Australian Government

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

Australia's National Air Navigation Plan 2024–27

Draft for consultation

May 2024

Executive summary

Economic, social and technical advancements are rapidly changing the air navigation system. The international aviation community's efforts are continuing to address safety, efficiency, capacity and environmental challenges. Remotely piloted aircraft systems, advanced air mobility, and space launches and returns also bring new challenges and opportunities. Steady and incremental improvements to the global, regional and Australian air navigation system are helping address these challenges and to harness the opportunities and benefits presented by the solutions.

Australia's National Air Navigation Plan (NANP) reflects our priorities and ongoing initiatives for evolving our air navigation system, as well as its regulatory structure, governance and key stakeholders. It details the evolution of our air navigation system to meet growing community needs and expectations focusing on operational improvements to increase capacity, efficiency, predictability and flexibility while ensuring interoperability of systems and harmonisation of procedures globally, and measures to protect the environment.

Achieving Australia's air navigation system policy priorities and initiatives will allow us to share in the safety, economic, efficiency, productivity and sustainability benefits enabled by new technologies and international best practice. Australia's NANP is closely related to our State Safety Programme and National Aviation Safety Plan, which together support a desired level of safety performance and ensure the effective implementation of aviation safety oversight to permit innovation in the air navigation system in a managed way.

Aviation safety will always be the key priority for Australia, including for air navigation. Australia aims to equitably accommodate all airspace users' operations in a safe, secure and cost-effective manner while reducing the environmental impact of aviation. Our requirements for evolving our air navigation system also include:

• Effective use of, and investment in, technology, infrastructure, and services

• Closer alignment with internationally agreed Standards and Recommended Practices

• Civil-military air navigation system harmonisation

• Regional air traffic services based on risk assessment

• The recruitment, retention, and training of skilled personnel

• Effective management of environmental impacts from aviation operations.

Australia's air navigation system initiatives respond to global and regional developments as well as our own requirements and priorities aligning strongly to agreed international commitments and timeframes. This links Australia's work in enhancing its air navigation system to the global harmonisation activities of the International Civil Aviation Organization.

Abbreviations and acronyms

AAM	Advanced air mobility
AAPS	Australian Airspace Policy Statement
A-CDM	Airport Collaborative Decision Making
AFAF	Australian Future Airspace Framework
AGA	Aerodromes and ground aids
AIG	Aviation Implementation Group
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Services
AMSA	Australian Maritime Safety Authority
ANS	Air navigation system
ANSP	Air navigation service provider
APANPIRG	Asia Pacific Air Navigation Planning and Implementation Regional Group
APG	Aviation Policy Group
AP-RANP	Asia/Pacific Seamless (Regional) Air Navigation Service Plan
AP-RASP	Asia Pacific Regional Aviation Safety Plan
ARFFS	Aviation rescue and fire fighting
ASBU	Aviation system block upgrade
ATFM	Air traffic flow management
ATM	Air traffic management
AWOS	Automatic Weather Observing Systems
BARO VNAV	Barometric vertical navigation
the Bureau	Bureau of Meteorology
CASA	Civil Aviation Safety Authority
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
Chicago Convention	Chicago Convention on International Civil Aviation
CMATS	Civil Military Air Traffic Management System
CNS	Communications, navigation and surveillance
DASP	Defence Aviation Safety Program
Defence	Department of Defence
the department	Department of Infrastructure, Transport, Regional Development, Communications and the Arts
FIMS	Flight information management system

FUA	Flexible Use of Airspace
GADSS	Global Aeronautical Distress and Safety System
GANP	Global Air Navigation Plan
GASP	Global Aviation Safety Plan
GDP	Ground Delay Program
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IWXXM	ICAO Meteorological Information Exchange model
LR-ATFM	Long Range Air Traffic Flow Management
MET	Meteorology/Meteorological
MetCDM	Meteorological Collaborative Decision Making
the Minister	Minister for Infrastructure, Transport, Regional Development and Local Government
NAMO	National Airspace Management Office
NANP	National Air Navigation Plan
NANP-DIG	National Air Navigation Plan Drafting and Implementation Group
NASP	National Aviation Safety Plan
NEAT	National Emerging Aviation Technologies
NOMC	National Operations Management Centre
PBN	Performance Based Navigation
RANP	Regional Aviation Navigation Plan
RPAS	Remotely piloted aircraft systems
SAR	Search and rescue
SARPs	Standards and Recommended Practices
SAS	Safety Alerting Service
SBAS	Satellite-based augmentation system
SOE	Statement of Expectations
SSP	State Safety Programme
SUA	Special Use Airspace
SWIM	System Wide Information Management
TBO	Trajectory Based Operations
UTM	Uncrewed Traffic Management
WSI	Western Sydney International

Table of Contents

Evolving Australia's air navigation system

Our National Air Navigation Plan (NANP) reflects Australia's priorities and ongoing initiatives for evolving our air navigation system (ANS).

The ANS includes:

- Communications, navigation, and surveillance (CNS) systems

- Air traffic management (ATM)

- Meteorological (MET) services for air navigation

- Aeronautical information services (AIS) and aeronautical information management (AIM)

- Aerodromes and ground aids (AGA)

- Search and rescue services (SAR).

Achieving Australia's ANS policy priorities and initiatives will allow us to share in the safety, economic, efficiency, productivity and sustainability benefits enabled by new technologies and international best practice.

Purpose

Australia's NANP describes our ANS and its operating environment, as well as the roles and responsibilities of government agencies and industry. The NANP reflects our ANS policy objectives and outlines the outcomes of ANS planning and investment by Australian Government agencies and industry. It responds to global, regional and Australian strategic planning documents providing stakeholders with a consolidated indication of the pathway that is being followed to evolve Australia's ANS.

Consistent with the ICAO Global Air Navigation Plan (GANP), our NANP's objective is to describe how we contribute to global and regional efforts to increase capacity and improve the efficiency of the ANS while maintaining and improving safety.

Australia's NANP is closely related to our State Safety Programme (SSP) and National Aviation Safety Plan (NASP). Our NANP details the evolution of our ANS to meet the growing needs and expectations of the aviation community focusing on operational improvements to increase capacity, efficiency, predictability and flexibility while ensuring interoperability of systems and harmonisation of procedures at a global and regional level, and measures to protect the environment.

The NASP supports the implementation of the NANP by ensuring a safety management approach to oversight, which permits innovation in the ANS in a managed way. The SSP plays an important role in identifying, monitoring and maintaining the effectiveness of all aspects of our aviation safety performance and objectives. It establishes our key safety principles, structures and processes that underpin our aviation safety system.

Australia's NANP is subject to a regular three year review cycle, aligned to updates to the GANP as endorsed at triennial ICAO Assemblies, and the Asia Pacific Seamless (Regional) Air Navigation Service Plan (AP-RANP), to ensure it remains contemporary and continues to demonstrate clearly how Australia is responding to its global and regional commitments to evolve its ANS.

The draft Australian NANP has been developed by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (the department) in close consultation with:

- Airservices Australia
- the Australian Maritime Safety Authority (AMSA)
- the Australian Space Agency
- the Australian Transport Safety Bureau (ATSB)
- the Bureau of Meteorology (the Bureau)
- the Civil Aviation Safety Authority (CASA)
- the Department of Defence (Defence)
- the Department of Home Affairs
- Geoscience Australia.

Our air navigation system regulatory framework

Australia's NANP is informed by global, regional and domestic strategic ANS planning documents, as well as our international obligations under the *International Convention on Civil Aviation* (the Chicago Convention) and existing policy, legal and regulatory frameworks. The agreed priorities and initiatives outlined in Australia's NANP are consistent with our aviation safety objectives set out in the SSP, NASP and specific airspace and ANS management policies and legislation.

The Global Air Navigation Plan

The GANP is ICAO's strategic implementation planning tool for setting global priorities to drive the evolution of the global ANS to ensure that the vision of an integrated, harmonised, globally interoperable and seamless ANS becomes a reality, while maintaining and improving safety.

The GANP outlines the strategic goals of ICAO to evolve the global ANS in the key performance areas of: access and equity; capacity; cost-effectiveness; efficiency; environment; flexibility; interoperability; participation by the air traffic management community; predictability; and, safety and security.

The GANP also provides a technical framework for harmonising avionics capabilities and the required air traffic management ground infrastructure, as well as automation, for evolving the global ANS. The framework is known as the Aviation System Block Upgrades (ASBUs). It is not intended that all ASBUs are applied in every State, sub-region and/or region. ASBUs are evaluated at the regional and State-level to identify which of those modules best provide the needed operational improvements, as appropriate, and consistent with State plans.

The Asia Pacific Seamless (Regional) Air Navigation Service Plan

The Asia Pacific Seamless (Regional) Air Navigation Service Plan (AP-RANP) is ICAO's strategic implementation tool for defining the goals and means of State planning objectives to achieve the strategic goals of the GANP for the region. This takes into account the needs of the region and may not reflect every goal in the GANP.

The objective of achieving a seamless ANS in the Asia Pacific region is:

> **…the safe and interoperable provision of harmonized and consistent air traffic management service provided to a flight, appropriate to the airspace category and free of transitions due to a change in the air navigation service provider or Flight Information Region.**

The AP-RANP provides a framework for the transition to a seamless ANS environment for the Asia Pacific to meet future ANS performance requirements. This includes:

- strategic objectives and a performance framework
- a deployment plan with specific operational improvements, transition arrangements, expected timelines and implementation examples, with reference to the relevant ASBUs
- an overview of financial outcomes and objectives, cross-industry business and performance/risk management planning.

The AP-RANP was developed as part of a suite of Asia Pacific air navigation plans and is considered alongside those listed in Figure 1, which illustrates the relationship between global and regional planning and reporting on the evolution of the global ANS.

Figure 1: Structure of global and regional planning and reporting on the ANS

Global vision
- Global Air Traffic Management Operational Concept

Global implementation
- Global Air Navigation Plan
- Global Aviation Safety Plan

Global reporting
- Global Air Navigation Report
- Global Air Safety Report

Regional reporting
- Regional Safety Briefing
- State Safety Briefing

Regional vision
- Asia/Pacific Region Air Navigation Plan

Regional implementation strategy
- Asia/Pacific Seamless ANS Plan
- Asia/Pacific A-CDM Implementation Plan
- Asia/Pacific Regional ATFM Framework
- Asia/Pacific Plan for Collaborative ATM
- Regional ATM Contingency Plan
- Asia/Pacific SAR Plan
- AMS, COM, NAV, SUR, Datalink, SID/STAR and PBCS Strategies

Regional monitoring
- Asia/Pacific Regional Picture
- Air Navigation Implementation

Regional implementation reporting
- Seamless ANS Reporting

Seamless ANS Guidance Material
- National Air Navigation Plan Template
- Regional eDocs Guidance Material

Through the 2018 *Beijing Declaration*, States in the Asia Pacific region have committed to improving aviation safety and air navigation through the implementation of the AP-RANP to enhance regional ANS capacity and harmonisation. Australia's commitment includes alignment with priority ASBUs and updating our NANP.

Australian legislation

Australian aviation legislation demonstrates our commitment to enacting the requirements of the Chicago Convention and defines Australia's governance arrangements for aviation safety and air navigation.

Air Navigation Act 1920

Australia ratified the Chicago Convention in 1947. The *Air Navigation Act 1920* gives effect to the Convention in Australian law. The department is responsible for administering the Air Navigation Act.

The Air Navigation Act also contains a provision for regulations to be made for the purpose of carrying out, and giving effect to, the Chicago Convention and ICAO Standards and Recommended Practices (SARPs) contained in the Annexes to the Convention.

Air Services Act 1995

The *Air Services Act 1995* establishes Airservices Australia as our civil air navigation services provider. Airservices Australia is legislated to provide civil services on behalf of Australia for air traffic, aeronautical information, aeronautical radio navigation, aeronautical telecommunications as well as aviation rescue and firefighting services (ARFFS), which are defined such that they give effect to the Chicago Convention.

Airspace Act 2007

The object of the *Airspace Act 2007* is to ensure that Australian-administered airspace is administered and used safely, taking into account matters such as protection of the environment, efficient use of airspace, equitable airspace access and national security. The regulatory responsibility conferred to CASA under the *Airspace Act 2007* is also subject to matters set out in sections 9A to 11A of the *Civil Aviation Act 1988*. Under the *Airspace Act 2007*, the Minister for Infrastructure, Transport, Regional Development and Local Government (the Minister) must make an Australian Airspace Policy Statement (AAPS). CASA must exercise its powers and perform its functions in a manner consistent with the AAPS. These airspace functions and powers conferred to CASA are set out in the *Airspace Act 2007* and the *Airspace Regulations 2007* and forms part of the broader regulatory authority provided by the *Civil Aviation Act 1988*.

Australian Maritime Safety Authority Act 1990

The *Australian Maritime Safety Authority Act 1990* establishes AMSA as the national provider of SAR services. AMSA is legislated to provide SAR services consistent with the Chicago Convention.

Civil Aviation Act 1988

The object of the *Civil Aviation Act 1988* is to establish a regulatory framework for maintaining, enhancing and promoting the safety of civil aviation, with an emphasis on preventing aviation accidents and incidents. The Civil Aviation Act establishes the functions of CASA as the aviation safety regulator and sets out its governance arrangements. In exercising its powers and performing its functions, CASA must regard the safety of air navigation as the most important consideration. CASA must perform its functions in a manner consistent with Australia's obligations under the Chicago Convention and agreements between Australia and other countries relating to the safety of air navigation.

Meteorology Act 1955

The *Meteorology Act 1955* establishes the Bureau as Australia's national weather, climate and water agency. The Bureau is tasked with providing aeronautical meteorological services to civil aviation.

Transport Safety Investigation Act 2003

The *Transport Safety Investigation Act 2003* establishes the ATSB as the independent 'no-blame' investigator of aviation accidents and incidents.

Australian policies, planning documents and other publications

Aeronautical Information Publication

Contracting States to the Chicago Convention are required to provide a document which records the State's aeronautical information, known as the Aeronautical Information Publication (AIP).

The details of air navigation services, including the manner in which the services are provided, are published in the Australian AIP for a number of matters including:

- a flight information area or a flight information region
- a control area or a control zone
- airspace of any class
- a controlled aerodrome.

Australian Airspace Policy Statement

The AAPS outlines the Australian Government's airspace policy objectives and priorities. CASA must administer airspace, as a national resource, consistent with its legislative functions, government policy objectives and priorities, and Australia's obligations under the Chicago Convention. The AAPS also provides guidance for the aviation industry and other aviation agencies. The AAPS is reviewed every three years.

The Government considers the safety of air navigation an integral part of airspace administration.

The current AAPS outlines other specific airspace policy objectives, such as:

- CASA developing an Australian Future Airspace Framework (AFAF), incorporating a long-term strategic airspace implementation plan for the deployment of solutions to address evolving user needs in airspace classes across Australian airspace.
- Ensuring Australia's approach to airspace administration reflects the Australian Government's commitment to supporting innovation and growth of new and emerging digital aviation technology, as well as reviewing legislation to ensure future operations can be accommodated in Australian airspace.
- CASA continuing to undertake operational reviews of Australia's airspace architecture and, as appropriate, to consider proven international best practice airspace systems to deliver safe, efficient and appropriate airspace arrangements. CASA is also expected to continue to move towards closer alignment with ICAO.

State Safety Programme

Australia's Aviation SSP is the primary publication used to ensure the effectiveness of Australia's aviation safety system. It is a summary of all Australian safety-related activities and provides detail on relevant legislation, systems and processes that support Australia's aviation safety system.

The SSP aligns with ICAO Annex 19 – Safety Management, Doc 9859 – Safety Management Manual, and Doc 9734 – Safety Oversight Manual.

National Aviation Safety Plan

Australia's NASP details Australia's commitment to continuously improve aviation safety management capabilities to reduce the risks of aviation operations.

It is closely related to our SSP and NANP to support the achievement of an acceptable level of safety performance. Australia's NASP is strategically aligned with ICAO's Global Aviation Safety Plan (GASP) and the Asia Pacific Regional Aviation Safety Plan (AP-RASP).

The purpose of the GASP is to:

> **… continually reduce fatalities, and the risk of fatalities, associated with accidents by guiding the harmonized development and implementation of regional and national aviation safety plans. States, regions and industry facilitate the implementation of the strategy presented in the GASP through regional and national aviation safety plans.**

Australia's NASP identifies initiatives that are being undertaken to reduce the risks associated with aviation operations in Australia, and details the strategic direction for the management of aviation safety in the short, medium and long term.

The NASP is subject to ongoing maintenance aligned to the review, development and publication of the GASP, the AP-RASP and Australia's SSP.

Statements of Expectations and Corporate Plans

The Australian Government agreed that Ministers would issue Statements of Expectations (SOEs) to statutory agencies. By issuing SOEs, Ministers are able to provide greater clarity about government policies and objectives relevant to a statutory authority, including the policies and priorities it is expected to observe in conducting its operations.

SOEs recognise the independence of the statutory agency and are to be read alongside the laws that apply to the regulator and the laws that they administer.

The Minister has issued SOEs to portfolio statutory agencies, with the SOEs for Airservices Australia and CASA specifically identifying key ANS initiatives as focus areas, including:

- progressing implementation of OneSKY Australia and the Civil Military Air Traffic Management System
- developing and implementing services to support emerging aviation technologies such as remotely piloted aircraft systems (RPAS) and advanced air mobility (AAM) and integrating them into Australian airspace
- developing and implementing a flight information management system (FIMS) to underpin Australia's uncrewed traffic management (UTM) ecosystem
- Airspace Management Modernisation, including regularly reviewing instrument flight procedures to ensure suitability and relevance and enhancing the safety and efficiency of Australian controlled airspace
- implementation of satellite-based augmentation systems (SBAS) in the aviation environment.

Corporate plans serve as Australian Government agencies' primary planning document. It provides the Australian Parliament, the public and stakeholders with an understanding of the purpose of an agency, its functions, objectives and role, and how it will achieve major initiatives. It sets out how the agency undertakes its functions and role and how it will measure performance in achieving its purposes.

Our air navigation system stakeholders

The evolution and implementation of advances to Australia's ANS are influenced by strategic planning and governance arrangements at the global, regional and national levels, and close engagement with stakeholders at home and globally.

The role of the International Civil Aviation Organization

ICAO is responsible for preparing, coordinating and monitoring the implementation of the GANP at a global and regional level. Through the GANP, ICAO seeks to create a globally interoperable air navigation system, as well as a proactive, integrated and common approach to emerging challenges and opportunities stemming from aviation and technological trends.

The role of the region

ICAO has established a series of regions around the world to promote collaboration on civil aviation within a specific geographic area. Australia is part of ICAO's Asia and Pacific region.

Each ICAO region produces a Regional Air Navigation Plan (RANP) that presents the strategic direction for the evolution of air navigation within the region. While RANPs generally align with the GANP, they are designed to focus on regional priorities. The AP-RANP is the chief strategic air navigation planning document for the Asia Pacific region, as outlined above under The Asia Pacific Seamless (Regional) Air Navigation Service Plan.

Australian Government responsibilities and authority

Various Australian government agencies are tasked with specific legislative and regulatory responsibilities and authority for the Australian ANS.

Minister for Infrastructure, Transport, Regional Development and Local Government

The Australian Government, through the Minister, is the portfolio owner of civil aviation policy in Australia and sets the overall policy direction for aviation. The Minister is responsible to the Australian Parliament for civil aviation matters, including in relation to safety and air navigation.

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

The department provides policy advice to the Australian Government in relation to ANS matters, including advice on Airservices Australia's and CASA's strategic direction, their planning, financial and operational performance, and their governance frameworks.

The department prepares, in consultation with other Australian aviation agencies, industry and the community, the AAPS for approval by the Minister. The department chairs the Aviation Policy Group (APG) and Aviation Implementation Group (AIG), which are Australian Government aviation agency coordination forums dealing with aviation issues, including on airspace and ANS matters. APG and AIG bring together agency heads and senior officials, in the two respective forums, from the department, CASA, Airservices Australia and Defence.

Airservices Australia

Airservices Australia is responsible for Australia's airspace management, aeronautical information, aviation communications, navigation aids and technology, flight path changes, and ARFFS. It provides facilities and services for the safety, regularity and efficiency of civil air navigation within Australian-administered airspace.

Airservices Australia manages 11 per cent of the world's airspace, including the upper airspace for Nauru and the Solomon Islands. It is a corporate Commonwealth entity wholly-owned by the Australian Government and accountable to the Minister.

Civil Aviation Safety Authority

CASA is the independent statutory authority responsible for the safety regulation of civil air operations in Australian territory and Australian aircraft operating outside Australian territory. CASA is also responsible for the regulation and administration of Australian airspace.

Department of Defence

Defence regulates military aviation, including Defence aerodromes and the provision of certain air navigation services, through the implementation of the Defence Aviation Safety Program (DASP). It is also responsible for safety and airworthiness of military aviation systems. Defence cooperates with Australia's civil aviation agencies to harmonise its regulations and practices, where appropriate. Defence is responsible for military aviation operations and air traffic control at airports with a shared civil and military use. Airservices Australia and Defence are also working closely together to deliver a single harmonised civil–military air traffic control system known as OneSKY Australia.

Australian Maritime Safety Authority

AMSA is the national safety agency responsible for maritime safety, protection of the marine environment, and aviation and marine SAR. AMSA's primary areas of responsibility to the aviation community include: operating the joint aviation and maritime rescue coordination centre; providing a ground station and a Mission Control Centre for the Cospas-Sarsat satellite distress beacon system; and, leading the National SAR Council responsible for Australia's national SAR response arrangements in cooperation with the Australian Defence Force and State, Territory and Federal police.

Australian Transport Safety Bureau

The ATSB is Australia's independent no blame safety investigator. The ATSB is responsible for the independent investigation of accidents and other safety occurrences involving civil aircraft in Australia, and takes part in the investigation of accidents and other occurrences involving Australian aircraft overseas.

The ATSB is tasked with identifying factors that contribute to or affect aviation safety, and communicating improvements through safety action statements and recommendations, in line with ICAO Annex 13.

The ATSB is also responsible for Australia's mandatory reporting system for all aviation safety occurrences and operates schemes for voluntary and confidential reporting of aviation safety concerns. Its analysis and research functions derive from this responsibility for the collection and management of aviation safety data.

Bureau of Meteorology

The Bureau is Australia's national weather, climate, water, oceans and space weather agency and is tasked with providing aeronautical meteorological services to civil aviation.

Under the Chicago Convention, the Bureau is also Australia's designated Meteorological Authority and is required to ensure that aeronautical meteorological services are provided in accordance with the Annexes to the Chicago Convention.

Weather observations, forecasts and warnings for aviation in Australia are made in accordance with the SARPs set out in the Chicago Convention's annex on Meteorological Service for International Civil Aviation (Annex 3). In fulfilling this mandate, the Bureau works closely with Airservices Australia and CASA.

For the purposes of the *Civil Aviation Safety Regulations 1998*, the Bureau may approve third party Automatic Weather Observing Systems (AWOS) for use by aviation. There are currently a number of approved third party AWOS in Australia to standards required by the Bureau's Meteorological Authority Office.

Geoscience Australia

Geoscience Australia brings together Australia's expertise in geology, geophysics, geodesy, satellite imagery, and topographic mapping, with its work covering the Australian continent, Australia's marine jurisdiction, and Australia's territories in Antarctica.

Department of Home Affairs

The Department of Home Affairs regulates aviation security under the *Aviation Transport Security Act 2004*, the *Aviation Transport Security Regulations 2005*, and the *Security of Critical Infrastructure Act 2018*.

The aviation security legislative framework sets out minimum security requirements and requires aviation industry participants to safeguard against unlawful interference with aviation. At the time of enactment, terrorism and physical threats were the biggest risks to the transport sector, and while these risks continue to persist, malicious cyber activity is emerging as a significant and evolving threat.

Regulated aviation industry participants use information technology and operational technology including hardware, software, communication technologies, and technical equipment and systems to perform their functions and as part of security practices. Due to technological advancements, these systems are becoming increasingly interconnected, including in relation to air navigation. Many of these systems hold sensitive data and information, which could be valuable to both state-based actors and cyber criminals.

The Cyber and Infrastructure Security Centre's annual risk review recognises interconnected networks and third-party providers across supply chains expand the attack surfaces for cyber based disruptions in the transport sector, including in aviation. Remote access and management solutions, increasingly present in transport services, create more access points for cyber actors seeking to disrupt transport operations.

Owners and operators of certain critical aviation assets are required to report cyber incidents to the Australian Signals Directorate's Australian Cyber Security Centre. The broader SOCI framework also applies to critical aviation assets, including:

- the requirement to notify third party data service providers when they are storing or processing business critical data
- the availability to be designated as a System of National Significance
- the ability for the Government to help when responding to nationally significant cyber security incidents.

In response to the increasing prevalence of cyber security threats, the Department of Home Affairs is introducing amendments to the legislative framework to establish an 'all hazards' security framework to capture the spectrum of risks facing the transport sector, including cyber security. The reforms will strengthen the legislative frameworks and allow government and industry to respond to current and emerging threats in a flexible, risk based and scalable way.

Proposed amendments to the legislative framework, include:

- introducing new security obligations for regulated aviation industry participants to manage 'all hazard' security risks (including cyber security) requiring them to manage risks of unlawful interference to their operations that exist beyond their physical boundary or geographical location
- requiring regulated aviation industry participants to report cyber incidents to government, in line with existing reporting obligations for all critical infrastructure requiring entities to identify activities that can allow personnel to have access to, or influence of, secure areas, or critical systems, remotely, and implement appropriate mitigation measures to manage risks.

Australian Space Agency

The *Space (Launches and Returns) Act 2018* is administered by the Department of Industry, Science and Resources through the Australian Space Agency. It aims to achieve a reasonable balance between removing barriers to participation in space activities and encouraging entrepreneurship and innovation in the industry. The agency also oversees the safety of space activities, and the risk of damage to persons or property.

Coordinating and consultation forums

Aviation Policy Group and Aviation Implementation Group

The Aviation Policy Group (APG), comprising the heads of Australia's key aviation agencies – the department, CASA, Airservices Australia and Defence – is responsible for endorsing Australia's NANP. The APG is directly supported by AIG comprised of senior aviation officials from these agencies. It is responsible for coordinating and following up issues identified by APG including preparing coordinated advice and reporting back to APG for consideration. APG and AIG are not decision-making bodies as each individual agency retains their respective legislative and regulatory responsibilities and authority.

Asia Pacific Planning and Implementation Regional Work Group

Within ICAO, Air Navigation Planning and Implementation Regional Work Groups are the main drivers of air navigation planning and implementation in a given region, and serve to integrate global, regional, national and industry efforts in continuing to evolve the air navigation system.

The Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) was established by the ICAO Council in 1991 with membership open to all ICAO Member States that provide services in the region and are part of the RANP. APANPIRG includes representatives from Australia.

Industry

The aviation industry, including aircraft and aerodrome operators, play key roles in Australia's ANS. Industry and industry participants are expected to actively support implementation of the ANS initiatives reflected in Australia's NANP, and are encouraged to identify and undertake relevant supporting actions.

These roles include providing safe, efficient and cost-effective aircraft operations, investment in air navigation and communications systems and equipment (which increasingly relies on satellite-based technology) and the attraction, training and retaining of skilled personnel. Aerodrome operators also support the ANS through investment in ground-based systems which enhance the safety and efficiency of aircraft operations.

To ensure a fully effective and efficient ANS it is important that industry and Government work collaboratively to provide the necessary standards, services, facilities, equipment and specialised personnel to meet Australia's future ANS requirements.

Challenges, opportunities and benefits

Economic, social and technical advancements are rapidly changing the global, regional and Australian air navigation environments. While the global COVID-19 pandemic had a significant impact on civil aviation world-wide, a return to long-term growth is underway. The aviation community's efforts at the global, regional and national levels are continuing to address safety, efficiency, capacity and environmental challenges. RPAS, AAM and space launches and returns also bring new challenges and opportunities. Steady and incremental improvements to the global, regional and Australian ANS are helping address these challenges and to harness the opportunities and benefits presented by the solutions.

Australia manages 11 per cent of the world's airspace, including the Australian continent, international airspace over the Pacific, Indian and Southern Oceans, and the upper airspace of the Solomon Islands and Nauru. In recovering from the impacts of the COVID-19 pandemic, there has been less predictability in traffic patterns across this airspace and the rate of recovery is varying across Australia. Initiatives to increase network capacity, improve efficiency, harmonise civil-defence air traffic management, and implementation of digitisation and automation programs, while ensuring a safe, sustainable and efficient ANS continue to gain momentum as the aviation sector completes its recovery from the pandemic. Ensuring sufficient skilled human capability and capacity is available to meet these challenges and maintaining flexible regulatory approaches to accommodate emerging, new and adaptive business models are also being addressed.

Emerging aircraft technologies, such as drones and AAM, are expected to increase the volume and complexity of aviation activity in Australia and around the world. Increasingly automated and conventional aircraft will share our vast airspace, changing the types of safety and security risks that must be managed.

Australia's current airspace systems are being complemented with technology-driven solutions, such as ADS-B and UTM, to address increasing complexities while ensuring interoperability with the regional and global ANS. Efficiency gains are also being realised to help better manage capacity and assist with Australia's commitment to decarbonise aviation. Efforts to decarbonise will further require the Australian ANS to proactively adapt to maximise the benefits and manage the risks of this new operating environment. Artificial intelligence (AI) and machine learning are likely to also bring new challenges and opportunities to the management and evolution of Australia's, the region's and the global ANS.

Australia has committed, through the 2018 Beijing Declaration, to implement the priorities detailed in the AP-RANP to enhance ANS capacity and harmonisation in the Asia Pacific region. Australia has broadly addressed these commitments, the requirements of which have been integrated into Australia's air navigation initiatives.

Australia's ANS will continue to evolve addressing new challenges from UAS, increased demands on airspace, decarbonisation, and AI and machine learning. These will require careful management and close collaboration and engagement with industry, aviation agencies, ICAO, and regional and global partners, to ensure the Australian ANS remains safe and fit for purpose while achieving global, regional and national strategic goals. These goals include safety, access and equity, engagement, cost-effectiveness, capacity and resilience, predictability, global interoperability, flexibility, efficiency, and reducing aviation's environmental impacts.

Our policy priorities and requirements

Australia's NANP reflects our key policy priorities and initiatives to meet our future air navigation performance requirements. These priorities and initiatives respond directly to the Australian operating context and align with global and regional air navigation plans and their strategic aims. Achieving Australia's air navigation policy priorities and initiatives will allow us to share in the safety, economic, efficiency, productivity and sustainability benefits enabled by new technologies and international best practice.

Safety will always be the key priority of the Australian Government for aviation, including for air navigation. Australia aims to equitably accommodate all airspace users' operations in a safe, secure and cost-effective manner while reducing the environmental impact of aviation.

Our requirements for evolving our ANS also include:

• Effective use of, and investment in, technology, infrastructure, and services

• Closer alignment with ICAO SARPs

• Civil-military ANS harmonisation

• Regional air traffic services based on risk assessment

• The recruitment, retention, and training of skilled personnel

• Effective management of environmental impacts from aviation operations.

Australia has identified a number of key areas to use airspace more efficiently, to enhance air traffic control systems, and to address the increased use of drones and AAM systems. This will include an updated AAPS, the development of the AFAF and reviewing the Airspace Act.

In addition to airspace reform, the Australian Government has the following short, medium and long-term priorities to meet our future air navigation performance requirements. These timeframes are consistent with ICAO's approach of setting out short, medium and long-term objectives.

Our short term priorities reflect work that is already being implemented or is planned to be implemented imminently. Our medium term priorities reflects work that is planned or in planning, with our longer term priorities those that are dependent on other enabling work to be completed first.

Short term

In the short term, key priorities for evolving Australia's ANS to meet our future requirements include:

Updating regulatory frameworks, processes and procedures to support the evolution of the Australian ANS

• Develop the AFAF to provide a transparent, consistent, and scalable method to adapt Australian airspace.

• Develop a regulatory oversight framework for Uncrewed Traffic Management (UTM) based on principles already developed by the Australian Government to guide the development of a safe, open, competitive and commercial UTM market.

• Develop guidance material, design requirements and a regulatory framework for infrastructure (such as vertiports and RPAS landing sites) required to support AAM operations, and airspace requirements.

• Implement changes to Obstacle Limitation Surface Definitions consistent with standards and practices provided by ICAO.

Effective use of, and investment in, technology, infrastructure, and services

- Implement SBAS approaches.
- Finalise and implement airspace architecture in support of Western Sydney International (WSI) aerodrome.
- Maximise the use of electronic surveillance of traffic by airspace users and air navigation service providers to increase situational awareness and facilitate traffic management.
- Trial 'Predictable Sequencing' using ICAO's Continuous Descent Operations (CDO) on arrivals using certain air routes into suitable Australian aerodromes linking into developing trajectory-based operations (TBO).

RPAS, AAM and UAS

- Develop capabilities to support the implementation of low-level traffic management systems for RPAS, in particular, satellite-based surveillance technologies.
- Examine the utility of digital flight rules for the future needs of RPAS and AAM. Australia will consider the implementation of international digital flight rule standards as they are developed by ICAO.
- Investigate novel airspace volumes for UAS.
- Consider standardised requirements for RPAS in controlled airspace.
- Consider new separation standards, that may use new technologies such as UAT and ADS-L, for uncrewed and AAM aircraft.

Civil-military strategic and tactical coordination and ANS harmonisation

- Develop the integrated Civil-Military Air Traffic System (CMATS) to improve operational safety and efficiency and manage increasingly complex civil-military airspace requirements.
- Develop a national infrastructure redundancy plan, catering for business continuity and national security requirements, with a joint National Airspace Management Office (NAMO).
- Implement Conditional Routes and Flexible Use of Airspace to support Civil-Military coordination.
- Complete the transition from offshore restricted areas outside of Australian territory.

Higher airspace operations

- Support continued growth of the Australian space sector by improving tactical coordination between airspace users, air traffic control and those conducting launch and return activities to minimise impacts of airspace restrictions on other airspace users. Impacts on other airspace users will be further reduced through the establishment of danger areas outside of Australian territory to advise airspace users of launch and return activities, accompanied by detailed information promulgated through various channels.

SAR

- Implement the ICAO Global Aeronautical Distress and Safety System (GADSS).

Medium term

In the medium term, key priorities for evolving Australia's ANS to meet our future requirements include:

- Use of ADS-B as an alternative to multilateration for parallel runway monitoring.
- Implement a regulatory framework to support RPAS and AAM infrastructure.
- Develop an integrated traffic management framework to support all airspace users.
- High Altitude Airspace Management, including Collaborative Traffic Management in the Stratosphere.
- Space-based VHF and ADS-B.
- Provision of aeronautical, flight and meteorological information via System Wide Information Management (SWIM) information services.

Long term

In the long term, key priorities for evolving Australia's ANS to meet our future requirements include:

- Develop and implement airspace structures to support all airspace users in a seamless airspace environment.
- Develop standards and capabilities to support cooperative participation and levels of self-separation between all airspace users, where possible.
- Realisation of predictive risk management capability.
- Approaches with Vertical Guidance for all Australian Instrument Flight Rule runways.
- TBO for all appropriate flights, where possible.

How we are evolving our air navigation system

Australia's ANS initiatives reflect the global and regional ANS environment as well as our own requirements and priorities, taking into account our international commitments. Australia's ANS initiatives strongly align to ICAO ASBUs and agreed global and regional priorities and timeframes. This links Australia's work in enhancing our ANS to the global harmonisation activities of ICAO. Australian Government aviation agencies are responsible for reporting on the progress of their ANS initiatives on a regular basis through annual reports, corporate plans, and by being accountable to their Minister and the Australian Parliament.

The ICAO ASBU framework implements the aims of the GANP to modernise the global ANS. The framework includes a set of incremental operational improvements that harmonise national ANSs with regional and global approaches. These efforts aim to improve the efficiency of the global system, realising global harmonisation, increased capacity, and improved environmental outcomes that modern air traffic growth now demands around the world.

ICAO has prepared a roadmap for ASBU implementation, from a baseline level, with each of the five ASBU block upgrades aligned to agreed global and regional timeframes and organised to provide manageable and implementable steps forward through packages of capabilities for States, as shown in **Figure 2**.

Figure 2: ASBU framework
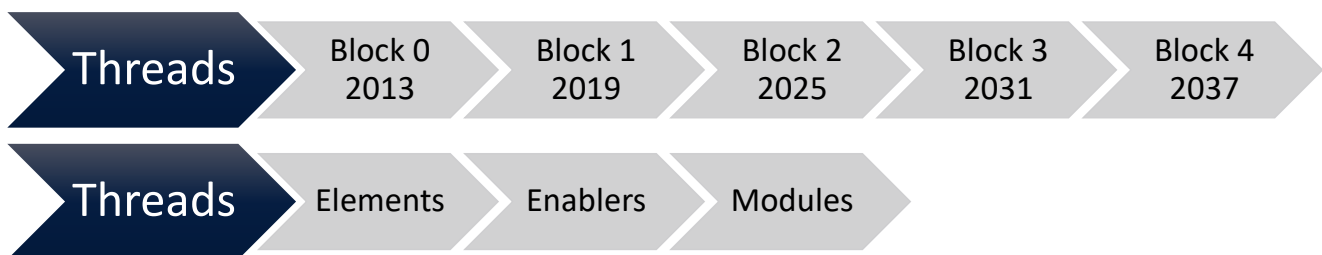
The ASBU framework has been further organised into threads, elements, enablers and modules:

- ASBU threads provide the thematic grouping for enhancements to the global ANS and describe the evolution of a given capability through the successive block upgrades along the lines of information threads, operational threads and CNS technology and services threads.

- ASBU elements outline a specific change in operations designed to improve the performance of the air navigation system under specified operational conditions.

- ASBU enablers are components (standards, procedures, training, technology, etc.) required to implement an element.

- ASBU modules are deployable packages based on performance or capability supported by procedures, technology, regulations and standards as necessary.

The ASBUs are modular and flexible, which allows States to advance their ANS based on their individual operational requirements. Although the GANP has a global perspective, it is not intended that all block upgrade modules are applied everywhere. Many of the modules contained in the GANP are specialised packages that would only be applied where the specific operational requirement exists or corresponding benefits can be realistically projected.

Guided by the GANP and regional planning, Australia has identified our own needs and draws from ICAO's ASBUs in implementing our ANS initiatives for closer alignment with ICAO's SARPs.

Outlined in **Appendix A** is the full set of ASBU threads and intended outcomes of relevant block upgrades covering improvements to each of the three performance areas outlined above. Not all elements will progress through each block and some blocks may be skipped where other ASBU enablers are a prerequisite.

The AP-RANP has identified 16 high priority Block 0 and 1 ASBU elements based on achieving a seamless ANS for the Asia Pacific. **Table 1** outlines those 16 highest regional priorities and Australia's progress against them.

Table 1: Australia's progress against regional ANS high priority ASBU elements identified in the AP-RANP

AP-RANP priority elements	Implemented by Australia
Aeronautical Meteorology: AMET-B0/1 – 4	Yes
Aeronautical Information Management: DAIM-B1/1 – 6	Yes
Airport CDM: ACDM-B0/1 – 2	Yes
ANSP human and simulator performance (Regional)	Yes
ATS Inter-facility Datalink Communications: FICE-B0/1	Yes
Ballistic launches/space re-entry management (Regional)	Yes
Civil-Military Special Use Airspace (SUA) management (Regional)	Yes
Civil-Military strategic and tactical coordination (Regional)	Yes
Core data communications: VDL Mode O/A and AMHS COMI-B0/3, 7	Yes
Direct and Free Route Operations: FRTO-B0/1 – 4	Yes
Enhanced SAR systems (Regional)	Yes
Ground-based Surveillance: ASUR-B0/1 – 4	Yes
Network Operations: NOPS-B0/1 – 5	Yes
Performance-based Navigation Approach Procedures: APTA-B0/1 – 2	Yes
Runway Sequencing: RSEQ-B0/1 – 2	Yes
Safety Nets SNET-B0/1 – 4	Yes

Australia has implemented those elements that align with our operational ANS priorities and circumstances. Australia has also implemented:

- Performance based navigation (PBN) approach procedures at international airports
- common ground/ground telecommunication infrastructure to support ANS applications
- an enhanced level of civil/military cooperation
- enhanced surveillance capability through ADS-B
- air traffic flow management/collaborative decision-making at high density airports.

Australia's key ANS initiatives that are being worked on during 2024–27, and how they align with agreed global and regional priorities, are outlined below. The implementation of Australia's ANS initiatives and relevant ASBU elements are expected to be evolutionary rather than revolutionary. Implementation programs are led and managed by individual agencies, with wide consultation with other relevant agencies and stakeholders. Agencies report on their activities, including the progress of these initiatives, through their annual reports and other mechanisms to stakeholders, their Ministers and the Australian Parliament.

Aeronautical meteorological services

The Bureau provides aeronautical users with meteorological information necessary for safe and efficient civil aviation operations. The service includes providing observations, forecasts, warnings and advisories consistent with the technical and regulatory framework of ICAO and the World Meteorological Organization.

The Bureau has commenced the transition from traditional deterministic text-based meteorological products to SWIM meteorological information services, through the conversion of existing products into the new ICAO Meteorological Information Exchange Model IWXXM form and projects to deliver probabilistic information. These information services will enable machine to machine exchange, supporting optimised flight planning and routing, seamless stakeholder collaboration, and improved air traffic management safety and efficiency.

The Bureau is also improving meteorological observations at aerodromes through the enhancement of observing algorithms, adoption of improved observing technologies and the installation of new observing equipment. This will result in full automation of aviation observations. The Bureau has also implemented Aeronautical Meteorology: AMET-B0/1 – 4.

A decision support team is being established in the new Airservices Australia National Operations Management Centre (NOMC). This team will lead the MetCDM process and be a core contributor in the collaborative decision making in support of ATFM. The Bureau services will continue to evolve to meet the needs of industry, such as those required by Airservices Australia's OneSKY initiative. The Bureau will continue to work closely with stakeholders, to improve windshear warnings and alert services at key aerodromes.

Airport Collaborative Decision Making

The Airport Collaborative Decision Making (A-CDM) program is a cross-industry initiative with the potential to realise major efficiencies for the aviation industry over the next decade. This includes improved planning, reduced emissions, better service, increased safety and reduced costs.

Airservices Australia is working alongside airline and airport partners to lead the implementation of A-CDM at Sydney, Melbourne, Brisbane and Perth airports. Airservices Australia is the first air navigation service provider in the world to lead a multi-location A-CDM implementation. Typically, A-CDM initiatives have been led by the airport and only in a single location. Airservices Australia has adopted the lead role because airlines have asked for a single solution to harmonise operations across all major airports, reduce duplication costs and to elevate the benefits of A-CDM to a whole-of-network perspective.

A-CDM will play an important role in the efficient and effective management of the national aviation network working to minimise disruptions to the travelling public through better runway utilisation and gate capacity, smoother recovery from adverse operations and higher predictability. It will do this by, in real time, connecting airport operations to the ANS network.

A-CDM has included implementation of the following high-priority ASBU elements for the regional ANS:

• ACDM-B0/1 – Airport CDM Information Sharing

• ACDM-B0/2 - Integration with ATM Network function.

Foundational work is being undertaken with A-CDM expected to be deployed when required by traffic demand and complexity. This work is evolutionary for and related to enhancing the planning and management of airport operations and allows their full integration in the ANS network to enhance collaboration between airport stakeholders.

Airport departure slot management

Air Traffic Flow Management (ATFM) is a service provided by Airservices Australia aimed at achieving a balance between forecast air traffic capacity and actual air traffic demand.

A contributor to the pre-tactical phase of ATFM is the Meteorological Collaborative Decision Making (MetCDM) capability program which aims to optimise runway capacity in relation to weather.

ATFM identifies and manages demand and capacity imbalances, both at airports and in airspace volumes. Where imbalances are identified, ATFM enables the implementation of measures to reduce airborne delays. This is called the Ground Delay Program (GDP) and run for Melbourne, Sydney, Brisbane and Perth airports.

During the hours of operation of a GDP, aircraft operators are able to manage and optimise their fleet's operation using the Harmony Web Client connecting via the internet. This tool enables aircraft operators to swap landing slots internally using the Slot Substitution functionality and to advertise for external swaps using the Inter Aircraft Operator Slot Exchange functionality. Once proposed changes have been made, the aircraft operators submit them to the Harmony server. The Harmony server responds automatically and displays the results on the Web client.

Australia has implemented airport departure slot management through the following ASBU elements, which has been identified as a high priority for regional ANS planning:

- B0-NOPS – Improved flow performance through planning based on a network-wide view
- B1-NOPS – Enhanced flow performance through network operational planning
- B0-RSEQ – Improved traffic flow through runway sequencing (AMAN/DMAN)
- B1-RSEQ – Improved airport operations through departure, surface and arrival management.

Australia's Airspace Modernisation Program

Australian Government agencies are undertaking a range of work to modernise Australia's airspace:
- Establishment of the NOMC and the National Airspace Management Office (NAMO)
- Integration of Sydney Approach Services into the Air Traffic Services Centre in Melbourne
- Establishment of User Preferred Routes (UPR)
- Enhancing services in regional areas.

The National Operations Management Centre (NOMC) will be a central entity in the Airservices Australia aerospace services architecture, providing planning, oversight and operational authority of all Australian airspace. The NOMC delivers complete management of the network, system and operations as distinct functions within a wider strategy that also includes delivery of aerospace management and the provision of air traffic control services.

The National Airspace Management Office (NAMO) will provide increased notification and more flexibility in flight planning options through a less restrictive airspace construct to better manage traffic volumes for military and civilian operations. The primary function of the NAMO will be to coordinate access to appropriately sized and sited airspace within the Australian Flight Information Region supporting civilian aviation, joint forces operations and Defence preparedness activities.

Sydney Approach Services will also be integrated into Australia's major Air Traffic Services Centre in Melbourne. This means the approach services for one of Australia's major gateways will be co-located with other key air traffic services. By taking the opportunity to move this service to our major Air Traffic Services Centre we align to global best practice, enhance service resilience, increase access to training, provide greater career development opportunities, and enable sustainable technology integration.

In modernising airspace, Airservices Australia will establish two types of airspace:

- UPR, where airlines have the option to operate on UPRs and utilise the Dynamic Airborne Reroute Procedure.
- Non-UPR, where airspace is only serviced by fixed routes.

UPR airspace will cover the whole of the Australian Administered Airspace with Non-UPR areas established to provide systematic protections in areas of high complexity or high traffic levels. This will be active only during the period when protection is required. Utilisation will be solely based around what equipment an aircraft is carrying, with the equipment requirements being already met by the majority of airlines.

Planning is underway to enhance our services at Ballina by working with CASA's Office of Airspace Regulation to establish controlled airspace and the associated air traffic control services for Ballina by 2025.

Australian Future Airspace Framework

Over the next decade, traditional and non-traditional aviation activities will increasingly operate within the same airspace, which is rapidly evolving due to economic, social and technological developments. It has become clear that Australian airspace operations will involve a mix of significantly different aircraft types and performance characteristics. This will include traditional jet and prop aircraft passenger services (including ultra-long-haul aircraft), helicopters, military operations, sport and recreational aircraft, RPAS activities, and in the near future, electric or hybrid AAM using electric vertical take-off and landing aircraft. As such, the existing safe and efficient airspace system that has served Australia well for many years will need to evolve to accommodate this rapidly changing airspace environment.

The AFAF, being developed by CASA, Airservices Australia and Defence, will include a long-term strategic airspace implementation plan for the deployment of solutions to address evolving user needs in airspace classes across Australian administered airspace. The AFAF will be Australia's primary reference source for airspace strategic principles, future operations, and strategic change planning.

Barometric vertical navigation

Barometric Vertical Navigation (BARO VNAV) has been developed to assist pilots when landing. BARO VNAV uses satellite signals to position an aircraft horizontally and barometric pressure to control the vertical descent to the runway.

Australia has implemented these elements of PBN through the following ASBU elements, which are a high priority for regional ANS planning:

- Performance-based Navigation Approach Procedures: APTA-B0/1 – 2.

Cybersecurity

Airservices Australia has invested significantly in its cyber capability to ensure contemporary technologies are in place supported by teams of people who protect Australia's ANS from debilitating cyber threats. Airservices Australia's cyber security projects ensure Australia's ANS remains resilient to cyber-attacks and agile in an evolving threat environment. Its current cyber security projects include:

- Hardening project – this project developed a roadmap for addressing cyber security threats to Australia's legacy operational technology systems that support air traffic control.
- Resilience Uplift project – this project identified and remediated vulnerabilities and mitigated incidents to ensure adversaries are unable to compromise our ANS.

- Cyber Tranche 4 – secures Airservices Australia's service delivery environment and focuses on addressing the increasing cyber threat landscape in which its services are delivered through:
  - Mission system surveillance – increased visibility with a cybersecurity and system availability focus which will allow Airservices Australia to enhance its monitoring of key mission systems.
  - Defending mission systems – enhanced protection services with a focus on detecting and blocking malicious content and adversaries which will impact the resilience of the ANS.
  - Managed interaction with mission systems – enhanced technologies to ensure trusted support functions are carried out safely and securely.

Digitalisation

Digital air traffic control towers are being introduced to help air traffic controllers enhance service delivery and improve safety outcomes for the aviation industry and travelling public. Digitalisation aims to improve cost effectiveness, flexibility and safety.

Current considerations include:

- back-up facility for service continuity and resilience purposes in Sydney
- a control tower service where there is the need for a future replacement of the current air traffic control tower, such as in Canberra
- the introduction of a service at an aerodrome that does not currently have an air traffic control tower, but may require an air traffic control service in the future, such as at Western Sydney International airport.

While a lower order priority for the region's ANS, Australia has identified RATS-B1/1 – Remotely Operated Aerodrome Air Traffic Services as a priority for Australia.

Trials conducted during 2019–20 and 2020–21 helped determine the technology's suitability to meet Australia's stringent operational and safety standards and deliver the expected benefits.

Other digitisation efforts include:

- Intelligent systems – digitisation, digital aerodrome services, A-CDM, AIM/AIS
- Integrated and increasingly automated air traffic management providing a single seamless Australian administered airspace (going from 2 to 1 FIR)
- Real time data flow and predictive analytics
- Flexible, scalable automated ARFFS and air traffic management services
- National surveillance capability
- Flexible, scalable automated and remote aerodrome services.

Flexible use of airspace

The flexible use of airspace (FUA) is founded in the concept that airspace should be considered a continuum that accommodates all user requirements to the greatest extent possible. Airspace should no longer be designated as either military or civil airspace and instead is used flexibly on an as required basis. FUA facilitates the optimum capacity of the airspace, by enabling more flexible flights and efficient flight paths. The implementation of PBN with FUA will facilitate more accurate navigation through shorter more direct routes, as well as safer more efficient take-offs and landings. This will have sustainability benefits with reduced fuel burn and aircraft emissions and efficiency gains through reduced congestion.

Airservices Australia has purchased the local and sub-regional airspace management support system named LARA to support and enhance the airspace management process utilising advanced FUA principles.

This system will be implemented prior to OneSKY (see below). The NAMO will provide the FUA management service to Australian airspace users.

Advanced FUA is not currently part of the AP-RANP, although initiatives are being considered in relation to this future technology which will expand FUA beyond the civil-military continuum to include all airspace users.

Flight Information Management System

As UAS increasingly operate in Australia's low-level airspace, Australia has progressed the development of a Flight Information Management System (FIMS) prototype to unlock the benefits of an increasingly integrated airspace environment. It serves as the interface that underpins the safe and efficient use of airspace.

Australia has implemented an enhanced flight information management system through the following ASBUs, which are a high priority for the regional ANS: Aeronautical Information Management: DAIM-B1/1 – 6.

Global Aeronautical Distress and Safety System

Australia continues to implement the elements of the Global Aeronautical Distress and Safety System (GADSS), which has been developed by ICAO to improve flight tracking outside air traffic service surveillance, the timely alerting of aircraft in distress, and accurate location of end of flight position to support efficient and effective SAR operations globally, particularly in remote areas.

The GADSS also provides improvements in the timely and efficient recovery of flight data, particularly following an aircraft ditching, to support accident investigation. The GADSS contains measures targeting improvements to assist SAR system response and recovery of flight recorder data integrated within the wider ANS and aircraft/airline operations systems.

The implementation of the GADSS through the following ASBU elements is a global priority:
- GADS-B1/1 – Aircraft Tracking
- GADS-B1/2 – Operational Control Directory
- GADS-B2/1 – Location of an aircraft in Distress
- GADS-B2/2 – Distress tracking information management
- GADS-B2/3 – Post Flight Localisation
- GADS-B2/4 – Flight Data Recovery.

The implementation of enhanced SAR systems to support GADSS implementation and in accordance with the *ICAO Asia/Pacific SAR Plan* is a high priority for regional ANS planning. Australia has partially implemented many aspects, where possible, including regional priority aspects, subject to those matters that are still in development by ICAO.

Long-range air traffic flow management

Long Range Air Traffic Flow Management (LR-ATFM) is an initiative to enhance demand and capacity management by integrating international flights into Airservices Australia's ATFM system. LR-ATFM shifts some or all of the required airborne delay for long range flights from the arrival phase of the flight to the enroute phase. The resulting benefits are less fuel burn for aircraft, reduced emissions, better service, increased safety, reduced costs and improved predictability of arrival flows into major airports.

LR-ATFM enhances RSEQ-B0/1 – Arrival Management (a regional priority already implemented by Australia) and supports the further regional priorities of ACDM-B0/1 – Airport CDM Information Sharing (ACIS) and ACDM-B02 – Integration with ATM Network function.

Foundational work is being undertaken with LR-ATFM expected to be deployed when required by traffic demand and complexity. A wide range of domestic and international stakeholders have been consulted in the development of this concept.

OneSKY Civil and Military Air Traffic Management System

Airservices Australia is delivering five technology initiatives under the OneSKY Program including design and delivery of the Civil Military Air Traffic Management System (CMATS), upgrade of the legacy voice communications system, the design of a Regional Tower Solution, enhancement of Defence air traffic control towers, and the integration of OneSKY into the National Airways System.

Australia's OneSKY Program, in conjunction with the Department of Defence, is central to this and will deliver a world-first harmonised civil and military air traffic management system (CMATS) for Australian airspace, unlocking an associated forecast $1.2 billion in economic benefits for the aviation industry over the next two decades. The program has entered testing for the initial release of the system and installation has begun at a number of sites. To support and enable the OneSKY Program and Australia's future aviation services, we are also modernising our critical telecommunications network infrastructure that our ANS relies upon.

The OneSKY initiative includes implementation of the following ASBUs identified as regional ANS priorities:

- Optimised wake turbulence separation (B0-WAKE/1) enabler
- Free routes (B1-FRTO/4) enhancements
- UPR and DARP (B0-FRTO/4) enhancements
- Downlinked Aircraft Parameters (DAPS) (B0-ASUR/3) enhancements
- ATC Sector Capacity - Optimum Capacity and Flexible Flights (Regional) enabler
- Continuous Descent Operations (CDO) with vertical guidance (B1-CDO/4) enhancements
- Safety Nets (B0-SNET/3) enhancements
- Reception of aircraft ADS-B signals from space (SBA) (B1-ASUR/1)
- SATCOM (B0-COMI/5)
- Dynamic Sectorisation (B1-FRTO/4)
- Basic Conflict detection and conformance monitoring (B0-FRTO/4)
- Single FDRG
- Civil-Military Special Use Airspace (SUA) management (Regional)
- Civil-Military strategic and tactical coordination (Regional).

Performance based navigation

Air navigation in continental airspace has transitioned from conventional ground-based radio navigation aids to PBN. PBN enables more direct routes along a flight path and more efficient take-offs and landings.

PBN also results in reduced fuel burn, aircraft emissions, and airport and airspace congestion.

Australia's implementation of PBN is consistent with the regional ANS priority of Performance-based Navigation Approach Procedures: APTA-B0/1 – 2.

Remotely piloted aircraft systems and advanced air mobility

The RPAS and AAM roadmap provides visibility of Australia's intended approach to aviation safety regulation and oversight for RPAS and AAM. It provides priority activities towards how these sectors can be supported to ensure acceptable levels of safety. The RPAS and AAM Strategic Regulatory Roadmap, developed under the Australian Government's National Emerging Aviation Technology Policy Statements sets CASA's policy direction for RPAS and AAM regulations. The roadmap identifies six regulatory areas:

• Aircraft and aircraft systems

• Airspace and traffic management

• Operations

• Infrastructure

• People

• Safety and Security.

As part of the RPAS and AAM Strategic Regulatory Roadmap, CASA has already committed to develop clear pathways and regulations to certify drones and aircraft systems consistent with major international regulators, in particular the US Federal Aviation Administration and the European Union Aviation Safety Agency, and use performance-based standards.

CASA's RPAS and AAM Roadmap is being reviewed consistent with the commitment to do so on a regular basis. The Roadmap will be subject to future change based on legislative progress, industry consultation and revised priorities. The National Emerging Aviation Technologies Policy Statement foreshadows regular reviews and updates to the RPAS and AAM Roadmap to ensure it remains current, achievable and relevant. Updates will take into account changing priorities based on industry progress and needs.

Space-based augmentation, surveillance and communications

Geoscience Australia is responsible for delivering the first SBAS in the Southern Hemisphere along with Land Information New Zealand, known as the Southern Positioning Augmentation Network or SouthPAN. The program will give Australians instant access to real-time location data that is accurate to within 3-5 cm in areas with mobile phone coverage and 10 cm everywhere else on land and sea, versus 5-10 m currently.

SouthPAN will be certified for aviation use against the ICAO standards for safety, integrity, continuity of service and availability. It will be interoperable with avionics used for the United States Wide Area Augmentation System and European Geostationary Navigation Overlay Service. SouthPAN early Open Services have been live since September 2022, with safety-of-life certified SouthPAN services planned in 2028.

Trajectory-based operations

Airservices Australia's Continuous Descent Operations (CDO) project is a step towards creating a Trajectory-Based Operations (TBO) environment, that will optimise sequencing processes for air traffic control and provide flight crews with predictable descent into Australian airports.

Using the ICAO CDO concept as a basis, Airservices Australia has developed a procedure termed 'Predictable Sequencing', that will be trialled on arrivals using certain air routes into suitable Australian capital city aerodromes. Predictable Sequencing involves air traffic control re-routing aircraft via pre-defined waypoints positioned off major air routes to provide a certain time delay. When able, this re-routing will be used instead of vectoring and provides flight crew with predictability of lateral path to plan their descent.

Melbourne was selected for an initial trial in December 2022 in collaboration with airlines. The trial measured benefits such as optimisation of air traffic flow including maximising use of runways and reducing travel delays. It will also determine the ability to save fuel and reduce carbon emissions.

Western Sydney International Airport

The Australian Government has invested $5.3 billion to provide a full-service airport in Western Sydney – offering domestic, international and freight services to meet future demand in the Sydney region.

ANS services for Western Sydney International Airport will include:

- Air Traffic Management for terminal control and enroute services delivered through aerospace and flight path design.
- Digital Aerodrome Services will leverage state of the art cameras positioned at the airfield to provide air traffic controllers with an enhanced 360° view displayed on a panorama of screens supported by real-time operational data to manage arrivals and departures from a remote location.
- Airfield Navigation delivered through Category III-B Instrument Landing Systems, an Advanced Surface Movement Guidance and Control System and A-CDM.

Appendix A – ICAO Aviation System Block Upgrades summary tables by thread and intended block outcomes

Information threads

AMET   Meteorological information

- Baseline – Meteorological information provided to support operational efficiency and safety.
- Block 0 – Global, regional and local meteorological information to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimised flight trajectory planning.
- Block 1 – Meteorological information supporting automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.
- Block 2 – Integrated meteorological information in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term.
- Block 3 – Integrated meteorological information in support of enhanced operational ground and air decision-making processes, for all flight phases and corresponding air traffic management operations.
- Block 4 – Integrated meteorological information supporting both air and ground decision making for all phases of flight and ATM operations, especially for implementing immediate weather mitigation strategies.

DAIM   Digital Aeronautical Information Management

- Baseline – Provision of aeronautical information services (AIS) is a State responsibility. States provide an Aeronautical Information Service that focuses on making available the following products: Aeronautical Information publication (AIP), Aeronautical Information Circular (AIC), Aeronautical charts, AIP supplements and NOTAMs.
- Block 1 – Improved aeronautical information based on enhanced data quality (accuracy, resolution, integrity, timeliness, traceability, completeness, format) to support PBN, airborne computer-based navigation systems and ground automation. In addition, digital exchange and processing of aeronautical information allows a more efficient management of information by avoiding reliance on manual processing and manipulation.
- Block 2 – The exchange of aeronautical information is now based on service orientation in accordance with the SWIM concept.

  Fully digital aeronautical information should be the standard and paper aeronautical information should have been abandoned. All airspace users and ANSPs are required to continuously provide and subscribe airspace constraint alerts so that any changes to any constraint are immediately available.

  Improvement in the position and time accuracy of the data. All airspace constraints have an applicability time, including static constraints. Additional aeronautical information is provided in support to network operations.

  Within this timeframe a considerable amount of traffic in higher and lower airspace is flying. Traditional aeronautical information will be complemented by new information required to support operations in high airspace or the UAS Traffic Management concept. A rich dynamic obstacle database is available for this environment and automated dynamic geo-fence restrictions apply.

FICE   Flight and Flow Information for a Collaborative Environment (FF-ICE)

- Baseline – The exchange of messages between ATS units is performed manually using the AFTN and/or via voice. Messages are pre-formatted and have a limited number of characters, which results in limitations on the amount of information that can be exchanged. The dependency of manual action for message exchange generates high probability of miscoordination or lack of it.
- Block 0 – To improve coordination between air traffic service units (ATSUs) by using ATS interfacility flight data communication. The benefit is the improved efficiency through digital transfer of flight data.

Information threads

- Block 2 – Provide the flight information management basis for initial TBO. Implement collaborative coordination and maintenance of advanced flight information for planning, re-planning and ATFM. ATFM considers operator flight preferences. Capacity and demand balancing improvement (better capacity utilisation) due to timely and accurate flight information. Mechanisms are in place to support the exchange and synchronisation of intent suitable for planning flights pre-departure and in execution. Mechanisms to support ATFM including the update of existing exchange models and/or development of new exchange models for exchange of ATFM initiatives and weather impacts on flight operations. It also includes variations to support new types of operations at the higher and lowest airspace, not used by today's commercial air traffic.

- Block 3 – Trajectory management integrated with tactical ATC operations. Mechanisms support the synchronisation of intent across applications supporting planning through tactical ATC operations (e.g., separation provision and tactical RSEQ processes). ANSP-to-ANSP coordination processes become trajectory-based providing more seamless boundaries. Information models support the application of dynamic airspace constraints allowing their interaction with the trajectory to be managed strategically or tactically, as appropriate.

- Block 4 – End-to-end trajectory management to support flight trajectories transition to high density airspace or airports (supports their time -based TS, RSEQ and NOPS).

  Full FF-ICE which includes multi-ANSP full flight information exchange system and operational agreements.

SWIM   System Wide Information Management

- Baseline – Prior to SWIM, store-and-forward based exchange of information is being used between ATM stakeholders (ANSP, airspace users, airport, etc) relying on point-to-point connectivity and protocols using pre-defined messages.

- Block 2 – System Wide Information Management (SWIM) is a new way for managing and exchanging information. It replaces the current ground-ground point-to-point information exchange by an aviation intranet relying on internet technologies enabling information services to be provided to the ATM community. In order to facilitate publish/subscribe and request/reply based information exchange through standardised information services, provisions for the information service content and service overview are defined and appropriate SWIM governance established.

  In addition, Air/Ground (A/G) System Wide Information Management is a capability that enables improved operational awareness and decision making by flight crews by exchanging information with the aircraft and its automation systems. A/G SWIM makes the aircraft a node in the network and supports the exchange of information such as trajectories, aeronautical, meteorological, and flight and flow information between ground based ATM components and the flight deck. As a first step, A/G SWIM is supporting the exchange of non-safety-critical information.

  SWIM governance ensures interoperability for global access to SWIM information by the ATM community.

  This thread is an enabler to support all operational improvements that require information.

- Block 3 – A/G SWIM will become available for the exchange of safety critical information between ground ATM components and the aircraft.

Operational threads

ACAS   Airborne Collision Avoidance System

- Baseline – Airborne collision avoidance system (ACAS) is the last resort safety net for pilots. Although ACAS is independent from the means of separation provision, ACAS is part of the ATM system. ACAS is subject to global mandatory carriage for airplanes with a maximum certificated take-off mass greater than 5.7 tons.

- Block 1 – The traffic alert and collision avoidance system (TCAS) version 7.1 provides short-term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts as well as enhancing the logic for some geometries (i.e., Uberlinghen accident). This will reduce trajectory deviations and increase safety in cases where there is a breakdown of separation.

- Block 2 – Implementation of a new airborne collision avoidance system will support more efficient operations and airspace procedures while complying with safety regulations. Fewer "nuisance alerts" will reduce pilot and controller workload as personnel spend less time responding to such alerts, increasing safety. Remotely-Piloted Aircraft Systems (RPAS) will be provided with a new collision avoidance function.

ACDM   Airport Collaborative Decision Making

- Baseline – All stakeholders involved in aerodrome operations have their own processes that are conducted as efficiently as possible. However, there is not enough effective information sharing among them. Some basic coordination between ATC and ramp control (which may also be provided by ATC) exists. The aerodromes operate in isolation from the ATM network and aircraft operators manage their operations independently from each other.

- Block 0 – Aerodrome operators, aircraft operators, air traffic controllers, ground handling agents, pilots and air traffic flow managers share live information that may be dynamic, in order to make better and coordinated decisions. This applies notably in day to day operations and also in case of severe weather conditions or in case of emergencies of all kinds; for these cases A-CDM procedures are referred to in the snow plan, the aerodrome emergency response plan and the aerodrome manual. In some cases, aerodromes are connected to the ATM network via the ATFM function or to ATC through data exchange.

- Block 1 – Aerodromes are integrated within the ATM Network, from the strategic through all tactical phases. Situational awareness and decision support information is made available to affected stakeholders to establish a common understanding of the various needs and capabilities and make adjustments to assets in order to cope with these needs. Support mechanisms include an Airport Operations Planning (AOP) and an Airport Operations Centre (APOC).

- Block 2 – Planning and management of airport operations is enhanced through Total Airport Management (TAM), meaning that passenger terminal management is fully integrated with "traditional" A-CDM in order to optimise aerodrome operations and passenger management. Tools and decision support information supporting landside management are made available and interfaced with Airport Operations Centre.

- Block 3 – All stakeholders are fully connected. All tactical decisions are synchronised and operations are managed by trajectory. All ground processes including aircraft turnaround operations and the landside processes are agreed on the en-route to en-route view of flight operations. Expected ground event times are managed with known impacts to the ATM system, to ensure that the agreed trajectory is consistent with the Airport Operations Plan.

APTA   Improve arrival and departure operations

- Baseline – Terminal Area Arrival and Departure Procedures: Where implemented, standard terminal arrival procedures (STARs) provide a defined lateral path for arriving aircraft to connect to the approach. Similarly, Standard Instrument Departure procedures (SIDS), where implemented, provide a lateral path for aircraft to depart the terminal area after take-off. These terminal procedures enable more efficient terminal airspace management.

  Approach Procedures: Aircraft with appropriate equipment are capable of flying instrument approaches promulgated as Instrument Approach Procedures, including ILS and RNP APCH. (Prior to the PBN Manual, the RNP APCH approaches were known as GPS or GNSS Approaches). Approach minima are operationally derived

from the procedure design, aircraft type and equipage, and supporting ground infrastructure. PBN procedures may be implemented alone or can be added with existing conventional procedures.

Since GNSS can support PBN procedures independent of ground based navigation infrastructure, it is a foundational building block that can enable implementation of PBN to improve arrival, departure and approach operations globally.

- Block 0 – Terminal Area Arrival and Departure Procedures: Procedures implemented as STARS in terminal airspace provide lateral path guidance to support improving the efficiency in the descent phase of flight by enabling near idle power operations from top of descent, to a point where the aircraft transitions to approach operations. For takeoff, SIDS provide a lateral path that can support continuous climb operations to the top of climb where the cruise phase of flight starts.

  Enhanced STARS and SIDS with altitude constraints along the lateral path improve ATC management, and further support operational efficiency by providing vertical profiles that all aircraft can follow.

  Approach Procedures: Performance based aerodrome operating minima (PB AOM) allows for implementation of vertically guided approaches at a wider range of aerodromes, and facilitates a phased approach to improvement in approach capabilities. Advanced aircraft with technology such as Enhanced Vision Systems (EVS) benefit from operational credits to continue operations below normal minima.

  Helicopter Point in Space procedures allow for access to landing locations other than heliports.

- Block 1 – Terminal Area Arrival and Departure Procedures: Improvement in airspace management is brought by the utilisation of advanced capabilities such as standardised Baro-VNAV functionality and scalable RNP. These optimise descent phase and terminal airspace by providing vertical descent and climb corridors in combination with more precise lateral paths in the terminal area. Such advanced capabilities will reduce the amount of protected airspace vertically and laterally which will enhance the efficiency and flexibility of the terminal airspace design, allowing for optimum arrival and departure operations. These enhancements build on the achievements developed in Block 0.

  Approach Procedures: Further development of the PB AOM concept includes more options such as synthetic vision guidance systems (SVGS).

- Block 2 – Approach Procedures: Development of GBAS Cat II/III approaches allows for an alternative precision approach landing system to be used in low visibility operations.

CSEP   Cooperative Separation

- Block 1 – Enhanced traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations and visual separation on approach are enabled by the evolutions of ADS-B IN capabilities and associated applications.

  In oceanic airspace, the use of Performance Based Longitudinal Separation minima and Performance Based Lateral Separation minima will enable the optimisation of trajectories.

- Block 2 – The Interval Management (IM) procedure using distance or time will be implemented to improve traffic flow and aircraft spacing.

  Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. In the lower airspace, UTM separation rules apply based on vehicle to vehicle interaction. In the high upper airspace separation is provided strategically through sharing of operators business and mission trajectories.

- Block 3 – The Interval Management (IM) procedure will be gradually implemented in more complex geometries including departures thanks to upgrades of airborne functionalities and performance based surveillance.

  UAS/RPAS will use an airborne functionality to remain well clear from traffic in all phases of flight, even in uncontrolled airspace.

- Block 4 – Use of airborne conflict detection and resolution to achieve own separation from traffic designated by ATC to enable more efficient flight profile while reducing ATCO workload… At this point in time, there is enough accurate and timely information so that all constraints (static, dynamic, vehicles or obstacles) are separated from each other and are described as spatial temporal volumes with trajectories.

The use of the information allows for performance based separation. This means that the separation is provided based on the performance requirements on time and position of all constraints in the airspace.

DATS   Digital Aerodrome Air Traffic Services

- Baseline – Aerodrome ATS are provided by an on-site tower.
- Block 1 – Aerodrome ATS may be provided from a facility other than an on-site tower, this 'remote' facility could be physically located at the aerodrome or at a distant location.

FRTO   Improved operations through enhanced en-route trajectories

- Baseline **–** En-route trajectories are constrained by the fixed route network, permanently segregated areas, conventional navigation or limited use of area navigation (RNAV), rigid allocation of airspace between civil and military authorities, and rigid sector configurations. Conflict detection is a manual task, performed on the basis of paper/electronic flight strips.
- Block 0 – En-route trajectories are enhanced by using more direct routings, and collaborative airspace management process and tools. ATCOs are assisted by tools for the conflict identification and conformance monitoring.
- Block 1 – Block 1 introduces the initial steps towards trajectory-based operations by the enhancement of FRTO B0 processes and system support or the deployment of new processes and system support where necessary.

  In continental airspace, the most important operational improvement is related to Free Route Airspace (FRA) as the continuation of direct routing introduced in FRTO B0. For airspace where FRA cannot be deployed, or for connectivity between FRA and terminal manoeuvring areas (TMAs), RNP routes might be considered. Collaborative airspace management is enhanced with new features such as real time airspace management (ASM) data exchanges. Additional system capabilities such as dynamic sectorisation intend to align the traffic demand to the available capacity.
- Block 2 – Block 2 includes further steps towards trajectory-based operations by the enhancement of FRTO B1 processes and system support or the deployment of new processes and system support where necessary applicable to both continental and oceanic airspace where trajectory type operations are common.

  The most important operational improvement is related to the large scale cross border Free Route Airspace (FRA) as the continuation of FRTO B1. Large scale FRA (e.g. Continental operations) are envisaged to be widely deployed, except where structure provides for efficient performance-based routings into and out of high density airspace. There is a need ensure a smooth transition between FRA and highly structured airspace based on Dynamic Airspace Configuration (DAC) principles. There is a need for more dynamic, accurate and precise information on constraints allowing the FRA extension and accommodation of different business trajectories.

  All trajectories, planned and submitted/shared, are consistent with constraints and associated avoidance measures. This will be supported by Enhanced Collaborative Decision Making (ECDM) processes in the execution phase, enabling optimisation of trajectories in real time. Airspace user's participation in the ECDM will be extended to a higher level of integration between the decision support tools and it will be a major factor for the harmonisation of the competing goals.

  One of most important tools to support the ECDM concept is the integration of ATFM and ATC planning by bridging the gap between conventional ATFM planning and conventional sector based ATC planning, maintaining the autonomy and certain level of flexibility of ATC for separation management. The local components of integrated ATFM/ATC planning function are addressed by FRTO B2.

  Dynamic Sector Management will evolve into Dynamic Airspace Configuration (DAC), capable of accommodating traffic demand and air traffic flows in real time. DAC will be mainly executed at a network level, FRTO elements cover: the local DAC components to be provided as inputs (ATC sectorisation, airspace structure, and restrictions), the application of dynamic airspace configuration identified at a network Level and the local adaptation and fine-tuning of DAC according to local ATC needs. This capability will be based on the Network Operations Plan, which will evolve and allow for airspace adaptations at a local level, always taking into account the overall network effect of these changes. In addition, new ATC working methods will be established (like Flight Centric ATC), in order to optimise ATCO workload in this dynamic environment which is

not necessarily based on geographical sectors but rather on distribution of logical flows and individual trajectories.

Any airspace user, including manoeuvrable new entrants, operating at regular airspace will follow the same rules and procedures. If they are not manoeuvrable then they will become a dynamic type of restriction.

Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. These operating environments will be free routing and any new proposal or change to any existing trajectory should be strategically de-conflicted from constraints. Seamless airspace and operations between ATSUs with interoperable ATC tools and systems are envisaged. The tools and system should include at least:

– Enhanced conflict and complexity resolution tools taking into account the network

– Associated trajectory optimisation processes;

– Tools for trajectory coordination, revision and execution.

GADS   Global Aeronautical Distress and Safety System (GADSS)

- Baseline – Air Traffic Service Unit (ATSU) Alerting Service. ATSUs provide an alerting service according to ICAO Annex 11. ATSU's have the responsibility to assess and set the emergeny phases and notify and coordinate with the relevant search and rescue (SAR) authorities, aircraft operators and adjacent ATSUs. Rescue Coordination Centres (RCCs) to operate in accordance with Annex 12.

- Block 1 – In oceanic areas without automatic surveillance, ATSU Alerting Service is supported with aircraft tracking capability implemented by the aircraft operator. Point of Contact (PoC) information is provided to facilitate establishing contact between relevant Stakeholders in emergency situations.

- Block 2 – Addition of capabilities to identify and share the location of aircraft in distress, to guide SAR services to the distress site and to recover Flight Data.

NOPS   Network Operations

- Block 0 **–** The Air Traffic Flow Management (ATFM) is used to manage the flow of traffic in a way that minimises delay and optimises the use of the entire airspace and available capacity. The management of airspace starts to be integrated with the management of the traffic flows. Some main processes are automated, however substantial procedural support is still required to balance demand with available capacity. Collaborative ATFM can manage traffic flows by:

  – smoothing flows and managing rates of sector entry;

  – re-route traffic to avoid flow constraint areas;

  – level capping;

  – collaborative airspace management;

  – ATFM slot management including departure information planning;

  – adjust flow measures by use of enhanced collaborative flight planning and enhanced tactical flow management.

- Block 1 – Many AFTM processes are automated, while some elements are still managed procedurally. This module introduces enhanced processes to manage flows or groups of flights in order to improve overall fluidity. It refines ATFM techniques, integrates the management of airspace and traffic flows through a holistic network operational planning dynamic/rolling process in order to achieve greater efficiency and enhance network performance. It also increases the collaboration among stakeholders in real time so as to better know the Airspace Users preferences, to inform on system capabilities and ATC capacity and further enhance Collaborative Decision Making (CDM) to address specific issues/circumstances, including Airspace Users flight prioritisation input as regards ATFM measures.

Airports operations planning starts to be integrated in the network operations planning.

ATFM includes the following main features:

  – management of occupancy counts and application of ATFM measures;

Operational threads

- management of arrival/ overfly times (TTA/TTOs);
- enhanced Network Operation Planning;
- enhanced ATFM slot management;
- integration of network planning and airport planning;
- dynamic/rolling airspace management process;
- management of dynamic airspace configurations;
- complexity management;
- ATFM contribution to the extended Arrival Management.

- Block 2 – ATFM evolves to support Trajectory Based Operations (TBO). There will be an improved Trajectory Forecast based on the qualification and quantification of uncertainties, probabilistic approaches, and enriched en-route and airport information sharing.

  Enhanced Demand and Capacity Balancing (DCB) provides capabilities which create a paradigm shift with all stakeholders expressing dynamically and precisely their needs which have to be accommodated within an agreed performance framework.

  The Collaborative Network Operations Planning will be further enhanced.

  Initial steps towards Airspace Users' driven priorities and the extended airports integration with the ATM Network Planning are envisaged.

  Within this timeframe a considerable amount of traffic in high upper and lower airspace is flying. Due to the characteristics of this traffic, the principles of block 4 network operations are exhibited at higher airspace and within the UTM airspace.

- Block 3 – ATFM further supports trajectory based operations (TBO) based on the use of the more precise information provided by the different nodes of the air navigation system (aircraft becomes a node of information). All vehicles participate in intent sharing and airspace intent network is in place).

  Collaborative Network Operations becomes cooperation in network operations. This means providing optimal flow planning for pre-flight and active flight trajectories that will be impacted by another network operational region supported by common procedures and exchanges.

- Block 4 – ATFM shifts from trajectory management to airspace constraints management. The availability of more timely accurate information allows for a shift on the provision of DCB, capacity accommodates demand and not vice versa therefore airspace users plan and execute their own business and mission trajectories based on real time management of the constraints by the ANSPs.

OPFL	Improved access to optimum flight levels in oceanic and remote airspace

- Block 0 – Use of in-trail procedure (ITP) enables equipped aircraft to change flight levels through otherwise blocking traffic for the purpose of flight efficiency or to avoid turbulence.

- Block 1 – Use of ADS-B the in-trail procedure (ITP) IN technology procedures enables equipped aircraft to change flight levels through otherwise blocking traffic for the purpose of flight efficiency or to avoid turbulence.

- Block 2 – Lateral offsets climb and descend within standard separation buffer. Supports Free-Routing by providing tactical manoeuvring accommodation to support cruise climb/descent (e.g. flight deck supported procedures for climbs/descends according to the sep minima). No difference between oceanic or continental airspace is made at this point.

RSEQ	Improved traffic flow through runway sequencing

- Baseline – Air traffic controllers use local and manual procedures and their expertise to sequence departures or arrivals in real time. This is generally leading to sub-optimal solutions both for the realised sequence and the flight efficiency, especially in terms of taxi times and ground holding for departures, and in terms of holding for

arrivals. In some cases, user preference is addressed through airspace user access to pre-departure arrival time booking and swapping system integrated with arrival management process.

- Block 0 – Arriving flights are "metered" and sequenced by arrival ATC based on inbound traffic predication information, optimizing runway utilisation. Also departures are sequenced allowing improved start/push-back clearances, reducing the taxi time and ground holding, delivering more efficient departure sequences and reduce surface congestion.

- Block 1 – Extension of arrival metering and integration of surface management with departure sequencing to improve runway management.

- Block 2 – Integrated arrival management and departure management to enable dynamic scheduling and runway configuration to better accommodate arrival/departure patterns and integrate arrival and departure management. In addition, integrated arrival management and departure management expands scope from single airport operations to take into account multiple airports within the same terminal airspace.

- Block 3 – Extended metering within an integrated AMAN, SMAN and DMAN environment to enable dynamic scheduling and support network operations based on full FF-ICE which includes multi-ANSP. Flight information exchange system and operational agreements. Transition operations, including approach and departure to and from runways is supported by automation that runs time based separation to the threshold with display characteristics to support the operations. By this timeframe, full time-based management across merge points, departure and arrival airports is in place.

- Block 4 – The increase in the use of accurate time and position constraints allows a shift from traffic synchronisation managed by the ANSP setting target times to fulfilling the business and mission trajectory target time at the runway.

SNET   Ground-based Safety Nets

- Block 0 – Ground Based Safety Nets are an integral part of the ATM system using primarily ATS surveillance data with warning times of up to two minutes. Upon receiving an alert, air traffic controllers are expected to immediately assess the situation and take appropriate action if necessary.

  The goal of current Ground Based Safety Nets is collision avoidance, or the avoidance of collision with terrain or obstacles, or to warn the controllers of the unauthorised penetration of an airspace.

  Alerts from short- term conflict alert (STCA), area proximity warnings (APW), minimum safe altitude warnings (MSAW) and approach path monitoring (APM) are proposed.

  Ground-Based Safety Nets do not change the way air traffic controllers perform their work and have no influence on the calculation of the sector capacity.

- Block 1 – Technological advantages will bring new opportunities, including the possibility to develop new or enhanced Ground-Based Safety Nets. But these advantages shall not compromise the robustness and the safety performance of the Safety Nets in operation.

  Thanks to ADS-B and Mode S Enhanced Surveillance, ground based safety nets can be provided with airborne data enabling performance improvements (less nuisance alerts, earlier positive alerts). However, a very important point is the compatibility of STCA with airborne safety nets. In particular, the compatibility between STCA and ACAS needs constant improvement whilst maintaining their independence.

SURF   Surface operations

- Baseline – Traditional surface movement guidance and control system (SMGCS) implementation (visual surveillance, aerodrome signage, lighting and markings). Surface operations are comprising all operations on the platform including those dedicated to airport maintenance functions.

- Block 0 – This module aims to enhance the situational awareness of Air Traffic Controllers and pilots during ground operations by the provision of the aerodrome surface situation on their respective displays being A-SMGCS for the controller or electronic maps in the cockpit. Some initial alerting services for prevention of runway incursions are proposed to the controller.

Operational threads

- Block 1 – Using capabilities offered by enhanced surveillance of the surface and new capabilities to support traffic management during ground operations, additional assistance is provided to aerodrome controllers and pilots by enhancement of alerting services and improved vision of the situation on the surface. The improved management of taxi times through improved routing services allow to gain predictability and performance to support runway sequencing.
- Block 2 – Full situational awareness is provided to all actors including vehicle drivers. Small UAS operating airport specific functions (e.g. runway inspection, calibration, inspections, …) are integrated in A-SMGCS. Enhanced vision systems allow to perform optimum surface management in Low Visibility Conditions. Complete predictability and efficiency of ground operations at all conditions contribute to trajectory-based operations.
- Block 3 – The complete and reliable knowledge of ground traffic with associated data and information allow for development of automation and optimisation of Surface Traffic Management in complex situation. The performance of the management of the Surface can be anticipated and computed. It is supporting as such full synchronisation of tactical decisions and full trajectory-based operations. RPAS are part of the traffic.

TBO	**Trajectory-based operations**

- Block 0 – Introduction of time-based management within a flow centric approach.
- Block 1 – Initial Integration of time-based decision making processes.
- Block 2 – Pre-departure trajectory synchronisation within a flight centric and network performance approach.

  Extended time-based management across multiple FIRs for active flight synchronisation.
- Block 3 – Network performance on demand synchronisation of trajectory-based operations.
- Block 4 – Total airspace management performance system.

WAKE	**Wake Turbulence Separation**

- Baseline – Wake turbulence separation minima applied to IFR flights is provided based PANS ATM DOC.4444 three aircraft wake turbulence categories (heavy, medium and light). The wake turbulence separation does not apply to VFR flights neither to IFR flights executing visual approach when the aircraft has reported having the preceding aircraft in sight although the ATC unit concerned will issue a caution of possible wake turbulence when appropriate.
- Block 1 – Wake turbulence separation applied to IFR flights is provided based on 7 groupings of aircraft wake turbulence.

  In airports with parallel runways with runway centre lines spaced less than 760m (2500 ft) apart, under certain wind conditions, wake turbulence separation can be reduced on dependent parallel approaches or wake turbulence independent departures. Independent segregated parallel operations can be undertaken.
- Block 2 – Wake turbulence separation applied to IFR flights is provided based on leader/follower static pair-wise wake separations delivered either through a tailored 7 (or more) groups of aircraft or a decision support tool referring to an aircraft pairwise separation matrix .

  In airports with parallel runways with runway centre lines spaced less than 760m (2500 ft.) apart, under monitored wind conditions, wake turbulence separation can be reduced on dependent parallel approaches or wake turbulence independent departures. Independent segregated parallel operations can be realised, based on static pair-wise wake separations.
- Block 3 – Wake turbulence separation applied to IFR flights is provided based on a time based leader/follower time based pair-wise wake separations delivered through a decision support tool referring to an aircraft pairwise separation matrix. In airports with parallel runways with runway centre lines spaced less than 760m (2500 ft.) apart, under monitored wind conditions, wake turbulence separation can be further reduced on dependent parallel approaches or wake turbulence independent departures using time based separation minima. Wake separation minima on independent segregated parallel runway operations can be further reduced, based on pair-wise time based wake separation.

Technology threads

ASUR   **Surveillance systems**

- Baseline – Aircraft surveillance is accomplished through the use of non cooperative and cooperative surveillance radar. Non cooperative surveillance radar derives aircraft position based on radar echo returns. Cooperative surveillance radar is used to transmit and receive aircraft data for barometric altitude, identification code. However, non cooperative and cooperative surveillance radars cannot be easily sited in oceanic locations, or rough terrain such as in mountainous regions, and have a heavy reliance on mechanical components with large maintenance requirements.

- Block 0 – Surveillance is provided supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems. These capabilities will be used in various ATM services, e.g., traffic information, search and rescue, and separation provision. ADS-B OUT and MLAT systems complement existing cooperative surveillance radar and may be deployed independently or together. Depending on local airspace needs, ADS-B or MLAT may replace cooperative radar.

- Block 1 – ADS-B surveillance is provided using receivers on spacecraft, allowing improved options for surveillance in oceanic and remotes areas.

- Block 2 – The evolution of ADS-B and transponder avionics provides new aircraft/atmospheric information to support ANSP and vehicle-to-vehicle applications. New community and internet-based surveillance system to track airborne vehicles at low altitudes and/or high altitudes. Performance-based surveillance framework is provided for ANSP services. Within this timeframe, vehicle identities/positions/velocities may be shared using the internet. Automated dependent surveillance broadcast vehicle-to-vehicle potentially is provided in a different spectrum in lower airspace for small RPA operations.

- Block 3 – All aircraft identities/positions/velocities are provided/shared by the operator using an aviation network. A performance-based surveillance framework allows ANSPs to determine the most effective blend of surveillance methods. Cooperative surveillance is expected to be the principal means of surveillance and is typically provided by ADS-B and MLAT systems; rotating radars will be replaced at end-of-life where appropriate. New passive non-cooperative surveillance techniques available to provide such services at lower cost.

COMI   Communication infrastructure

- Baseline – Air-Ground

    Air-ground ATS communications have been historically accomplished through the use of voice communications between pilots and controllers.

    Voice over HF has been the traditional communication means to provide Air Traffic Services (ATS) over oceanic and remote airspace.

    Voice over VHF has been the traditional communication means to ensure Air Traffic Services over domestic airspace. Voice over SATCOM is used as a backup means for emergency situations.

    Ground-Ground

    Ground-Ground ATS communication has been using Aeronautical Fixed Telecommunication Network (AFTN) over dedicated low speed circuits (2.4-9.6Kbps) to support the exchange of Flight plan/Clearance/Transfer between ANSPs. The ATS voice communication is used for routine communication when the AFTN infrastructure is not available. ATS voice communication is also utilised in case of emergency.

- Block 0 – Air-Ground

    VHF, HF and SATCOM \Communications:

    VHF Voice Communications remains the primary means of information exchange in most regions.

    Continued use of the ACARS Network to support the distribution of ATS message sets (FANS)

    Introduction of the ATN/OSI Network to to support B1

    Continued use of VDL Mode 2 to support ATN/OSI and FANS.

Continued use of SATCOM Class C, VDL Mode0/A and VDL Mode 2 as Datalinks to support Terrestrial, Oceanic and Remote Airspace and as a complement to voice and in order to reduce voice channel congestion and increase capacity.

Continued use of HFDL as the Datalink to support Oceanic Airspace as a complement to voice and in order to reduce voice channel congestion and increase capacity.

Ground-Ground

Deployment of IP based AMHS linked service:

as an improvement over AFTN in term of bandwidth and length of the message,

as a mean to enhance traffic transfer between ANSPs by expanding the use of ATS Inter-Facility Communication Data (AIDC) to improve efficiency of air traffic management by reducing the use of ATS voice service.

- Block 1 – Air-Ground

Improved Terrestrial Data Communications:

VHF Voice Communications remains the primary means of information exchange in most regions.

Introduction of the VDL Mode 2 Multi-Frequency design to accommodate increased capacity and reduce interference.

Introduction of the New SATCOM Class B Satellite Datalinks to increase performance and deliver increased ATN/OSI and ACARS network connectivity.

Ground-Ground

Introduction of IP based network to replace point-to-point circuits:

AMHS with extension service to support XML, FTBP (IWXMM).

Expansion of AIDC to enhance efficiency and safety.

Implement regional IP networks.

AeroMACS circuits for airport local communications.

- Block 2 – Air-Ground

Improved Link Performance:

VHF Voice Communications remains the primary means of information exchange in terminal area, however a major shift toward greater use of Datalink in the enroute and surface domains is envisioned.

Introduce Connectionless VDL Mode-2 design to improve performance and spectrum efficiency.

Introduce new SATCOM Class B systems to support both voice and data operations with total global coverage.

Introduction of the ATN/IPS Network technology to improve datalink performance, support message routing and multilink environments, improve system cyber-security and achieve cost reductions.

AeroMACS for aircraft mobile connection.

Ground-Ground

Implement network services.

Implement AMHS/IP addressing gateway to support legacy services during transition.

Connect regional IP networks to provide for a federated aviation network for exchange of information.

Converged (both g/g and a/g) communications

Make use of available link technologies meeting performance requirements to provide aviation communications for non-safety critical information.

- Block 3 – Air-Ground

IP-based connection and broadband communication links:

Technology threads
Introduce SATCOM Class A into Oceanic and Domestic Airspace to provide improve link performance and to achieve increased resiliency through the use of commercially available Satellite constellations which meet the ATS performance requirements.
Introduce new Broadband A/G Communication systems (LDACS) to support increasingly large messages with stringent requirements and digital products.
Converged (both g/g and a/g) communications
Make use of available link technologies meeting performance, interoperability and certification requirements to provide aviation communications for safety critical information.

COMS   ATS Communication Service

- Baseline – Air-ground ATS communications have been historically accomplished through the use of voice communications between pilots and controllers.

  Voice over HF has been the traditional communication means to provide Air Traffic Services over oceanic and remote airspace.

  Voice over VHF has been the traditional communication means to provide Air Traffic Services over domestic airspace. Voice over SATCOM is used as a backup means for emergency situations.

- Block 0 – Introduction of air-ground ATS data link services:

  CPDLC (ATN B1) as a complement to voice for domestic airspace in order to reduce voice channel congestion and increase capacity,

  CPDLC and ADS-C (FANS 1/A) as a means to improve communications and surveillance in airspace where procedural separation is being applied.

- Block 1 – Extension of air-ground ATS data link services:

  CPDLC (FANS 1/A+) as a complement to voice for domestic airspace in order to reduce voice channel congestion and increase capacity,

  PBCS approved CPDLC and ADS-C (FANS 1/A+) as a means to apply reduced separations in airspace where procedural separation is being applied.

  Introduction of Satellite Voice Communications in airspace where procedural separation is being applied for routine communications in support of Air Traffic Services.

- Block 2 – Extension of air-ground ATS data link services:

  CPDLC and ADS-C (B2) as a means to increase automation on ground and aircraft systems, gradually moving towards full and continuous air-ground synchronisation of the aircraft trajectory.

  Extension of Satellite Voice Communications with PBCS approved systems in airspace where procedural separation is being applied to support further reduction of separations.

- Block 3 – Extension of air-ground ATS data link services:

  Extended CPDLC and ADS-C (B2) as a means to increase further automation on ground and aircraft systems, supporting the introduction of Advanced Interval Management and dynamic RNP operations.

NAVS   Navigation systems

- Baseline – Before Block 0, navigation systems deployed and in operation are a combination of ground-based navigation systems (NBD, VOR, DME, ILS), and global satellite-based navigation systems (GNSS). Airborne Based Augmentation Systems (ABAS), Ground-Based Augmentation System (GBAS) and Satellite-Based augmentation systems (SBAS) augment a single frequency of GPS and GLONASS constellations, but GLONASS utilisation remains limited at this stage.

  ABAS is the widest available development, including GNSS hybridisation with inertial system (INS)/barometric vertical navigation (Baro-VNAV) and largely supports PBN implementation, but its performance is not as optimal as SBAS and GBAS, in particular for approach and landing phases of flight. The implementation of ground-based conventional navigation systems starts to decrease in number with the rationalisation of

conventional infrastructure through Navigation Minimum Operating Networks (NAV MON), while the implementation of satellite-based navigation systems starts to increase.

ABAS and SBAS support PBN implementation for all phases of flight down to Category I precision approaches. GBAS supports approach and landing operations down to Category I minima.

Three SBAS are certified for PBN operations: WAAS in North America, EGNOS in Europe, MASAS in Japan. A few certified GBAS are deployed worldwide, including US, Australia, Germany and Spain.

- Block 0 – GBAS is provided to support precision approach and landing operations at a specific airport, in particular Category I operation utilizing GBAS Approach Service Type C (GAST-C), with the improved accuracy, integrity, and availability of satellite navigation.

SBAS and ABAS are implemented as a mean to comply with ICAO Assembly Resolution A37-11 regarding Vertically-Guided Approach. SBAS is provided to support PBN in all phases of flight with increased accuracy and integrity. ABAS is provided to support non-precision (LNAV) and vertically-guided approach with Baro-VNAV as well as other terminal and en-route navigations.

Rationalisation of conventional navigation aid infrastructure through Minimal Operating Networks starts to happen and supports a reduction in the number of NDBs, VORs, and, where appropriate in some States, ILS. Alternative Positioning, Navigation, and Timing is based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures.

- Block 1 – With enhanced ionospheric monitoring and mitigation as well as enhanced VHF Data Broadcast receiver performance, extended GBAS is provided to support precision approach and landing operations at a specific airport, particularly Category II operation utilizing GAST-C and Category II/III operation utilizing GAST-D, with the improved accuracy, integrity, and availability.

Within this Block 1 timeframe, new core constellations and new signals are available for civil aviation use (multi-constellation concept), i.e. Galileo (Europe) and Beidou (China), and support dual frequency navigation signals. GPS (USA) and GLONASS (Russia) also evolve to support dual frequency navigation signals.

Rationalisation of the conventional infrastructure through Minimal Operating Networks continues to be implemented and supports a reduction in the number of NDBs, VORs, and, where appropriate in some States, ILS. Alternative Positioning, Navigation, Timing remains based upon a combination of existing ground navaids, airborne inertial systems and ATC procedures. New APNT infrastructure is being explored and evaluated.

- Block 2 – Dual-Frequency Multi-Constellation (DF/MC) GBAS, SBAS, and ABAS start to be provided, improving the resolution of atmospheric propagation errors affecting navigation core constellation signals and supporting additional robustness, compared to single frequency interference.

- Block 3 – Airborne equipage for Dual-Frequency Multi-Constellation (DF/MC) including GBAS, SBAS and ABAS capabilities will grow over time. Additional technology developments to support more robust navigation may become matured and be deployed in some regions. Technologies developed to support widespread UAS deployment could potentially be adopted as part of these improvements to robust navigation.

Rationalisation of conventional navigation aids will continue when the dependency on GNSS signals is alleviated by new technologies. New support technologies necessary for GNSS cyber security will be deployed in this timeframe (e.g. key management and distribution systems for cryptographic GNSS signal authentication systems). Technologies for GNSS anti-spoofing will be standardised and deployed to some degree.

- Block 4 – GNSS will be the primary means of navigation globally with conventional navigation aids maintained only as necessary for backup capability. Dual-Frequency Multi-Constellation (DF/MC) airborne equipage will be deployed on most of the fleet supported by more robust backup technologies allowing operations during GNSS unavailability. More advanced sensor fusions for increased operational autonomy will be introduced (i.e. less reliance on external or single thread systems and services) for greater reliability of navigation capabilities.