All together now?

Australia's joint civil and defence ATM project

by Ian Thompson

Airservices Australia and the RAAF are working together on an ambitious joint procurement to replace their respective air traffic management (ATM) systems.

This is a substantial and complex project that will need to accommodate sometimes disparate civil and defence operational requirements, provide a base system that can readily incorporate new software functions to meet Australia's future air traffic demands, and achieve operational and financial efficiencies for both organisations.

Over the last five or so years, Airservices Australia and the RAAF have sought to form a collaborative working agreement. It was considered that a harmonised civil and defence air traffic system could provide organisational and operational benefits to both organisations. Potential benefits included training and sharing of air traffic control staff, and undertaking some RAAF radar functions from Airservices Australia facilities, following the example where approach radar services for RAAF Base Pearce are now provided from the Perth terminal control unit (TCU).

Initial attempts at collaboration had limited success due to the inability of both organisations to form a relationship of equality as well as overcoming differences in customer focus, operational purpose and priorities, operational systems and financial terms. However, government has persisted in its belief that considerable benefits would be possible if both organisations worked together. Aviation and Defence policy papers released in 2009 both identified the imperatives and benefits that would occur through collaboration between Airservices Australia and the RAAF. In particular, both organisations have air traffic management systems that reach the end of their planned operational life during the 2015-2017 period. Government directives and recognition that this is a generational opportunity for ATM system alignment have provided the impetus for both organisations to resurrect attempts at a collaborative working arrangement.

Airservices Australia and the RAAF have formed a joint steering group, ACMAC (for Australian Civil-Military Air Traffic Committee), to lead harmonisation initiatives. Airservices' Phil Baxter, general manager, ATC Future Systems, and Air Commodore Neil Hart, director general capability planning – Air Force, jointly co-chair this group. Initiatives have included developing common regulations, licensing, standards and air traffic controller training.

But as Baxter states, "these initiatives won't stick unless we have common technology".

Airservices Australia's ATM system (TAAATS) has been operational since 1998. It comprises two air traffic control centres, located at Brisbane and Melbourne, each responsible for approximately half of the airspace over continental Australia. These air traffic control centres are built on independent processing systems, providing terminal control radar and tower services at all major cities – Melbourne, Sydney, Canberra, Adelaide, Perth, Brisbane and Cairns. In essence, the Thales supplied TAAATS incorporates the data processing automation, controller consoles, simulators, communications systems and facilities associated with providing radar services. Other air traffic control systems such as radar sensors, automation systems for regional control towers, and simulators and other training tools for the Learning Centre, are purchased and managed under separate supplier contracts.

The RAAF's ATM system – ADATS – includes radar sensors (fixed and deployable), software and display systems, communications systems and radar simulators for the school of air traffic control and military approach units. In the main, defence operates a network of control towers and approach radar locations. At

Richmond and Edinburgh air bases, radar approach services are provided from nearby Airservices Australia facilities. Supplied by Raytheon, ADATS was installed into the defence control towers and radar approach units, with the first site becoming operational in 2000.

ATM systems operated by both organisations are ageing. Hardware items that have been in operation for 10 years or more are prone to failure, spares are reluctantly supported by suppliers, and consequently are expensive to maintain. The software architecture is outdated, complex and largely proprietary, while software enhancements to help cater for new operational requirements are difficult to incorporate into existing systems.

Airservices Australia has adopted an evolutionary approach with TAAATS since it was first commissioned. New enhancements have been progressively introduced, such as multi-radar tracking and conflict detection. 'Off the shelf' solutions for these enhancements were often not immediately available from the original supplier. As a result, significant enhancements often required a full software development life cycle, including operational commissioning, that became complex, time consuming and expensive. Defence adopted a replacement program which involved some upgrade to core components, but has now resulted in a complete system replacement to address obsolescence.

The new Australian ATM system will be strongly influenced by new generation systems being developed in Europe and the United States. Primarily, these programs have been established to overcome legacy ATM systems that are: reaching the limits of capacity at important airports and air routes; fragmented across system components (such as ATC providers, airports and airlines, as well as among the elements involved in air traffic control delivery) under pressure from airspace users to improve quality of service and safety while reducing the cost of delivery; and experiencing societal pressure to minimise aviation environmental impacts and costs.

The Single European Sky Initiative (SESAR) has established four performance targets to be achieved by 2020, from baseline figures established in 2005. These targets are to: provide for a threefold increase in capacity; improve safety by a factor of 10; achieve a 10 per cent reduction in the environmental impact per flight; and reduce ATM costs to users by 50 per cent.

Similarly, the United States' Next Generation Air Transportation System (NGATS) is being developed to meet a predicted increase in demand for air traffic operations of between 150 to 200 per cent over the next 20 years. Traffic growth in Australian airspace is expected to be more modest, at around five per cent annually during this period.

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Attainment of these targets requires significant changes to the traditional methods of managing air traffic. Trajectory management will govern airspace design and management. This involves providing the framework for aircraft to fly unconstrained for as far as possible, enabling them to define the route, height, speed and time of flight (ie, a 4D trajectory). The unconstrained flight philosophy can apply to civil and military operations.

Flexible flightpaths will mean that surveillance is needed in areas beyond traditional route structures. Cost-effective surveillance methods such as ADS-B and multi-lateration will increasingly be used alongside traditional primary and secondary radar systems. Defence radars also form part of this surveillance network. New ATM systems need the capability to fuse data from a range of surveillance sources to accurately determine the position of an aircraft.

Airspace design philosophy will change. Dimensions of en route airspace will increase, while terminal airspace will correspondingly become smaller with fixed routes, as far as practical, limited to high density airspace. These fixed routes will become more precise, increasingly being based upon satellite technology with the reliance on ground based navigation systems lessened. Approach and departure routes within terminal airspace will become shorter due to the increased accuracy of aircraft navigation systems.

Greater numbers of aircraft operating within terminal airspace and the application of unconstrained en route operations require changes to air traffic service delivery and separation methods. The ratio of aircraft able to be managed by an air traffic controller must increase to cater for the greater numbers of aircraft operating within a smaller volume of airspace, as well as reduce operating costs. Some responsibility for separation will transfer from the air traffic controllers to the pilot, enabled by ADS-B technology providing situation awareness to the cockpit.

Application of air traffic control separation will become increasingly strategic, being planned in advance of the actual departure of the aircraft. Initiatives will attempt to minimise in-air holding and ground queues. This is enabled by airports, air traffic services providers and aircraft operators working together to negotiate and plan aircraft movements ie, the number, time and type of aircraft operations. Airservices has already established a Network Operations Centre to lead these operational planning activities.

A system-wide information management (SWIM) network is needed to integrate ATM data received from all components of the operational system. These components, including airports, air traffic providers, operators and the aircraft, are considered to be nodes that provide and receive system information. These are complex system developments based upon universally agreed international stand-

ards. Modern ATM systems will need to integrate with the information systems operated by many organisations.

Reliance on SESAR and NGATS to lead the development of system functionality presents some problems for the new Australian ATM system. Most initiatives to achieve system performance, safety and cost targets will become available in 2020 at the earliest, many developments will occur some years after this date. But implementation of the Australian system is likely around 2017, which means that a fully developed turn-key solution will not be available. In many ways, the new Australian system, once implemented, will be a somewhat interim system until new applications progressively become available in the future. This presents challenges to Airservices Australia and the RAAF in managing the pathway to incorporate system enhancements.

Investment by Airservices and Defence in a combined ATM system provides the building block for the whole system, incorporating airlines and airports, to begin initiatives to improve efficiency.

"A whole system approach is being adopted in the development of the combined ATM system," Group Captain Forster Breckenridge, officer commanding RAAF air traffic control functions, says. "Airservices Australia and Defence need to provide the framework, in the first instance, through ATM system development. This ATM development then enables certainty for airlines and airports to plan and invest in new technologies to take advantage of potential operational efficiencies. The whole of system approach also needs to address the evolving military requirements."

Flexible civil and military airspace use is one the most important elements to enable aircraft to fly on the most efficient air routes. This requires a high level of cooperation and coordination between Airservices and the RAAF. In addition to the civil use of military airspace, access to civil airspace is now being seen as important by the RAAF to meet military requirements.

"From the military side, new systems like the Joint Strike Fighter, UAVs, new air defence capability and national contingency planning have different demands, requiring access to greater volumes of airspace," AIRCDRE Hart explains.

Flexible airspace use can be most effectively accomplished through a common ATM system. "With Airservices Australia and the RAAF operating on different systems, the data and processing is different which means that you have systems that interact in a fairly rudimentary way," Baxter notes. "So when we have changes in airspace or a requirement for an aircraft to fly from civil to military airspace, inefficient manual handovers need to take place between controllers. In a common system, everyone is looking at the same data, processed the same way for the whole of Australian airspace."

Adds AIRCDRE Hart, "Radar displays can be replicated on both systems, requiring a lot less manual coordination between controllers. High manual coordination tends to mean that we can't be as flexible to meet the needs of different aircraft."

The current two air traffic control centre (ACC) configuration operated by Airservices Australia at Brisbane and Melbourne, while providing system redundancy in the event of catastrophic failure, is based upon legacy design concepts and provides limited operational flexibility. It is not easy to deploy air traffic control staff to different sectors in response to traffic demands, or to overcome staff shortages. Dynamic allocation of sectors and staff between the two centres is not possible.

A joint civil and military solution enables system redundancy for control centres to be provided by an increased network of radar control facilities incorporating Airservices Australia's terminal radar control units and RAAF approach locations. Although technology now provides the opportunity for Airservices Australia to operate from only one ACC, making the dynamic allocation of staff easier, natural disasters in early 2011 affecting Christchurch, Brisbane and Japan have highlighted the benefits of maintaining two ACCs.

"Even though the [Christchurch] air traffic control centre was still working [following the Christchurch earthquake], the controllers couldn't get to work," Baxter observes. "This geographical split is a model we will keep because it gives us robustness in the system."

In maintaining a two ACC operation, the capability to dynamically allocate sectors and staff between the two locations will be required to manage flexible air routes and provide contingency.

Military security considerations necessarily impose restrictions on interoperability of the civil and military systems. Secure military data and communication will need to be exchanged by military elements of the ATM system, but not be accessible to the civil functions. GPCAPT Breckenridge believes that security needs to be carefully assessed to ensure that the level of protection is properly balanced within a harmonised system. Phil Baxter notes that meeting these military requirements in a combined system assists in anticipating and overcoming future long term threats to system operations.

COLLABORATORS The RAAF's GPCAPT Alan Holtfreter (left) with Airservices Australia's Phil Baxter (general manager - ATC future systems), Chief of Air Force AIRMSHL Mark Binskin and Airservices Australia CEO Greg Russell during a joint Airservices-RAAF briefing at the Avalon Airshow in March. (Airservices Australia)

The new Australian system will need to provide for system evolution after it is commissioned. Airservices and the RAAF are likely to favour some form of 'open system', whereby the core software functionality will be open to interface with best of breed solutions from a variety of suppliers. It is presumed that these functions can be added relatively quickly with minimal integration problems. Availability of solutions from more than one supplier provides the opportunity to select the best product, promote competition and, arguably, contain prices.

However, obtaining software modules from various suppliers will increase the responsibility of Airservices and the RAAF to perform a greater range of system activities, such as project management, system engineering, interface development and integration. It seems that the two organisations are mindful of this greater level of responsibility and risk.

Baxter states that "we're very conscious of our strengths and weaknesses as organisations and what would work best for us jointly." Adds AIRCDRE Hart, "we don't want to have big integration risks that we're seeing in other projects. The advantage we have is that in the global market those interface standards are well established. So we'll have to balance that."

Another issue with a common Australian civil and defence ATM system is that at least one of either Airservices or the RAAF will have a new ATM systems supplier. A change in supplier will increase the magnitude of commissioning and transition activities, meaning significant retraining of operational and technical staff.

Greater implementation complexity and risk has seen an emerging trend in Europe for air traffic service providers to enter into long term, strategic relationships with one of the large systems suppliers, for example COOPANS (COOPeration between Air Navigation Services providers), whose member nations Ireland, Sweden, and Denmark have partnered with Thales.

Systems are no longer considered to have a finite life of around 15 years before a replacement is tendered in the open market. Software is updated in accordance to a planned development path and hardware is replaced and upgraded periodically. This trend also seems to be tempting some air traffic providers to become the design authority and undertake in-house development of their systems. Countries assuming this responsibility include Portugal, United Kingdom, France and New Zealand. These structural changes in the market mean that fewer ATM systems are being tendered, and it is becoming more difficult for global systems suppliers to gain new customers.

Airservices Australia is a risk averse organisation that sets demanding standards in commissioning new systems. This can often increase the time, effort and costs associated with project implementation. The RAAF has similar standards to Airservices Australia, but the challenges presented to a supplier are somewhat different. Defence requirements can mean custom development of important elements such as processing and display functions, military interrogation of aircraft and communications systems. Significant custom development and integrating complex system components increases the likelihood of project delays and cost overruns.

POINTS OF DIFFERENCE Military security considerations necessarily impose restrictions on interoperability of the civil and military systems. (Dept of Defence)

Although both organisations express optimism about the planned joint system procurement, a number of potential hurdles will need to be navigated. The two organisations have somewhat different needs to be solved in an ATM solution. As well as a local service requirement, the RAAF must meet deployment obligations into war and disaster zones. It is possible that the preferred supplier of the defence solution may not be the most suitable for the civil application and vice versa.

The RAAF is under government pressure to obtain operational efficiencies from a new ATM system. Efficiencies are expected to come from the joint system procurement, development and through life support, as well as improved access to airspace for civil and military users. However, operating and upgrading this complex system will make demands on the RAAF to supply operational and technical staff for joint development and system management responsibilities. Inability to demonstrate financial benefits may raise questions over whether a joint procurement and operation is in the best interests of Defence.

Final scope of the joint system as well as the contractual relationship between Airservices Australia, Defence and the contractor(s), are still being finalised. Industry consultation is expected to commence shortly, with a briefing to suppliers expected to take place in Australia later in 2011. The request for tender (RFT) is expected to be released in February/March 2012.

This joint civil and military system is a very complex undertaking. Airservices Australia and the RAAF face the challenge of defining and implementing a system that can meet Australia's air traffic and Defence requirements for at least the next 15 years. The project will receive considerable interest from international and local systems suppliers and be scrutinised by government and industry stakeholders. Most important to the success of the joint system will be the ability of Airservices Australia and the RAAF to maintain an effective working relationship so that the aspirations of both organisations can be achieved.

"A lot of the early work was just about maturing the relationship and getting some of the dirty linen on the table, for want of a better word, and actually working through some of those harder issues and just understanding what both organisations' needs are," Baxter notes.

"It's driven us to really define that relationship and define what is different about a military air trafficker and an Airservices air trafficker, and what do we need to do differently," observes AIRCDRE Hart. ■

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