airservices

Civil Aviation Historical Society & Airways Museum

A BRIEF HISTORY OF

CIVIL AIR TRAFFIC SERVICES IN AUSTRALIA

Q.A.N.T.A.S. commenced its scheduled services in 1921 using this Armstrong Whitworth F.K.8.

EARLY DAYS

At the end of the First World War most Australians still thought of themselves as 'British', and Australia maintained important social and economic ties with 'the Mother Country'. However, communication between the two countries at opposite sides of the world required a two-week sea voyage. Even at home, a vast and sparsely populated island-continent with limited infrastructure made communication between Australians an arduous and time-consuming business.

Many Australians had learned to fly during the war and they could see the potential for civil aviation to connect Australians at home as well as connecting Australia with the world, especially Britain. In 1921 ex-servicemen created the first domestic airlines including the Queensland and Northern Territory Aerial Service, which still exists today as the well-known Qantas Airways.

Airline flying in those days was a rudimentary affair. The aircraft were of wartime design, constructed of wood and fabric, and with low performance and payload. Aerodromes were basic, meteorology was in its infancy and navigation aids were non-existent. While the new airlines clearly demonstrated their worth in improving communications within Australia, it is not surprising that over the next fifteen years

1920: QANTAS was created and started operating. Scheduled services (Government-subsidised) commenced in **1921.**

a number of highly publicised accidents highlighted the shortcomings of the state of current operations. Airline operators and the government alike realised that aviation would not reach its full potential as long as people did not have confidence that they would be able to travel in safety.

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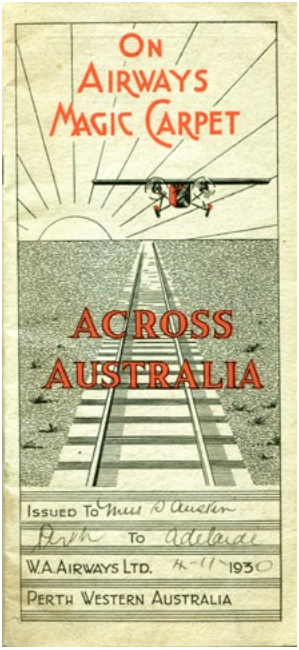


WAA brochure

Australia’s first airline, West Australian Airways, used small Bristol Tourers when it commenced operations in 1921.

1935: The government sends a technical mission overseas to examine developments in beacon technology for radio-navigation.

Standard Telephones & Cables advertisement from 1938 for the new Lorenz navigation beacon receivers.

AERADIO

As a consequence of these accidents, along with rapidly improving technology, the Australian government embarked on a program of improvement to the nation's airways infrastructure. By the mid-1930s radio technology had advanced to the point at which radio could play an important part in improving the safety of operations.

The first step was a requirement for all airline aircraft to be fitted with communications radios so that a continuous watch could be kept on aircraft in flight, as well as enabling the provision of updated information to pilots about weather and facilities – what today we would term the SAR Alerting Service and the Flight Information Service.

Additionally, in 1935 the government sent a technical mission overseas to examine developments in beacon technology for radio-navigation. This mission recommended the adaptation of the German 'Lorenz' blind-landing system for en route use. In 1938, Australia became to first country to operate a network of en route radio navigation beacons operating in what is today the VHF band.

1937: The government appointed the first Aerodrome Control Officers (ACOs) at Brisbane/Archerfield, Sydney/Mascot, Adelaide/Parafield and Melbourne/Essendon.

‘In 1938, Australia became to first country to operate a network of en route radio navigation beacons operating in what is today the VHF band.’

Of course, aircraft with radios require ground stations with which to communicate. At first, a network of coastal radio stations designed for shipping use and operated by Amalgamated Wireless Australasia (AWA) were used. However, ships and aircraft are not really compatible and it was soon realised that dedicated Aeronautical Radio (Aeradio) stations would be necessary. Accordingly, in 1938 the government contracted AWA to build and operate a network of twelve (later increased to fifteen) Aeradio stations at the principal aerodromes on the main east-coast trunk routes, from Tasmania in the south to New Guinea (then an Australian mandate) in the north, and across the north of the continent from Brisbane to Darwin. Brisbane was the Australian terminus of the Qantas international service that had commenced at the end of 1934 and Darwin was the jumping-off port for the overseas portion of the service. The following year, 1939, the government decided to take over the Aeradio network itself.

A technician uses a portable field strength meter at Essendon to test the Lorenz beacon in the background.

In 1938: Australia became to first country to operate a network of en route radio navigation beacons operating in what is today the VHF band.

Loss of the Douglas DC-2 Kyeema in 1938 led to the creation of the Operational Control branch of ATC.

OPERATIONAL CONTROL

Alongside these developments, the crash of a Douglas DC-2, the Kyeema, in 1938 had highlighted shortcomings in the existing system of operations. A consequence of the subsequent accident inquiry was the appointment of Flight Checking Officers (FCOs).

The job of FCOs was to maintain a watch on the progress of flights on the main air routes, with communications being done through the Aeradio network. This was to guard against a pilot making a grave miscalculation of his position, as had happened with the Kyeema. FCOs were also responsible for checking and approving flight plans. In time this new and uniquely Australian service became known as Operational Control, a function more usually performed in other countries by the airlines themselves.

‘The crash of a Douglas DC-2, the Kyeema, in 1938 had highlighted shortcomings in the existing system of operations.’

1938: The crash of a Douglas DC-2, the Kyeema, highlights shortcomings in Australia’s existing system of operations.

Melbourne Ops in the 1940s: air traffic controller Don Charlwood assists with flight planning by Ansett Captain Max Angwin.

1939: The Australian Government takes over the Aeradio network from AWA which had been contracted to set up and run it initially.

The Signal Square, such as this one at Perth/Guildford in the 1950s, displayed important information for pilots. Some of the signals are still in use today.

AERODROME CONTROL

The third strand in the development of air traffic control, as we know it today, occurred in 1937. By this time the major capital city aerodromes had become quite busy. Being all-over grass fields, it sometimes occurred that pilots used conflicting directions for takeoff and landing, and this had resulted in a number of collisions in and around these aerodromes. Clearly something had to be done to bring order to this chaos.

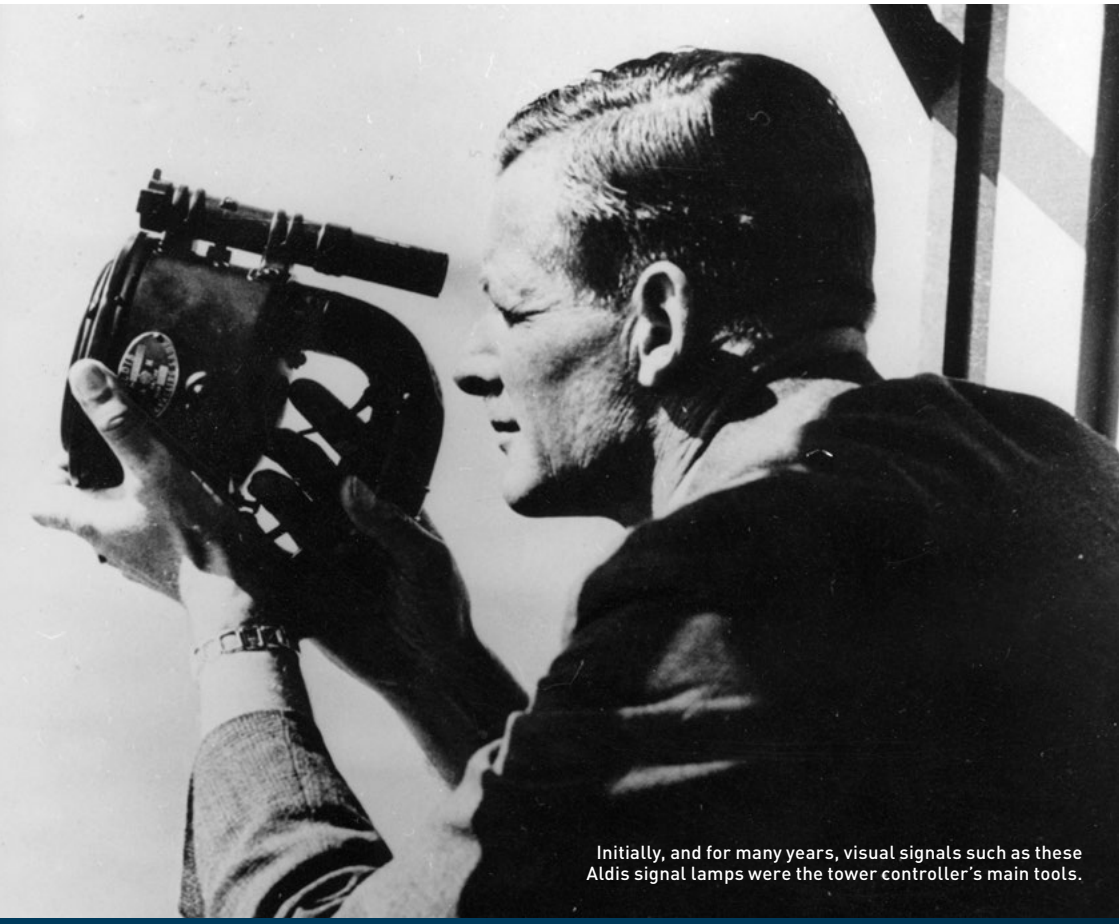
Consequently, the government appointed the first Aerodrome Control Officers (ACOs) at Brisbane/Archerfield, Sydney/Mascot, Adelaide/Parafield and Melbourne/Essendon. Their function was to regulate air traffic at these aerodromes, provide a meteorology service, and give advice to pilots of aircraft engaged in cross-country flights – the Aerodrome Control Service, as we would call it today.

'The personal qualities required of ACOs were mature age, discipline, power of command and level-headedness.'

1944: Australia attends the Chicago Convention on International Civil Aviation.

The personal qualities required of ACOs were mature age, discipline, power of command and level-headedness. The tools for the job were limited though: they did not have radio communications, but then most aircraft could not carry a radio either. Instead they relied on signal lamps and flare pistols to provide visual signals to pilots.

However, one of the most important tools at the ACO's disposal was the 'wind T'. This was located in a 'signal square' near their rudimentary 'towers' and indicated the wind direction. This in turn dictated the direction to be used for takeoff and landing. One of the critical ACO jobs, therefore, was manipulation of the wind T signal.



Initially, and for many years, visual signals such as these Aldis signal lamps were the tower controller's main tools.

1955: Australia becomes the first nation to deploy a network of Distance Measuring Equipment (DME) beacons.

The first control towers were simple affairs, such as this one built on the roof of the Aero Club building at Sydney/ Mascot. Note the coloured cane visual signal balls.

EN ROUTE CONTROL

Development of the final component of the Australian air traffic control system took place during the Second World War. Increasing traffic on the nation's trunk air routes had made the establishment of en route control - or Area Control - necessary.

Control centres were established in the capital cities and the first separation standards were developed. These are still familiar today in the form of 1,000 feet vertical separation, 10 minutes longitudinal separation in the same direction, and vertical separation to be established 10 minutes before and relaxed 10 minutes after the time of passing for opposite direction traffic. Control was exercised by recording the aircraft's details in chalk on a large blackboard, known as the Air Traffic Pattern Board, the controllers receiving reports, and providing clearances and instructions, through the Aeradio communications network.

The shortcomings of this crude system were soon evident and an FCO (and former pilot, as most FCOs then were), Norman Rodoni, invented a new tool to assist this work. The 'Rodoniscope' was essentially a large circular slide-rule on which aircraft position reports could be plotted in chinagraph pencil. The calculations necessary to establish separation standards could then be readily performed.

1959: Short range Cossor radar equipment installed in the towers at Sydney and Melbourne in 1959.

The Rodoniscope in use at Melbourne in 1947 with the Air Traffic Pattern Board in the background.

1963: Compagnie Générale de Télégraphie Sans Fil (CSF) long-range radar system is commissioned.

An ANSETT-ANA Vickers Viscount taxies past Melbourne (Essendon) Tower in 1961. The controllers are Bill Cashmore, Charlie Hyatt and Ian Arblaster. Control was sill primarily procedural and Approach was done from the tower.

THE POST-WAR ERA

Australia attended the Chicago Convention on International Civil Aviation in 1944, which set the path toward the modern aviation industry. From the beginning, Australia took a leading role in the Provisional International Civil Aviation Organisation (PICAO, later ICAO), created out of the Convention.

Australia's Mr A.R. McComb was elected Chairman of the Air Navigation Committee, while Mr A.G. Berg was elected Chairman of the first session of the Airworthiness Division. Thus began the tradition of Australia's significant involvement in, and contribution to, the workings of ICAO.

Although not known internationally as an aircraft-manufacturing nation, Australia had amassed an enormous amount of experience in aircraft operation over huge distances and in arduous conditions, and it was in the areas of operations, airways and airports that Australia was able to make significant contributions. Australia was at the forefront of many airways technical developments. For example, in 1955 Australia became the first nation to deploy a network of Distance Measuring Equipment (DME) beacons, an important step forward in safety and efficiency based on radar principles.

1984: The first Air Traffic Control Autonomous Radar Display System (ATCARDS) is commissioned in Adelaide and Perth.

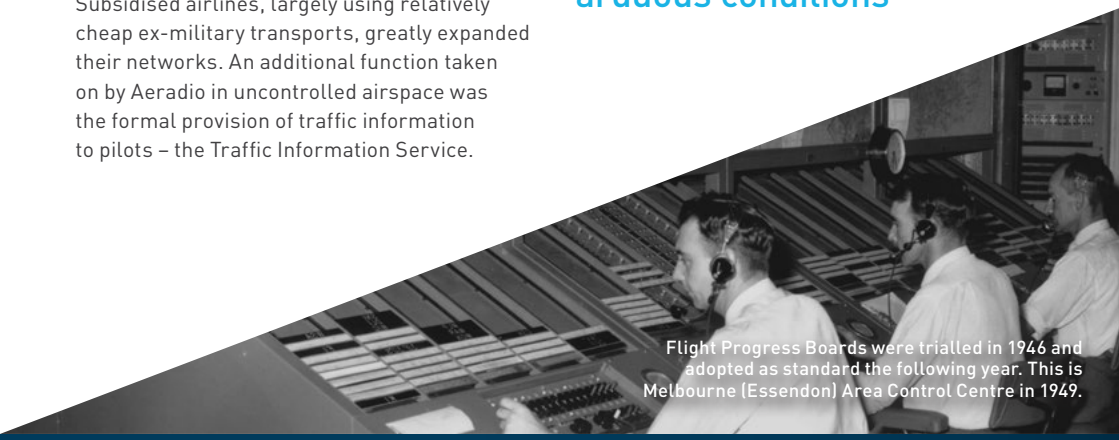
With the basic components of the air traffic services system in place, the years following the Second World War saw incremental advances in technology and organisation. Following international investigations, in 1946 en route - or Area - control adopted the Flight Progress Board, with paper Flight Progress Strips to record flight details and a layout representative of the geographical arrangement of the airspace. The limitations of technology meant that only the sector of airspace closest to the Area Control Centre could have direct VHF radio contact with 'their' aircraft, all other communications still being relayed through Aeradio.

Aeradio itself had undergone significant expansion during the war as wartime activity had greatly increased both the amount of traffic and the scope of operations. The technological requirement to have radios and their operators at the same location meant that most major regional aerodromes throughout Australia gained an Aeradio unit. This continued into the post-war era as the government sought to improve communications and connectivity through the far-flung communities of Australia. Subsidised airlines, largely using relatively cheap ex-military transports, greatly expanded their networks. An additional function taken on by Aeradio in uncontrolled airspace was the formal provision of traffic information to pilots – the Traffic Information Service.

In 1948 Aeradio underwent a name change to Communications. Reflecting international developments, it changed again in 1963 to Flight Service (FS) but remained organisationally separate to Air Traffic Control (ATC), which comprised the Aerodrome Control, Area Control and Operational Control branches.

In civil control towers VHF radio made an appearance in 1949, although most light aircraft did not carry a radio for many years to come. Approach Control was established in the major towers to manage the problem of multiple arrivals wanting to do instrument approaches in bad weather. For some time in the 1950s, Melbourne Airport (today Essendon Airport) was the busiest civil airport in the southern hemisphere.

'Australia had amassed an enormous amount of experience in aircraft operation over huge distances and in arduous conditions'



Flight Progress Boards were trialled in 1946 and adopted as standard the following year. This is Melbourne (Essendon) Area Control Centre in 1949.

1984: Brian O'Keeffe becomes the Australian member and Vice Chairman of the ICAO Special Committee on Future Air Navigation Systems (FANS).

Air traffic controller Peter Carroll reaches out to adjust a 'shrimp boat' on his Bright Display console in the Melbourne AACC in 1981.

RADAR

By the early 1960s increasing traffic and the forthcoming introduction of jets on domestic airline routes focused attention on the need to upgrade air traffic control technology at the capital city airports.

The Department of Civil Aviation had been experimenting with radar for air traffic control purposes since immediately after the war, the first unit being an Australian-made Light Weight Air Warning radar housed in a tent at Melbourne (Essendon) Airport. The first practical units were short range Cossor equipment installed in the towers at Sydney and Melbourne in 1959.

A contract was awarded to French company Compagnie Générale de Télégraphie Sans Fil (CSF, later Thomson-CSF and now Thales) for a modern, long-range radar system that would enable both Area control and, for the first time, stand-alone radar Approach control. This established a long-standing relationship between the French company and Australian ATC that continues to this day, almost 60 years later.

The equipment was ordered in December 1960 and commissioned in August 1963. The first units of the 'Bright Display' system, so called because the display did not need to be viewed in a dark room, were installed at Sydney,

1988: Melbourne becomes the first installation to use multi-radar tracking.

The Bright Display radar system introduced in the 1960s.

with Melbourne, Brisbane and Canberra TCU following later. The original radar equipment was a Primary Surveillance Radar (PSR) with a range of 120NM, later increased to 160NM. In the early 1970s Secondary Surveillance Radar (SSR) capability was added by piggybacking an SSR bar antenna on the PSR antenna.

The display was a scan-converted image of the raw cathode ray tube picture, which enabled a map to be overlaid electronically. In the SSR application, only a limited range of non-discrete Mode A SSR codes and track symbols were available. Mode C (altitude reporting) was not available. Controllers kept track of which return was which using 'shrimp boats' – small pieces of Perspex with the callsign written on them in chinagraph pencil and stuck on the display screen using surface tension. This could provide some interesting moments if the shrimp boats fell off the screen or if the controller did not keep up with moving them as the aircraft moved. The later Interim Label Display System (ILDS) modification of the Bright Display system, only used in Sydney, enabled use of discrete codes to attach an electronic label to displayed tracks.

Despite these advances, the extent of radar coverage in Australia remained very limited, being confined to the 'J curve' from Adelaide in the south-east and up the east coast to Brisbane, with units also at Perth. The Royal Australian Air Force operated a limited number of other joint-user airports with radar, such as Darwin.

Traditional procedural ATC was still required across the vast majority of the continent, and throughout Australia's enormous oceanic Flight Information Regions (FIRs). Throughout this era the network of VHF outlets available to ATC spread as technology enabled the installation of microwave links to some remote sites. Nevertheless, much of the vast Australian controlled airspaces remained outside of VHF coverage, with communications on HF being relayed through Flight Service. Flight Service also remained responsible, separately, for aircraft operating in uncontrolled airspace.

Face-to-face pilot briefing closed in the 1990s. This is the Melbourne Briefing Office in 1979 with air traffic controller Mike Webb briefing an Ansett crew.

THE 1980'S

By the 1980s the amount of voice coordination and manual manipulation required by the Bright Display system, as well as technological obsolescence, necessitated an upgrade to more modern equipment.

Once again, Thomson-CSF was contracted to supply a new ATC radar display system, known initially as the Air Traffic Control Autonomous Radar Display System (ATCARDS) and, after subsequent local modification, becoming AUSCATS. The first systems were commissioned in Adelaide and Perth in late 1984. Melbourne followed in 1988, and was the first installation to use multi-radar tracking. Increasing traffic also necessitated the establishment of new Approach units at Cairns and Coolangatta using AUSCATS equipment fed from new radars. Brisbane and Sydney were never transitioned to AUSCATS due to budgetary constraints and the prospect of more advanced systems becoming available.

ATCARDS/AUSCATS incorporated for the first time a Radar Data Processor (RDP) and presented tracks to the controller in a fully synthetic, finely drawn monochrome picture. The RDP enabled full SSR implementation, including Mode C, with electronic labelling of tracks. It also introduced the concept of 'Jurisdiction', enabling system-level handoffs

1988: Completion of FANS Phase I, Brian O'Keeffe is elected to lead the interim Committee.

of aircraft between controllers. However, paper strips and voice coordination were still required in order to record and transfer flight data from one controller to the next.

The launch of Australia's first communication satellites in the 1980s opened up the possibility for the first time of establishing remote links to the extensive network of VHF outlets throughout Australia's immense interior. As a result, outstation Flight Service Units (FSUs) began to be consolidated into the capital cities from the late 1980s. While this offered significant economic benefits, the closing of Briefing Offices operated at the FSUs, followed by the remaining capital city Briefing Offices in the early 1990s, also had the consequence of cutting off air traffic services from daily face to face contact with much of its industry base.

Satellites also offered the possibility of a revolution in airways operations with navigation and communication systems to a large degree independent of ground-based infrastructure. In 1984, Brian O'Keeffe became the Australian member and Vice Chairman of the ICAO Special Committee on Future Air Navigation Systems (FANS). In this period, the FANS Committee developed the model of what was probably the first truly integrated system of communication, navigation, surveillance and air traffic management capable of international acceptance. With the completion of FANS Phase I in 1988, Brian O'Keeffe was elected to lead the interim Committee and then elected Chairman of the FANS Phase II Committee in 1990. He then led the Committee to have the system accepted at a worldwide ICAO meeting in 1991.

Air traffic controller Bronwyn Traill at an ATCARDS console in the new Melbourne AACC, 1994.

1990: Brian O'Keeffe is elected Chairman of the FANS Phase II Committee, the system is accepted at a worldwide ICAO meeting in **1991**.

In 1993 the Flight Service function in Tasmania transferred to ATC in Melbourne, the first non-radar airspace to do so. At the Sector 3Low console in Melbourne AACC are controllers Christine Skepper, Phil Jelleff and Phil Vabre.

INTO THE MODERN ERA

Commencing in the early 1990s lower-powered PSRs with a range of 70NM and long-range SSRs with a range of 250NM replaced the earlier radars under the Radar Sensor Procurement Programme (RASPP). However, most of Australia still remained outside of radar coverage.

A re-structuring of Australian airspace to accord with ICAO classifications saw a decade of upheaval and reform from the mid-1990s to the mid-2000s. An early manifestation was the creation of ATC Radar Advisory Services (RAS) in the uncontrolled airspace surrounding the major airports at Melbourne and Sydney, hitherto operated by Flight Service. This had the effect of blurring the distinction between ATC and FS.

This distinction was further eroded in 1993 when the Launceston, Tasmania combined Area Control Centre and Flight Service Centre was closed, its functions being transferred to Melbourne. These included the former Tasmanian FS sectors, which became part of ATC – the first non-radar sectors to do so.

The 1970s saw a major ATC strike, causing considerable disruption to the industry and the public. In early 1989 Sydney controllers

1995: The Australian Government creates Civil Aviation Safety Authority (CASA) as the aviation regulator, and Airservices Australia as the air traffic services provider.

commenced a series of industrial actions that caused intermittent closures of Sydney Kingsford Smith Airport, the nation's busiest. In the middle of that year the Australian Pilots Federation took unrelated industrial action, which caused domestic airline operations to collapse and resulted in the mass resignation of almost all pilots employed by the domestic airlines.

As one consequence of this situation, the government established a course to break the monolithic Department of Aviation into an airport group called the Federal Airports Corporation, a separate Bureau of Air Safety Investigation, and a Civil Aviation Authority (CAA). The CAA provided the operational services, ATC and FS, and aviation regulation. The CAA was established as a Government Business Enterprise and was operated as a fee-for-service organisation under a government appointed Board. This also removed the CAA from government budgetary processes and facilitated a capability to borrow for procurement of capital purchases. The new CAA Board initiated a Review of Resources, the outcome of which substantially reduced staff numbers and resulted in decisions to stop all work on air traffic services projects. The Operational Control branch of ATC was closed, with the responsibilities transferred to aircraft operators. Responsibility for aviation search and rescue remained with the CAA until it was transferred to the Australian Maritime Safety Authority in 1997. The CAA Board determined to consolidate all en route ATC facilities into the existing Air Traffic Control Centres in Melbourne and Brisbane, with Terminal Control Units (TCUs) remaining in Sydney, Cairns, Adelaide and Perth.

In 1995 the Australian Government decided to further evolve the CAA by creating the Civil Aviation Safety Authority (CASA) as the aviation regulator, and Airservices Australia as the air traffic services provider. In 1999 the air-ground satellite datalink services ADS-C and CPDLC became operational. These FANS elements enabled surveillance and direct pilot-controller communication over the large oceanic airspace managed by Australia. Aircraft operating in oceanic airspace not equipped with this new technology continued to communicate by HF radio, relayed through Flight Service.

At Airservices Australia, a modernisation programme was commenced with two new, larger Air Traffic Services Centres (ATSCs) being built in Melbourne and Brisbane to house new facilities and new technology, together with the TCUs. Thales once again supplied The Australian Advanced Air Traffic System (TAAATS) and transition to the new system commenced in 1998. The decision was also taken to transfer all remaining FS functions into ATC, ending the separation of the two branches that had been in place since the beginning of air traffic services in the 1930s. The transfer of FS to ATC was completed as part of the transition to TAAATS, with the final FS units closing in 2000. Eurocat, the ATC system part of TAAATS, introduced a new generation of equipment and capability, with a Flight Data Processor enabling the automation of many more tasks. Eurocat introduced the capability of integrating data from multiple sources into a single air picture for display to the controller. This included: information from the flight plan, updated by in-flight position reports by radio; radar data from multiple sensors; and the implementation of new FANS technologies, including the full capabilities of Automatic Dependant Surveillance and Controller-Pilot Data Link Communications

1998: Transition to The Australian Advanced Air Traffic System (TAAATS) commences.

Today's aviation industry is a 24/7 business. This is Launceston Control Tower at night.

(ADS-CPDLC) which had only been in limited, standalone use up to that time. TAAATS was the first Air Traffic Management system which consolidated controller access to all these functions through a single keyboard and mouse. In preparation for the 2000 Olympic Games in Sydney a flow management tool, Maestro, was integrated into TAAATS for Sydney operations and subsequently extended to cover Melbourne, Brisbane and Perth airport operations.

'For the first time, Australia had continuous surveillance coverage at high level across the entire continent'

TAAATS/Eurocat was also relatively easily upgraded as new technologies emerged and one of the most important changes was the introduction of Automatic Dependant Surveillance-Broadcast (ADS-B). This system, using satellite positioning to derive accurate on-board navigation data and broadcasting this to any suitably equipped recipient, offered the possibility of nation-wide surveillance at a fraction of the cost of the equivalent radar coverage.

Following successful trials commencing in 2002 in Queensland's Burnett basin, Airservices Australia took the decision to install an Australia-wide network of ADS-B ground stations, co-located with existing air traffic services communication facilities. From 2010 ADS-B became mandatory for all aircraft operating above Flight Level 290 (29,000ft), and from 2018 for all aircraft operating under Instrument Flight Rules (IFR). For the first time, Australia had continuous surveillance coverage at high level across the entire continent, and greatly expanded coverage at lower levels. This had enormous operational benefit to the airlines as separation between aircraft could be reduced to the same as for radar, instead of the much larger distances required by procedural separation.

1999: The air-ground satellite datalink services ADS-C and CPDLC becomes operational. The transfer of FS to ATC is completed, with the final FS units closing in **2000.**

An artist's impression of urban air mobility solutions in the city of Melbourne.

THE FUTURE

In 2021 we celebrate the centenary of Airservices Australia and its predecessor organisations, nearly eighty-five years since the origin of air traffic services in Australia.

As we do so, Australia is embarking on another round of ATS modernisation. The Civil-Military Air Traffic System (CMATS) will integrate Australia's separate civil and military air traffic management systems into a single national system. CMATS will also incorporate advanced tools for managing Australia's increasingly crowded skies: the vision of the pioneers has been amply fulfilled and Australians have become a nation of fliers, frequently travelling by air for business or pleasure thanks to one of the safest aviation industries in the world.

Although the technology and facilities have changed enormously, the services provided by ATS today are recognisably the same services those provided from the earliest days. The Flight Information Service, the SAR Alerting Service, the Traffic Information Service and the ATC Service are provided with much more sophistication and efficiency today, but they are in essence exactly the same services.

2010: ADS-B becomes mandatory for all aircraft operating above 29,000ft, and from **2018** for all aircraft operating under Instrument Flight Rules (IFR).

Moreover, with the notable exception of the inclusion of women in the ATC profession, the nature and qualities required of air traffic controllers have changed little. With some of the busiest air routes in the world for its controllers to manage, CMATS will usher in another chapter in Australia's long and proud Air Traffic Services history

'Although the technology and facilities have changed enormously, the services provided by ATS today are recognisably the same services those provided from the earliest days.'

Artists impression of the Airservices building intented to house and support CMATS and its associated operations room.

2018: For the first time, Australia had continuous surveillance coverage at high level across the entire continent, and greatly expanded coverage at lower levels.

GLOSSARY

ADS-B	Automatic Dependant Surveillance - Broadcast
ADS-C	Automatic Dependant Surveillance - Contract
ATC	Air Traffic Control
ATS	Air Traffic Services
ATM	Air Traffic Management
CPDLC	Controller-Pilot DataLink Communication
FANS	Future Air Navigation System
FS	Flight Service
HF	High Frequency radio band
NM	Nautical Miles - 1NM = 1.85 km
VHF	Very High Frequency radio band
SAR	Search And Rescue
TCU	Terminal Control Unit

2021: We celebrate the centenary of Airservices Australia and its predecessor organisations, nearly eighty-five years since the origin of air traffic services in Australia.

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