Pacific Full Members.

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CONTEXT

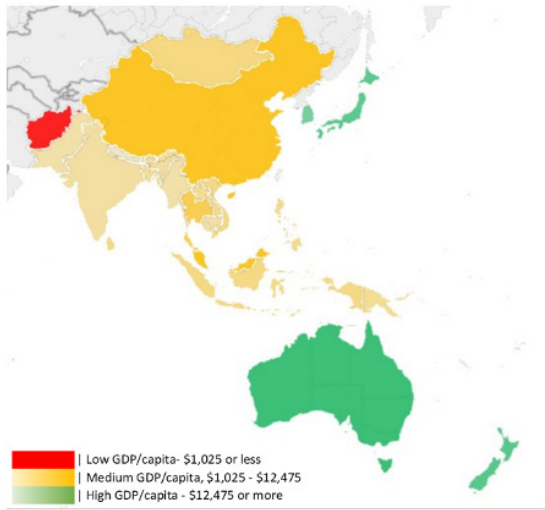
Asia Pacific (APAC) is a rapidly developing and highly diverse region

Geographically, APAC is very large and diverse. It comprises 39 countries of different sizes and different physical characteristics – large land masses comprising 30 per cent of the world's land, extensive ocean areas containing thousands of large and small islands, and extended archipelagos. APAC contains most of the world's mega-cities and very dense urban areas, as well as sparsely populated and remote regions. Air travel is essential within APAC but also to connect APAC to the rest of the world.



Population density and mega-cities

There is equal diversity in economic terms. APAC countries have some of the world's highest and lowest values of gross domestic product (GDP) per capita. Some APAC economies are highly developed whereas other are emerging. One common theme across the region, however, is rapid and accelerating economic growth.



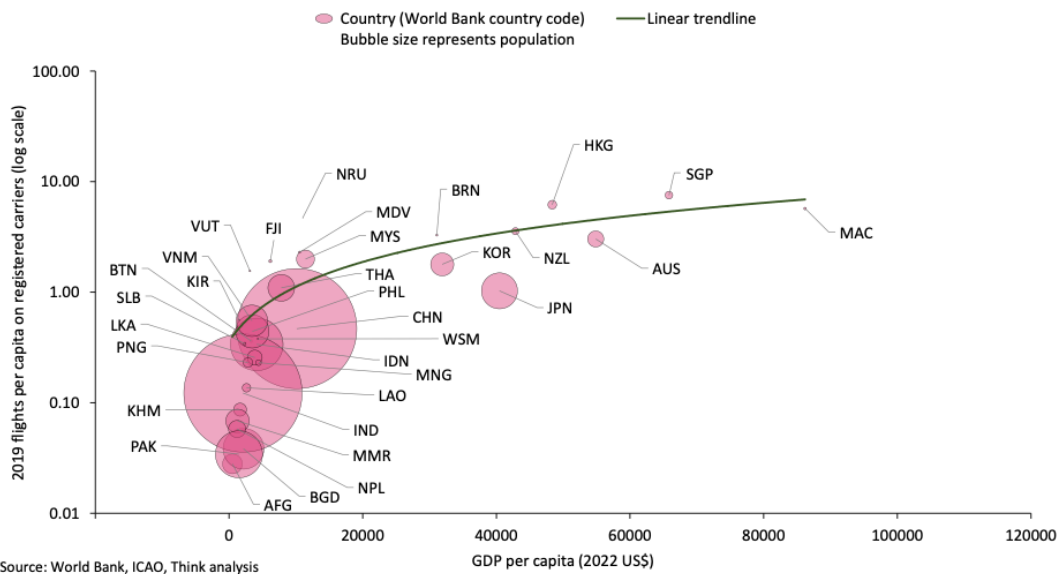
GDP per capita



Economic growth

The demand for air travel is high and increasing

Rapid increases in demand in APAC are driven by economic growth and the associated increasing prosperity. The familiar chart below, relating air trips per capita (propensity to fly) to wealth (GDP per capita), shows that even modest increases in economic wellbeing will massively increase demand for air transport in APAC's large countries with rapidly developing economies.



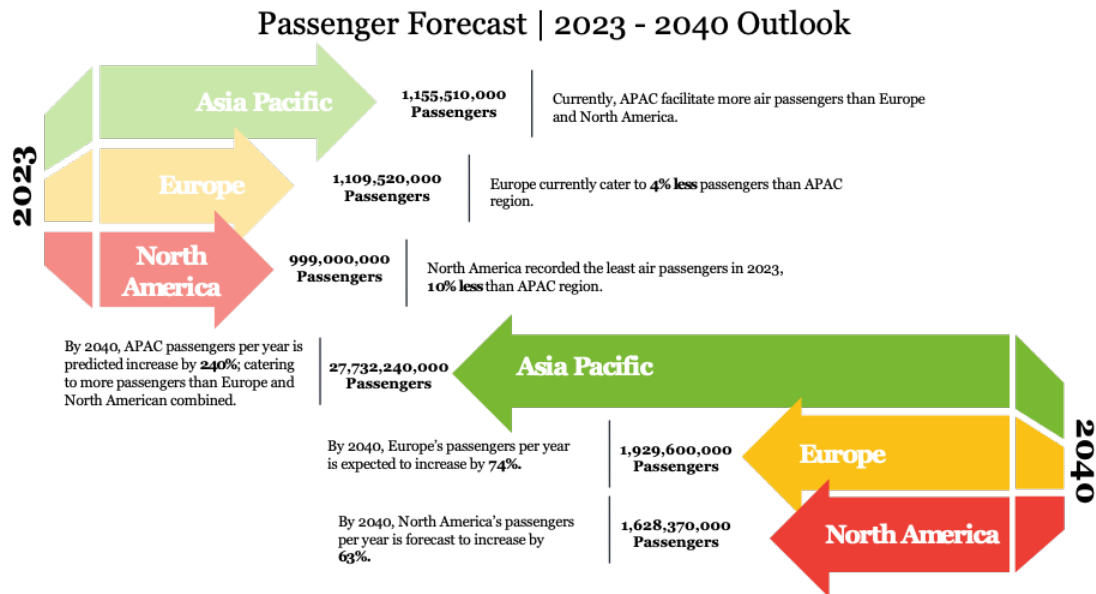
Propensity to fly (flights per capita) across APAC

As of 2019, the APAC region had the highest number of air passengers in any global region, accounting for 37 per cent of total passengers carried¹. The global pandemic caused major disruption to demand, and although the industry's recovery has been slower in APAC than elsewhere, traffic is growing steadily and is expected to reach pre-pandemic levels by 2025².

1 Source: ICAO Air Transport Reporting Form A and A-S plus ICAO estimates

2 Source: IATA, Tourism Economics Air Passenger Forecasts

IATA forecasts for air travel in APAC show a passenger growth rate of around five per cent, compared to the three per cent global average forecast to 2040³ and significantly higher passenger growth than Europe and the US. By 2043 air traffic in APAC will be approaching half of the global total.



Aviation is a major contributor to the region's economy

In addition to providing connectivity, both within APAC's large geographical region, where there are often no real alternatives, and to other regions, air transport supports international business, inward investment and inbound tourism. The region is also home to many of the world's busiest airports and largest airlines. In 2018, over four million people were employed in APAC's aviation sector, generating a \$225 billion direct contribution to GDP. More broadly including indirect effects, the aviation industry contributed nearly \$1 trillion to APAC's GDP, over three per cent of the total economy⁴.

Transport infrastructure is an essential economic enabler

Across the region, recognition of the critical importance of infrastructure to support the increase in demand for transport, pre-and post-pandemic, has led to high levels of investment in visible and tangible assets such as airports, seaports, and high speed rail, as well as in airline fleets. For example, there are many cases of large airport investment across APAC and the region is forecast to account for 45 per cent of global aircraft deliveries in the next 20 years⁵.

³ Source: ICCT Airline Traffic in 2050

⁴ Source: ATAG, Aviation: Benefits Beyond Borders (2020)

⁵ Source: Airbus Global Market Forecast 2022

Comparatively, there has been a lack of focus on air navigation services (ANS)

Understandably, there has been less focus on airspace as “publicly invisible” intangible infrastructure. This lack of focus extends to the services that support safe and efficient airspace operations, particularly those delivered by air navigation services providers (ANSPs). The result is, in general but not always, lack of investment in modernisation of ANS infrastructure. Unless this imbalance is addressed through modernisation of APAC’s ANS system, bottlenecks in air transport will shift from airports to ANS. Evidence for such bottlenecks is already being observed in flight delays as well as increased environmental impact due both to the delays themselves and inefficient flight routings.

Current APAC ANS is not equipped to accommodate traffic growth

Forecasts for APAC’s air traffic growth assume there are no constraints in airports, airspace and ANS. The reality is that, as currently organised, the region’s airspace does not have the capacity to absorb future traffic demand. Current services and infrastructure are unlikely be capable of supporting the level of traffic expected across the region. The priority to maintain safety would mean that restrictions would be applied resulting in inefficiency, delays and increased environmental impact. The network nature of ANS means that these negative impacts will ripple through across the region constrained by the ANS network even in areas that are not capacity constrained.

There are active, but non-binding, plans to improve the situation, including the International Civil Aviation Organization (ICAO) APAC Seamless ANS Plan⁶, and the aligned Regional Collaborative ATFM Framework. Plans like this aim at guiding ANSPs to collaborate towards useful improvements and updates to their systems and service provision. This includes solutions such as data communications, surveillance, automatic dependent surveillance – broadcast (ADS-B), air traffic flow management (ATFM), and enhanced tools for air traffic control (ATC).

Progress on delivering these plans has been mixed. Piecemeal increases in capacity will result in minor, local benefits but will move constraints to other places in the network. The ANS system must be treated in a holistic, coordinated and balanced way, otherwise improvements in one place will be undermined by shortcomings elsewhere and the overall situation will not improve. Coordinated transformation is needed across the region.

This White Paper highlights four potential solutions that offer innovative alternatives to overcome APAC’s current challenges and implement a shared vision. To leverage the opportunities that the proposed collaborative solutions offer, the White Paper also introduces a series of recommendations for APAC ANSPs to consider.

To meet future demand for air transport, enabling aviation to continue to make its significant contribution to APAC’s economic wellbeing, ANS across APAC must be modernised using a holistic, collaborative approach to achieve a seamless, efficient and effective ANS system-of-systems.

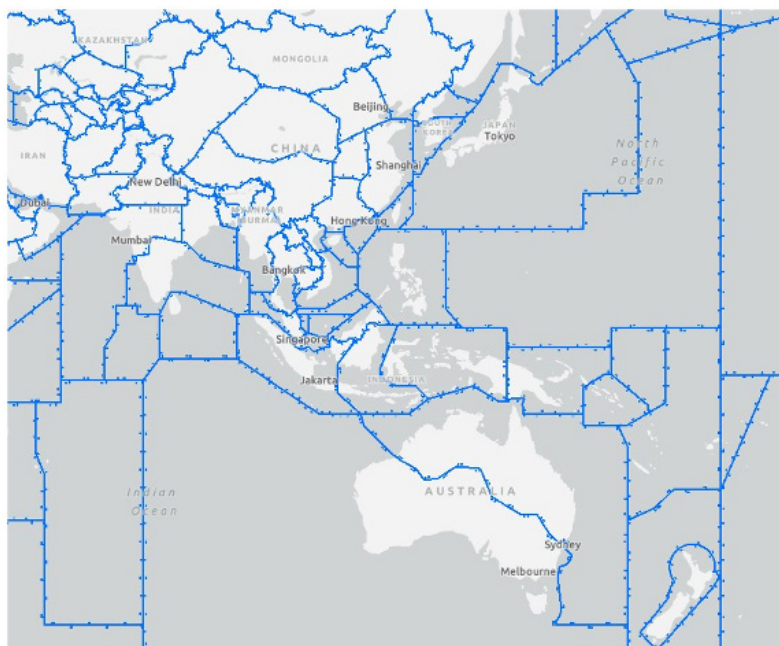
6 Source: Asia/Pacific Seamless ANS Plan 2019

CHALLENGES

Holistic, coordinated modernisation of APAC airspace is critical to accommodate future traffic demand efficiently without incurring delay and protecting the environment. APAC ANSPs face several challenges to deliver this modernisation.

APAC ANS is characterised by fragmentation

As in the rest of the world, APAC's airspace and the supporting ANS operate on a national basis under ICAO's sovereignty principles. The region is organised into 49 separate flight information regions (FIRs), as shown in the figure below.



APAC FIRs

This has resulted in a patchwork of interconnected but different technologies and capabilities rather than ANS being an integrated system-of-systems. ANS solutions are, often, unique to each country or even to an FIR within a single country. The technology, infrastructure and capability levels of these solutions vary widely between FIRs and their constituent air traffic service units (ATSUs). Data and information exchange is complicated because of the stand-alone nature of individual systems and can be further restricted because of national and cyber security concerns. Boundaries between systems and FIRs can inhibit the seamless flow of traffic.

APAC is large and diverse – one-size does not fit all

APAC's size and diversity means that one single solution on a continental scale is unlikely to be optimum or, indeed, feasible. Different but compatible solutions will likely need to be built on a sub-regional level across areas that have similar characteristics and challenges. Seamless interoperability between sub-regional solutions will be essential.

There is no framework for multilateral collaboration

Other than at the ICAO level, there is no overarching regional, multilateral framework agreed between APAC states to commit to address the needs of the region collaboratively. This means that, in addition to physical boundaries, there is also a lack of coherence across a multiplicity of other dimensions including policy, legal and regulatory, institutional, funding and financing, procurement, and processes. ANS developments are, therefore, unique to each country and are not coordinated, perpetuating the region's collage of mismatched solutions, capabilities and technologies. At a detailed level, for example, use of different mechanisms in different countries mean that there are no regional level capabilities for standards development or common procurement. Use of the ensuing bespoke rather than common solutions also most likely increases costs.

Sharing sensitive information amongst ANSPs to aid the decision-making and ATFM processes comes with concerns related to data privacy and security. Each country involved would need to have agreements and mutually recognised cybersecurity practices in place to share the data.

Most importantly, a single, agreed vision for the future of APAC's ANS is lacking and, even if such a vision existed, there is no mechanism for ANSPs and states to work together to achieve it.

The available resources and skills are limited

The availability of technical, human and financial resources and the associated experience and skills is constrained and varies widely across the region. These constraints apply equally to ANSPs and national aviation administrations that are responsible for the oversight of each country's aviation sector. In 2020, existing resource shortages were exacerbated by the COVID-19 pandemic causing the near shutdown of air travel. Although the aviation sector is now well into recovery, the pandemic was a major setback and has resulted in delays to investment in critical infrastructure upgrades and technology advancements that are essential for enhancing airspace efficiency, safety, and sustainability.

The one common theme is that everywhere is resource constrained. While some ANSPs are adequately resourced, others, mainly those within emerging economies, have very limited resources. This wide disparity is a barrier to some ANSPs investing in infrastructure, technology upgrades, workforce expenses, and more. Adoption of state-of-the-art technologies such as ADS-B, data link communications, and performance-based navigation (PBN) all incur significant costs and require expertise in procurement, training, operations and maintenance. This means that modernisation occurs at different paces in different areas of APAC and that the service levels provided can vary widely, perpetuating the fragmentation mentioned above.

Critical skills that are lacking in some places include:

- Financial risk assessment
- Procurement, including requirements specification, tender evaluation and contract negotiation.

Due to the lack of these skills, the varied experience and the lack of guidelines or best practices in the region, there is a high risk that spending in new systems and technologies is inefficient which leads to reduced desire to invest further in future.

Financial risks are perceived to be high

Funding models vary across ANSPs, with many relying on government funding and constrained by budgetary limitations. This dependency on public funding availability, which has historically focused on airports, may hinder the timely implementation of modernised technology in the region, impacting overall cohesion or even adding to fragmentation. Uncertainties and concerns about Return on Investment (RoI) and/or the timeline for cost recovery make some ANSPs hesitant to invest in modernisation. Although the outlook for aviation is optimistic, pandemic-induced uncertainty in air travel recovery has made financial planning and resource allocation more challenging, and ANSPs have had to navigate these constraints while maintaining operational excellence and adapting to evolving operational requirements.

There are conflicting policy drivers

Airspace is a critical national infrastructure, albeit an intangible one. Therefore, ANS modernisation, whether at state or regional level, will not happen without strong political support to, for example, provide funding, enable research and innovation (R&I), smooth the regulatory process for new technologies and incentivise their deployment.

However, governments always have competing priorities, such as security and defence; railways, roads and airports; telecommunications; energy generation and distribution; healthcare; and education. In APAC, as elsewhere, prioritisation reflects the diverse and rapidly evolving needs of the region's countries, which range from emerging economies to well-established economic powerhouses. Other priorities often take precedence over support for ANS, potentially because of a lack of understanding that ANS is a critical enabler to the realisation of the aviation sector's economic and societal benefits. Sadly, this understanding often only comes when the ANS system fails for some reason.

Enhanced cross-border collaboration across the region is also dependent on political support. Through Article One of the Chicago Convention⁷, aviation is a sovereign concern. This has resulted in monolithic aviation structures within each country, supported by bilateral or multilateral air services agreements, e.g. the proposed Association of Southeastern Asian Nations (ASEAN) single aviation market (ASEAN-SAM) agreement. Therefore, cross-border collaboration and cooperation between ANSPs, e.g. system interoperability, delegation of the provision of air traffic services (ATS) or data sharing, often requires explicit support from and formal agreements between governments. ASEAN-SAM shows that this is not always straightforward. New architectures, technologies, cross-border, interdependent systems-of-systems and services will challenge the sovereignty principle even more.

7 **Source:** Convention on International Civil Aviation at Chicago, ICAO, 1944

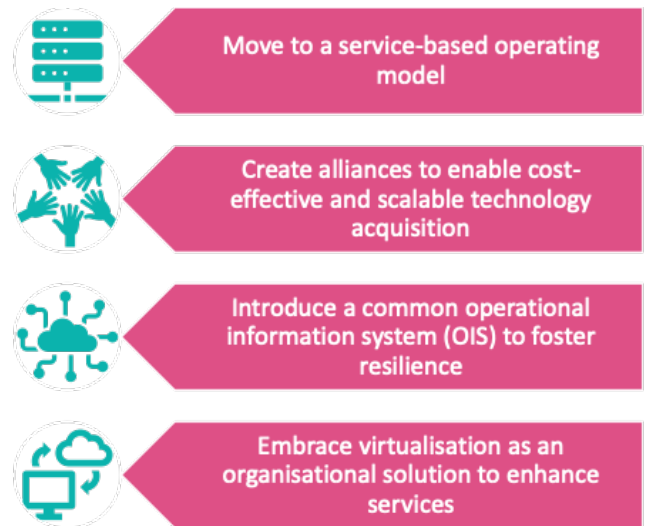
The sovereign nature of aviation aside, there are also other legal and regulatory barriers to enhanced collaboration, including concerns about data privacy and security, cyber security, and the protection of intellectual property rights (IPR).

Effective policy making, supported by political consensus, is crucial to overcoming these challenges and ensuring the region benefits from advanced ATM technologies and efficient operations.

FOUR PIVOTAL SOLUTIONS

To enable APAC modernisation, innovative solutions are required to address the complex challenges faced in upgrading ANS provision and implementing advanced technologies. Collaborative efforts among governments, ANSPs, international organisations, and industry stakeholders are essential to foster successful modernisation initiatives. Prioritising critical projects based on regional needs, reducing investment needs, optimising resource allocation, and adopting phased implementation plans can help ANSPs manage budget constraints while ensuring steady progress in modernisation and the acquisition of modernised technology. Despite its unique elements, the ANSPs in the APAC region are not the first ones to face the challenges in their modernisation path. This provides the region the benefit of building upon the lessons learnt by others as well as adopting ideas in line with emerging challenges.

Building on work already underway in ICAO's APAC Seamless ANS Plan⁸, and the aligned Regional Collaborative ATFM Framework, four pivotal solutions (see inset), based on collaboration and partnership, have been identified to meet APAC's ANS challenges and transform its ANS to be future-ready, resilient, and technologically advanced.



8 Source: Asia/Pacific Seamless ANS Plan 2019

SOLUTION 1:

MOVE TO A SERVICE-BASED OPERATING MODEL

There are numerous services underpinning ANS that can be delivered through partnerships or service agreements. Such services include communications, navigation and surveillance. ANSPs are already procuring services to fulfil these functions, e.g., telecommunications, instead of owning and operating their own ground-based infrastructure. As well as enabling greater flexibility, scalability and interoperability this approach can add functionality to remote and inaccessible areas, such as oceans and jungles, where it is not possible to install terrestrial systems.

For example, the space-based ADS-B surveillance service offered by Aireon⁹. Instead of relying on local, ground-based, radar systems, Aireon's ADS-B transponders enable continuous and accurate surveillance of aircraft, including oceanic regions where traditional radar coverage is limited. This greatly enhances overall ATM efficiency as flight separation distances can be reduced and more direct flight paths are planned, reducing ATFM delay. Another example is the L3Harris service-based Data Comms program¹⁰ which delivers FAA's data and voice network infrastructure to enable air traffic control of the American National Airspace System (NAS). L3Harris's service-based solutions improve aviation safety in the region by reducing errors in voice communications as a trusted, highly specialised vendor. Skykraft¹¹ is also developing a space-based ATM service due to be operational in 2025.

Investing in services such as these reduces the considerable burden of, for example, procurement, training, maintenance and cyber security. Although the service provider will pass these costs on to its customers, they can be shared across multiple ANSPs. Similarly, service providers can also achieve economies of scale by delivering services to multiple ANSPs. These economies cannot be achieved by a single ANSP operating alone. Service providers are also able to provide worthwhile investments meeting the varying needs of their ANSP customers by applying tiered charges charging reflecting that some ANSPs may require more sophisticated services whilst others may only require basic services.

9 **Source:** Aireon, Space-Based ADS-B

10 **Source:** L3Harris, Data Communications (Data Comm) User Information

11 **Source:** <https://www.skykraft.com.au/>

SOLUTION 2:

CREATE ALLIANCES TO ENABLE COST-EFFECTIVE AND SCALABLE TECHNOLOGY ACQUISITION

Groups of ANSPs have created alliances with technology providers to enable cost-effective and scalable development and acquisition of new technology solutions, building on a broad base of commonality. In these alliances, instead of each ANSP developing and procuring new technologies separately, they collaborate to define a core set of requirements and pool resources to conduct a single procurement process, extending through to the upgrade and maintenance cycles. The approach allows ANSPs to procure add-ons to the core system to meet their own specific needs. There are also savings on parts of the acceptance testing and commissioning processes, such as factory acceptance testing (FAT) and validation. Use of common software across the ANSPs' platforms rather than being bespoke and proprietary for each individual ANSP naturally reduces costs but also mitigates the high risk of total dependence on a single or few experts within each ANSP for software maintenance and upgrade.

These alliances increase buyer power and facilitate volume discounts for the ANSPs. The alliance approach creates a positive environment to secure competitive prices and favourable contract terms and conditions, warranties, delivery times and payment terms. The vendor benefits from a guaranteed volume of sales, avoiding the need to respond to multiple competitive tenders, which can be complex, lengthy and expensive for all parties.

The interoperability Through European Collaboration (**ITEC**)¹² alliance is an example of an agreement between seven European ANSPs (ENAIRE, NATS, DFS, LVNL, AVINOR, PANSA, and ORO NAVIGACIJA) with Indra as an industrial partner to develop an interoperable and innovative flight data processor (FDP). **COOPANS**¹³ is another example, focused on a common ATM system across six ANSPs (Austro Control, Croatia Control, Naviair, AirNav Ireland, NAV Portugal and LfV) with Thales as the industry partner. The approach allows ITEC and COOPANS partners to benefit from the integration of additional functionalities and services to meet local needs while retaining the benefits of economies of scale of the core system and maintaining standardised approaches to system functionality, engineering, and training. For example, while an ANSP might not be ready to acquire a particular functionality of the system when its being developed by another ANSP in the alliance, it still has easier access (and deployment) when required. Alliance agreements enable the easy sharing of information, data, knowledge and experience as well as managing intellectual property rights.

In the APAC region, because many ANSPs are driven by government processes, government-to-government policies will play a crucial role in shaping the alignment of procurement processes for modernisation initiatives. Different states have varying and sometimes contradictory laws, regulations, as well as differing financial capacities related to procurement. The bureaucratic complexity and diverse priorities

12 **Source:** <https://www.itecskynex.com/>

13 **Source:** <https://www.coopans.com/>

inherent in implementing cross-border, multi-agency collaborations can result in considerable administrative “red tape.” Navigating through various national regulations, policies, and procedures requires substantial effort and time, potentially impeding the progress of collaborative efforts.

Specificities in each state’s airspace and ANSP operating model adds an additional layer of complexity, demanding tailor-made solutions that align with unique requirements. This could present a barrier to multiple states reaching consensus on new technology procurement. The decision-making process will likely be complicated as each ANSP may have different priorities, timelines, and specific requirements – the greater the number of partners, the greater the complexity. A high level of coordination and communication among all participants is needed to avoid delays, inefficiencies in the process and difficulties in reaching a unanimous agreement on the choice of technologies and solutions.

There could also be concerns as ANSPs converge on a shared procurement approach, of an increasing risk of creating a closed market, consolidating market power, and reducing the flexibility and diversity of available solutions. This transformation from a multi-supplier environment to one that favours a monopoly or duopoly could stifle fair and transparent competition.

To mitigate these concerns, it is possible to explore hybrid approaches that address local procurement challenges while still leveraging the concept of alliances. Within this, similar ANSPs could collaborate to develop a set of common technical specifications, reducing the expense associated with the development of multiple individual specifications. Alternatively, ANSPs could consider sharing on a smaller, scale, for example, for spare part as an alternative to full joint procurement. To enable joint procurements government involvement is essential to harmonise procurement rules. This underscores the importance of educating politicians and engaging with decision-makers to raise the priority of the air traffic management sector.

SOLUTION 3:

INTRODUCE A COMMON OPERATIONAL INFORMATION SYSTEM (OIS) TO FOSTER RESILIENCE

ICAO Annex 11 provides comprehensive requirements that emphasise the need for:

- contingency planning;
- collaborative decision-making (CDM);
- training, performance monitoring; and
- international cooperation between ANSPs to enhance ATM continuity.

The APAC region has segregated national contingency plans but a local disruption, caused usually by weather or technology outages, has a knock-on effect on the surrounding airspace and, often, a considerable distance upstream in the network. Limited information sharing usually aggravates the situation especially across boundaries and can result in significant constraints on capacity to ensure safety. This manifest as delays and their associated costs.

Information sharing in these situations enhances wide-spread situational awareness based on a common picture. This enables all stakeholders to understand the scope and impact of the disruption, which is essential for making informed decisions. In turn, information sharing enables effective contingency planning and response coordination, ensuring that resources and efforts are aligned to minimise the impact of disruptions on operations and passengers. All states will have unique experiences and expertise dealing with different types of disruptions. By collaborating, they can share this knowledge and learn from each other, enhancing their collective ability to handle various disruptions and foster resilience on a regional scale.

A foundational component in enabling resilience is having a common platform to share information. This is known as an OIS where ANSPs, airlines, airports and international organisations share pertinent information of day-to-day operations to support situational awareness and provide updates during disruptive events. CANSO ATFM Data Exchange Network for Cooperative Excellence (**CADENCE**) and the CANSO ATFM Data Exchange for the Americas (**CADENA**)¹⁴ are two ongoing examples of this initiative in the Latin America and Caribbean (LAC) region which is susceptible to severe weather disruptions. The platform provides access to common information and share special events (i.e., contingency plans/special events/anticipated capacity demand) via online server connection and acts as a standardised accessible portal. As the aggregation and availability of real-time data provided by partners grow, the platform can provide higher accuracy and increase situational awareness across the region.

APAC could leverage the platform used by LAC to enhance the region's capacity to respond to emergencies by providing a centralised information sharing system that enhances coordination and more unified and effective responses to regional disruptions and decision-making in general. The platform could be hosted in the cloud by a third-party, reducing costs for each individual country. Cost reduction

14 Source: <https://www.cadenois.org/>

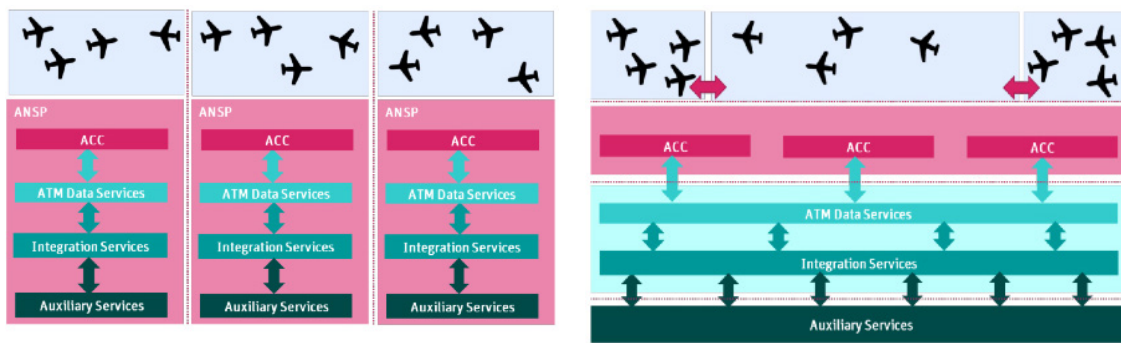
could extend to sharing of resources during the crisis. This can be particularly important in APAC due to its geographical diversity and heterogeneous resource levels. However, there may be concerns on the level of dependency on an external platform over the long-term.

It does also require significant amount of bureaucratic effort ensure the platform meets the state and ANSP requirements. At the very least, each country involved would most likely want to apply robust cyber security measures to protect shared data and measures would be needed to authenticate the shared data.

To address cyber security, at least partly, it is worth considering the successful approach taken by the APAC region in procuring the Common Aeronautical Virtual Private Network (VPN) (CRV) service from PCCW. This VPN service, which facilitates communications over the internet, exemplifies a regional procurement process that can help mitigate concerns about over-dependency or lock-in with a single vendor. In this case, the ICAO Regional Office served as a neutral and honest broker for vendor selection, while the ICAO TCB Bureau handled the technical specifications and procurement process. After the service provider for the region was identified, individual ANSPs signed contracts with the selected vendor. This CRV project marked the first region-wide procurement process of its kind. To further guard against over-dependency on a single vendor, future endeavours could consider selecting two vendors and implementing fixed-term contracts, allowing for regular renewal, and promoting healthy competition in the procurement process. This approach not only fosters diversity but also ensures adaptability and innovation in the provision of critical services for the aviation sector in the APAC region.

SOLUTION 4: EMBRACE VIRTUALISATION AS AN ORGANISATIONAL SOLUTION TO ENHANCE SERVICES

Currently, ANS in APAC (and in most places around the world) consists of country-based systems and processes, based on bespoke, vertically integrated systems owned and operated by each ATM provider. This has led, inevitably, to a lack of interoperability, higher ANS costs and inefficient use of limited resources. Breaking down the vertical integration and replacing it with horizontal integration enables more efficient provision of services.



Vertically Integrated

Horizontally Integrated

This approach separates data services such as flight data, radar data, and weather information from the physical controller working position (CWP). It enables more flexible service provision, with airspace sectors assigned to control rooms dynamically based on factors such as traffic, resource availability, weather, and special events. This horizontal integration is the basis of the so-called virtual centre concept and is predicted to deliver a host of flexible and dynamic benefits focused on performance from workload reduction, unified common procedures, cost saving, reduced ATFM constraints and airspace resilience. Virtual centres can be applied nationally across various ATSUs or cross-border. They can be implemented either as business as usual or restricted to contingency use.

skyguide has applied the virtual centre concept on the national level as its **Virtual Area Control Centre (ACC)**¹⁵. The aim is to use virtual technology to deliver an ATC environment spanning two physical ACCs. Through virtual instances of ATC systems and tools hosted on a shared infrastructure, controllers from both ACCs can collaboratively control air traffic, share real-time data, optimise resource allocation, enable load balancing, enhance redundancy, and facilitate seamless disaster recovery, ultimately leading to more efficient airspace utilisation and improved coordination between the ACCs.

The FINEST initiative between Estonia Air Navigation Services (EANS) and Fintraffic ANS¹⁶ demonstrates dynamic cross-border ATM. Based on harmonised working methods, procedures, and ATM systems, the FINEST initiative addresses service provision in the neighbouring flight information regions (Helsinki and Tallinn

15 Source: skyguide, Virtual Centre

16 Source: EANS, Development Initiatives

FIRs) through one FDP system. This virtual ATM approach is expected to increase airspace capacity by 20-30 per cent with the same resources, as sectors are shifted as needed. When combined with concepts like Free Route Airspace (FRA) and Flexible Use of Airspace (FUA), it improves cross-border operations, reducing delays and environmental impact while ensuring service continuity during emergencies.

However, virtual ATM provision can be constrained by capacity for additional training, licensing and regulatory requirements, alignment of operational procedures, and requirements. There are also concerns on the sovereignty and political barriers usually tied to security and military operations as well as job preservation and stakeholder buy-in. There are questions that remain on the liability.

Virtualisation can also be applied to regional ATFM. Today, ATFM in APAC is performed in a decentralised manner across a handful of participants such as the Civil Aviation Authority of Singapore (CAAS) and AEROTHAI and Hong Kong Civil Aviation Department (CAD). Optimisation is performed locally, not regionally, and there are no transparency or compliance obligations. This current reality reflects the lack of agreement on a EUROCONTROL-like Network Manager equivalent. However, if the regional Network Manager is not a physical entity, but an independent third-party vendor providing ATFM as a service, there could potentially be more acceptance. Virtual ATFM is now possible. To ensure that there is transparency and equity, a governing board of ANSP CEOs can be formed to set the ATFM rules, and conduct audit of the delay distribution, over this service provider.

ACTIONS

Complementary to, and in support of, the four potential solutions identified above, there are six actions that should be undertaken, described below in order or priority.

ACTION 1:

CREATE A FORUM AND FRAMEWORK FOR COOPERATION

ANS modernisation in APAC needs to be addressed holistically at least at sub-regional level. Local and national piecemeal developments are not sufficient to overcome the challenges. To drive regional progress and innovation effectively, a more structured framework is needed at the ANSP-to-ANSP and state-to-state level. In support of this, APAC's ANSPs must be aligned and have a common understanding of the current situation and the vision and goals for the development of the region's ANS. A mechanism is also needed to provide governance for collaborative activities in the future.

A possible first step is for CANSO, in conjunction with ICAO and IATA, to establish this mechanism to build relationships between the region's ANSPs. This could take the form of a forum of ANSP CEOs. The forum should be built on the principles of inclusivity, transparency, and accountability, and should be underpinned by strong terms of reference and decision-making processes. This CEO forum should be established at APAC level but with flexibility to establish more focused groups to address specific issues within individual sub-regions if needed.

This forum could potentially build upon the existing APAC ANSP committee and offer a centralised platform for meaningful discussions, networking, and the sharing of insights to learn from one another's experiences and drive mutual development, transferring knowledge from years of experience from more to less, experienced ANSPs. The forum could also create ad hoc working groups resources from the ANSPs to address specific tasks when needed. The first task of the forum should be to develop a vision statement, strategy and roadmap to ensure all parties have a clear understanding of and buy-in to the challenges to be addressed and the goals and objectives.

The forum would facilitate enhanced collaboration and accountability by fostering a shared sense of purpose and responsibility among ANSPs. By bringing together the collective wisdom of industry leaders, it can serve as a catalyst for innovative solutions, best practice dissemination, and alignment towards a common vision of a streamlined and efficient regional ATM network. The establishment of such a forum holds the potential to not only strengthen the exchange of knowledge and expertise but also to expedite the adoption of emerging technologies, harmonise operational and safety procedures, and effectively navigate the complexities of modern air traffic management. However, this will require support from Asia Pacific Ministerial Conference to contribute state resources to form a secretariat to support the forum.

ACTION 2:

DEVELOP AN INFORMATION SHARING PLATFORM TO INCREASE PREDICTABILITY AND CONTINUITY

In a region frequently affected by severe weather disruptions and natural disasters, adopting practical measures to ensure operational resilience is essential. This could start with simple calls or online meetings between ANSPs, either held regularly or triggered by forecast events. It is likely that a single ANSP would need to bear the responsibility for organising and hosting such calls.

This could be extended to conducting periodic exercises across the APAC region for as a sensible approach for contingency preparedness. These exercises enhance the coordination and communication capabilities of ANSPs, airlines, and airports, enabling them to respond effectively during crises.

Leveraging the OIS used in CADENCE can significantly contribute to maintaining business continuity during disruptions. This would facilitate transparent information sharing among ANSPs, enabling them to exchange day-to-day operational insights. This transparent framework would prove invaluable in coordinating unified responses during unforeseen situations, fostering a collaborative environment.

Such an OIS for contingency events meets a universal basic need for elementary contingency management. Conceivably, a more sophisticated ATFM OIS can be developed for the region and be also used for contingency management. However, implementing a region wide ATFM OIS will take time. This is especially so given the maturity state of ATFM in the region. Not every ANSP in the region would need ATFM. The contingency OIS which should be universally implemented can be separated from ATFM. The contingency OIS being easily implemented, can be a stepping stone or learning process for the more advanced ATFM OIS.

ACTION 3:

EDUCATE AND INFORM POLITICAL BODIES

ATM modernisation across the APAC region requires a focused effort to educate political bodies about the importance of investing in ATM as a critical enabler for air transport, thereby facilitating its contribution to economic growth. While, within APAC, airports are commonly recognised as essential infrastructure, the importance of modernised ATM systems must be emphasised to ensure policies and regulations that can support the progress of ATM modernisation. Areas where such as cross-border alliances, data sharing, harmonisation of standards, and collaborative procurement initiatives are greatly influenced by policy decisions. By raising awareness among policymakers about the manifold benefits of modernising ATM – such as increased airspace capacity, reduced flight delays, lower fuel consumption, decreased carbon emissions, and reduced costs – they are more likely to support its modernisation.

Engaging in proactive advocacy and presenting well-researched data and case studies showcasing successful ATM modernisation in other regions are essential steps to gain political support. Involving political bodies in discussions and planning sessions related to aviation and ATM development fosters a deeper understanding of the complexities and potential benefits involved. By fostering collaboration and communication between aviation stakeholders, a unified voice can be presented to policymakers, motivating them to develop favourable policies and regulations. These proactive measures will encourage innovation and lead to the seamless modernisation of air traffic management systems across the APAC region, ultimately promoting safe, efficient, and resilient air travel and contributing to the sustained economic development of countries in the region.

To convince politicians to invest, it is also crucial to demonstrate the cost of missed opportunities and the long-term impact of no investment.

ACTION 4:

ENHANCE TECHNOLOGY ADOPTION THROUGH PROCUREMENT ALLIANCES AND MANAGED SERVICES

Joint procurement is a vital step in lowering the cost and effort of technology adoption while increasing interoperability. It is recommended to share procurement goals and objectives among a group of ANSPs – in the form of an alliance – with a focus on defining requirements based on services that can benefit all parties involved. The joint development of technical specifications and cost sharing through managed services offers a powerful strategy for ANSPs in the APAC region to enhance technology modernisation efficiency. ANSPs can collaboratively design technical specifications by pooling their collective expertise and resources to create tailored solutions that address their unique operational challenges.

To enable the creation of procurement alliances and the use of managed services, ANSPs will need to review and adapt their business and operating models. Rather than undertaking all core activities in-house, ANSPs will need to work collaboratively with partners. This is more than simply contracting out services and will require true collaboration, including risk- and benefit-sharing with other ANSPs, with vendors and, perhaps, with users. To enable this and address pivotal legal concerns and differences within an alliance or partnership a strong legal basis is crucial to define the roles, responsibilities, rights, obligations and liabilities of each party. It can help manage potential disputes, handle regulatory differences between countries and provide clear guidelines for decision making, harmonising procurement regulations in the region. Furthermore, regular, clear and open communication between all parties is essential. This can help address any issues or misunderstanding promptly and can facilitate smooth coordination.

Early and active engagement with potential vendors can provide valuable market insights, build relationships, and promote standard pricing, leading to better procurement outcomes. However, it is also important for technology vendors participating in such common procurement alliances to maintain their autonomy and be able to operate free from undue influence. It fosters fair competition, objective decision-making, enhanced value, and innovation. By ensuring that vendors remain independent, conflicts of interest are mitigated, a diverse vendor pool is encouraged, and long-term sustainability is achieved. This approach promotes transparency and maximises the alliance's ability to acquire the most suitable technologies or services, ultimately benefiting all members involved.

A service-based approach offers another avenue to lower costs and technology adoption by allowing ANSPs to outsource technology management and support to specialised providers. This eliminates the need for extensive in-house resources dedicated to technology maintenance, freeing ANSPs to focus on their core mission of safe and efficient ATM. Through collaboration and shared resources, ANSPs can expedite technology adoption, enhance operational capabilities, and ensure continuous updates, enabling them to navigate the rapidly evolving aviation landscape more effectively while optimising costs and efforts.

In particular, the APAC region would benefit from the collective investment in a managed service like System Wide Information Management (SWIM) node implementation. A SWIM node would facilitate real-time sharing of information including (e.g., flight plans, weather data, traffic flow management) between key stakeholders in the region. This would lay foundational means for collaboration as data exchange is standardised.

ACTION 5:

INTRODUCE SUSTAINABLE FLIGHT OPTIMISATION AND ADOPT SUSTAINABILITY ACCREDITATION

Another key component in modernising APAC airspace is successfully setting and achieving sustainability goals. With the increasing capacity demands it is important to align with eco-conscious practices to ensure long-term economic resilience and demonstrate best practices in the industry. By introducing concepts such as cross-border User Preferred Route (UPR) and Free Route Airspace (FRA), ANSPs and airlines alike can significantly reduce fuel consumption and emissions as flight trajectories become more direct. Adopting the GreenATM¹⁷ accreditation scheme can help ANSPs in the region assess current efforts to reduce environmental footprints and establish realistic sustainability goals by identifying best practices and providing long-term viability in a transparent, accountable manner. Widespread participation in the accreditation program will allow ANSPs to uncover best practices and share lessons learnt in sustainability (i.e., measures in terminal airspace), all of which contribute to fostering innovation to reach a more sustainable aviation industry.

It is also important to highlight performance monitoring as a critical component of modernising APAC airspace. Despite the benefits of measuring performance, some ANSPs may be reluctant to be measured. Transparency is needed, and performance measurement would illuminate areas that require improvement. With the availability of commercial data sources like FlightRadar24 and FlightAware, data analytics can be conducted independently without ANSPs having to share proprietary data. Organisations such as ICAO and CANSO can play a pivotal role in this regard, providing impartial assessments and insights into ANSP performance. Prioritising performance reviews not only enhances accountability but also ensures that the industry can continually strive for improvement and efficiency. It is an important aspect that underscores the importance of transparency and accountability in the aviation sector's modernisation efforts.

17 Source: CANSO, GreenATM

ACTION 6:

CREATE INNOVATION ALLIANCES AND SHOWCASE ADVANCED TECHNOLOGY USE CASES

Next generation technology development can be motivated by forming research and innovation alliances such as those seen under the single European sky ATM research program (SESAR) initiative or Next Generation Air Transport System (NextGen) in the United States. Such alliances could be even more broad, such as the Advisory Council on Aviation Research and innovation in Europe (ACARE)¹⁸. These initiatives aim to modernise ATM and enhance overall efficiency, safety, and capacity of the aviation system by embracing the benefits of advanced technology and virtual services. Initiatives such as these promote technological innovation through a clear set of modernisation goals intertwined in interconnecting projects. The research and development of these projects are funded through the aligned views and expected outcomes of multiple stakeholders (such as airports, ANSPs, airlines, technology providers, academia), providing mutual benefit to each related party and towards the system.

To accelerate next generation development APAC there is an opportunity to showcase regular technology use cases that illustrate the potential of virtualisation in shaping the future. For example, implementing practical scenarios that demonstrate the benefits of the SWIM node – such as its ability to foster streamlined coordination between various aviation entities - will help validate the effectiveness, and therefore buy-in, to the relevant stakeholders. Other examples include demonstrating Flow Information for a Collaborative Environment¹⁹ (FF-ICE) in simulated scenarios where ANSPs and airlines collaboratively optimise ATFM to mitigate congestion and delays, highlighting the data-driven decisions capable for more efficient airspace utilisation.

18 **Source:** <https://www.acare4europe.org/>

19 **Source:** FAA, FF-ICE Fact Sheet



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