Air Traffic Management 07

A STRATEGIC VISION FOR AUSTRALIA

Part B

OPERATIONAL EVOLUTION DOCUMENT

stakeholders

DEVELOPMENT OF THE PLAN

This edition of the **Australian ATM Strategic Plan** and its complementary document, the **Operational Evolution Document**, have been developed collaboratively by the ASTRA member organisations listed below. Participation in this process does not, in and of itself, imply agreement to implement particular projects - any such decision needs to be supported by risk-based analysis and the normal business processes including cost benefit analysis and business case. ASTRA member organisations agree to keep ASTRA informed of their own ATM plans and any differences with this plan that are likely to affect other stakeholders.

Aircraft Owners & Pilots Association of Australia
Airservices Australia
Alliance Airlines
Australian & International Pilots Association
Australian Airports Association
Australian Defence Force
Australian Maritime Safety Authority
Australian Sport Aviation Confederation
Civil Aviation Safety Authority
Department of Infrastructure, Transport, Regional Development and Local Government
Qantas Airways
Regional Aviation Association of Australia
VirginBlue Airlines

foreword

The Australian ATM strategic planning process is intended to coordinate the introduction of a number of operational enhancements to the Australian ATM structures and processes over a 20 year horizon. The **Operational Evolution Document** [OED] is the second part of a suite of documents supporting the evolution to a future ATM system in Australia that is performance-based, addresses ATM community expectations, is cost-efficient and is globally harmonised. The objective of the OED is to support the ATM Strategic Plan, and to provide further detail on how the ATM system will evolve through the short and medium term to enhance the performance of the ATM system in Australia.

The OED has been derived from the Australian ATM Strategic Plan, its supporting Target Operational Concept and Strategies, and the ICAO Global ATM Operational Concept. It is also cognisant of the need for regional harmonisation, and is designed to allow implementation programs to expand across the Region subject to appropriate collaborative processes. The OED brings together a number of important initiatives in airspace management, collaborative decision-making, Flexible Use of Airspace (FUA), Flexible Tracking and integrated infrastructure, including the implementation of enhanced surveillance capabilities.

This document takes two slices through the possible futures: one at the end of the notional "short-term" horizon and one at the end of the notional "medium term" horizon. The short-term relates to the implementation of current technologies and capabilities and has an approximate horizon of 2012[1]. The medium-term relates to the implementation of technologies and capabilities currently "on the drawing board" and has an approximate horizon of 2017. Necessarily, the definition of the medium-term is less than that of the short-term.

The short-term evolution does not require radical new equipment programs as it seeks to maximise use of current tools and technology; however, its implementation does not preclude individual initiatives or the introduction of new technologies. The intent is to develop a performance based approach to ATM and to establish practices that will allow cost efficient evolution to the Target Operational Concept. The medium-term evolution will harness emerging capabilities including the most promising technologies and global standards.

The OED describes the operational environment primarily from the users' perspective and the proposed operational improvements in the principal areas of:

- improved planning and demand and capacity management
- information sharing and collaborative decision making
- amalgamation/integration of functions of airspace, flow and capacity management at network [trans-Australia] and local levels
- improved links with airports, and
- activation of dynamic airspace structures and routes to provide the best pan-Australian network situation for the day of operations.

Finally, the OED sets out, in broad terms, the roles and responsibilities of stakeholders, adopting the principle that each stakeholder assumes responsibility for the actions for which each is best placed to contribute to the overall ATM operation at the appropriate time.

1 - The time horizon is not fixed. Some of the 'short-term' implementation activity may be completed before 2012, some after. The date is a target for substantive completion, for business case purposes and also recognises the lead-times required for equipment transition in aircraft fleets or ground systems.

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The strategic vision for ATM in Australia has been constructed as a number of separate documents. The first part is the **ATM Strategic Plan**. Its intent is to describe the vision for air traffic management in Australia, and to describe, at a relatively high level, what is envisaged [the Target Operational Concept], and the framework to determine how well it is expected to operate [the ATM Performance Framework].

The ATM Strategic Plan has been constructed both to align with international best practice – including the ICAO ATM Operational Concept – and to "stand the test of time", allowing investment decisions to be taken with confidence. It is expected to be updated on a cycle of 5 to 7 years.

This document - the **Operational Evolution Document [OED]** - is the second document in the suite. It is intended to describe how the evolution to the future ATM system should occur – and who should undertake the work. As it contains detail at a lower level than the ATM Strategic Plan, it is expected to be reviewed and updated more frequently, to ensure that it anticipates evolutionary developments in ATM and its supporting infrastructure.

The third part of the suite will be developed in individual stakeholder implementation roadmap documents.

The Operational Evolution Document

The OED describes the Australian operational environment in the short and medium-term, with the integration of differing target operational concept strategies and the introduction of the flexibility to exploit all potential ATM system capacity.

Increased efficiency and collaborative processes, together with flexible and dynamic airspace structures, will contribute to meeting the projected increase in traffic and meeting the airspace needs of the military.

The Operational Evolution seeks improvements to ATM based on:

- improved planning and demand/capacity balancing through demand and capacity accuracy
- information sharing and collaborative management
- amalgamation or integration of the functions of airspace, flow and capacity management at network and local levels and throughout the whole gate-to-gate time cycle
- improved links with airports, and
- activation of dynamic airspace structures and routes to provide the best pan-Australian network situation for the day of operations.

The Operational Evolution drives towards realisation of the following Target Operational Concept strategies:

Table 1: ATM Strategies

Strategy	Description
Integrated Data Exchange (InDeX)	Establishes an integrated aviation information network to provide timely and high quality operational information to all users. This is a key enabler for other strategies.
User Preferred Trajectory	Allows a user to optimise their flight trajectory in four dimensions (i.e. three dimensions plus time) against their business or individual priorities.
Enhanced Conflict Management	Supports User Preferred Trajectories which will replace the current rigid separation standards.
Flexible Use of Airspace	Maximises the use of airspace to support civil and military operations without rigid airspace segregation.
National Demand/Capacity Management	Optimises air traffic flow throughout Australian airspace.
ATM Performance Framework	Provides the means to measure and report the efficiency and effectiveness of the ATM system, and to provide performance data to develop and refine strategies.
ATM Infrastructure	Provides integrated communication, navigation and surveillance infrastructure options as enablers, or supporting applications and capabilities which are essential to support the introduction of new ATM capabilities.

Scope

OPERATIONAL SCOPE

From an operational perspective, the key attributes of the Operational Evolution are:

- a dynamic Australian airspace structure together with associated pre-defined operational scenarios and operating modes
- collaborative processes & procedures to support flexible management of airspace and selection of pre-defined scenarios where applicable
- an integrated approach to airspace, flow and capacity management
- a strong airports interface
- enhanced processes to support effective civil/military cooperation;
- demand capacity management including demand and capacity balancing, traffic synchronisation and constraint management
- a pan-Australian network approach
- processes and repositories to support collection and sharing of accurate data, in particular demand data and flight data
- dynamic management of trajectories after pushback or 'off-blocks', and
- processes to support performance monitoring and sharing of best practices.

GEOGRAPHICAL SCOPE

The Operational Evolution is a concept for the whole of the Australian area[s] of responsibility, including those portions of adjacent airspace managed by Australia, providing a homogeneous area of operations. In addition, considering the potential cost benefits, the objective is the implementation of this Operational Evolution in an area as wide as possible. Users expect the same level of service across the Region. Dynamic management of the Trans-Tasman, South-West Pacific and/or Indo-Australasian airspace network means integrating the distributed activities within the network organisation.

The extent to which the Operational Evolution can be expanded into these areas depends on a range of factors. These are not covered here, but are the subject of separate regional planning processes. Nevertheless, the Operational Evolution takes into account the need for regional harmonisation and is designed to allow implementation programs to expand across the Region, subject to appropriate collaborative processes.

GATE-TO-GATE SCOPE

The Operational Evolution is a 'gate-to-gate" concept, covering all operational aspects, including improvements to flow and departure, enhancements to the en-route phase of flight and improvements to multi-layer planning. Route network development [static and dynamic] and the enhancement of forward planning ensure an early interaction by airspace users with any necessary air traffic capacity or flow management processes. Together with the enhanced distribution of up-to-date information, ATM will be enhanced through the provision of flight data after "off-blocks".

Making the latest information on arriving aircraft available in a timely manner to destination airports enables the most efficient handling of the flight after landing. This in turn will contribute to the turnaround phase of a flight. The Operational Evolution is involved with all phases of flight, including the post flight analysis of the network performance and of individual flights. The Operational Evolution, therefore, addresses all phases of flight from the moment the airspace user first interacts with ATM to engines shutdown and beyond.

TECHNICAL SCOPE

In the short-term, there is no radical new equipment program required to enable the Operational Evolution; however, it is intended to make maximum use of current tools and technology where required. There are a number of developments such as Medium Term Conflict Detection, Arrival Management and Departure Optimisation that will accompany the progress of the short-term Operational Evolution in the context of Air Traffic, Flow and Capacity Management and associated technical requirements. These initiatives will support and enhance the Operational Evolution if introduced in the same time scale, but they are not in themselves prerequisites for the short-term program – they are more appropriately focused on the medium-term horizon.

HUMAN FACTORS SCOPE

Over the course of the Operational Evolution, user demand is expected to increase at a rate of between 4.5% and 6% per annum, with an expected doubling of air traffic in a 15-20 year horizon. Whilst the number of personnel working in the industry is unlikely to increase at the same rate, there will, nevertheless, be an increase in staff across all domains. This will require an increase in productivity to maintain the industry's cost-effectiveness.

The short and medium term evolution will focus on developing air traffic management strategies which shift the emphasis away from a "just in time" tactical intervention paradigm, and towards "just in case" collaborative strategic and pre-tactical management. Appropriate decision support tools will be developed to allow a safe change to workload distribution across all human factors domains.

Human factors studies will ensure the design and implementation of technical, human and/or procedural systems delivers the desired performance, provides the necessary decision support tools and human machine interface changes and will identify and include training needs before implementation.

Benefits

The key benefits arising from the implementation of this **Operational Evolution** for each of the main actors are shown in Table 2.

Table 2: Potential Benefits of the Operational Evolution

	Potential benefits
Aircraft Operators	• Aircraft operators will be able to make informed choices from possible route options available for flight planning purposes as produced from the updated airspace environment and the most efficient route network available at that time. • Civil airlines will be better able to address punctuality, making schedules more robust and reducing block times • Capacity benefits through an ATM organisation best suited to meet the demand of the day • Increased efficiencies with more cost effective ATM service through enhanced collaborative processes
Military	• Increased flexibility to manage short notice requests for airspace and airspace changes (due bad weather etc). • Civil–Military process to ensure effective collaboration has taken place for airspace allocation & route activation • Military will be provided with coordination tools including a simulation function to design and map temporary airspace structures on the route network to assist airspace allocation which meet operational requirements and optimise capacity. • Military authorities will have their current and evolving airspace requirements incorporated into the overall Australian airspace structure design and be an integral part of a dynamic collaborative airspace allocation process which supports State requirements for military airspace use and defence needs.
Air Navigation Service Provider[s]	• ANSP(s) will be providing the ATC service within their area of responsibility which would have an operational coherency and basis in line with the objectives of a safe, cost-effective and efficient ATM system and consistent with efficient dynamic management of the complete Australian airspace network. • ANSP(s) will be better able to provide the right amount of capacity at the right place and at the right time. • ANSP(s) will be able to benefit from all relevant network information to optimise the service provided within their area of responsibility.
Controllers	• ATCs will be working within sectors best placed to satisfy the operational requirements (traffic demand, traffic pattern) and airspace availability, grouped within sector families which strongly interact with each other through close and complex coordination. • No fundamental changes in working practices. Any training needs will be identified through a Human Factors case.
Pilots	• Pilots will be flying a route specified in a consistent flight plan selected by the operator from options available as close as practicable to departure with the latest knowledge of the demand, ATM structure and the capacity available.

Potential Benefits of the Operational Evolution continued.	
Target Operational Concept Strategy	**Description**
Network Capacity	• Network Capacity will be enhanced by ensuring that the network elements of the airspace system and its management are compatible and by increased efficiencies in forward planning of structure and resources.
Airports	• Improved data flow on arriving flights to enhance traffic handling on the ground. • Enhancement of the interface between airside airport operations and ATM which takes account of airport operations in route planning & vice versa. • Increased ability to react to last minute changes on the ground.
Flexibility	• An airspace flow and capacity management service will be provided based on flexibility aimed at deriving the maximum capacity in a constant collaborative process using pre-planned validated route and associated sectorisation scenarios. • Military airspace allocation/route activation will be made in a highly dynamic manner through a collaborative decision making process supporting the different stakeholders' roles and responsibilities.
Network Situation	• INDEX will provide the latest updates on route and airspace availability to utilise effectively the available capacity.
Flow Regulations	• Improved prediction of traffic will avoid unnecessary sector regulation.

2. short- and medium-term operational evolutions

ATM evolution during the short and medium-term will enhance the performance of Australian airspace and air traffic management through a dynamic approach to the network environment, the sharing of related information, and a transparent partnership in selection of preferred routes and military user airspace requirements.

The ATM system will evolve to meet the actual demand for the key Target Operational Concept strategy – User Preferred Trajectories – providing the necessary flexibility and access through the activation of flexible and dynamic airspace structures. This airspace infrastructure, with its route options and military use airspace, will be exploited by amalgamating the functions of airspace, flow and capacity management, working at network and local levels throughout the whole gate-to-gate time cycle, creating a seamless interaction between the airspace structure, the airspace/route utilisation and airports to provide optimum system-wide performance.

Benefits from the concept will also be gained by improving planning and collaborative airspace flow and capacity management which will allow controllers to focus on the conflict management aspects of air traffic control. Experience in the successful application of the concept will support further development of improvements at the tactical and operational levels. The improved efficiency of the ATM operation will also benefit those areas where the need for capacity is not yet regarded as a current issue.

Greater accuracy and reliability of shared information will enhance confidence in the operational processes. An important objective of the short and medium-term programs is to achieve the same level of flexibility throughout the pan-Australian ATM network as can be achieved locally within an individual air traffic control unit or sector grouping.

Traffic Growth Context

Analysis by a number of organisations including Boeing and Airbus, has forecast traffic growth of between 4.5% and 6% per annum in the Australasian region over the next 20 years. Table 3 shows the potential traffic levels [as a multiplier] at the end of each evolution period compared to the baseline of traffic levels in 2006.

Table 3: Forecast Traffic Growth

	4% Growth	4.5% Growth	5% Growth	6% Growth
Baseline [end-2005]	1.0	1.0	1.0	1.0
Short-Term [end-2012]	1.3	1.3	1.3	1.4
Medium-Term [end-2017]	1.5	1.6	1.7	1.9
Long-Term [end-2025]	2.1	2.3	2.5	3.0

As well as increasing the performance levels of the current system, the short-term evolution will need to cater for an increase in traffic of between 30% and 40% compared to the baseline traffic levels of 2006. The medium-term evolution will need to cater for an increase in traffic of between 60% and 90%. The long-term evolution will need to accommodate an increase in traffic of between 130% and 200%.

Experience in Europe and the United States has shown that extrapolation of current ATM paradigms will not be sufficient to cater for such traffic growth demands and maintain or increase performance. A change in operating paradigm is required.

Network Perspective

SHORT-TERM

Airspace will be managed in a cooperative and iterative process aimed at maximum utilisation and greater flexibility and responsiveness. It will offer route and level options closer to preferred trajectories, support military use airspace requirements and ensure efficient connectivity between the route network and terminal airspaces.

Early indications by airspace users of their requirements will help to ensure an improvement in the ability of air traffic control units to meet the preferred routes or provide suitable alternatives. System enhancements will refine the planning process for both civil and military airspace users as part of balancing demand/capacity. Military or State authorities will supply their airspace requirements for exercises and training.

Aircraft operators will indicate their flight intentions in progressively more detail as the day of operations approaches. Air navigation service providers[s] will provide their capacity values against the forecast traffic demand and the airspace structure.

MEDIUM-TERM

Enhanced management of the airspace structure will enable flexible capacity with route options and alternatives provided pre-tactically and tactically to meet the preferred trajectories of the airspace users. There will be pre-determined scenarios and modus operandi, developed by the affected stakeholders and validated through simulation, to meet the varying traffic demand and needs for temporary segregated airspace. These scenarios will be known to the affected stakeholders [primarily ANSP(s), Military, and Airspace Users] and to the airspace database within InDeX. Adapted/flexible sectorisation [cross-border and modular developed by ANSP(s)] will give advantages to both civil and military airspace users.

The airspace database will include all the routes and reserved airspace which may potentially be used by civil and military airspace users. Such strategic demand identification is provided by the civil and military users through national and international coordination and is based on their respective business/ operational objectives.

Aircraft operators and/or the military will be able to obtain the forecast airspace structure for their time of flight or operations. The closer to the time of departure or the exercise activity, the more accurate the information will become.

The planned airspace database and information exchange system [Integrated Data Exchange - InDeX] will be fully deployed and available for all partners to update according to business rules and interrogate on a need to know basis. The pre-determined traffic management scenarios, including dynamic sector configurations for the airspace structure and traffic demand, will also be within the InDeX system.

With the knowledge of the airspace structure, flight intentions and the available capacity, it will be possible to determine an overview of the Australian network situation at any given time – past, present and future. All stakeholders will have access to the fora in which the on-going planning of scenarios and their activation are made. Following co-ordination within flow management processes, the results of these actions will be consolidated at network level ensuring network consistency and a visibility of the options for all users.

A Network Operations Plan will provide an overview of the Australian airspace situation from which stakeholders may access and extract data for selected areas to support their operation and, if required, to create their specific operations plan.

On the day of operations, aircraft operators will submit their flight plans based on the route or available airspace management choices. That information will be used to update the actual traffic demand. The various temporary segregated areas for military or other special use activity will be activated or deactivated with the changes incorporated into the airspace database. The ownership of the flight plan data is clearly established and any changes coordinated with the appropriate partners at the time.

Flight data, weather delays, actual departure and arrival times are distributed to both en-route and terminal air traffic control units and airports. Changes in the flight profile will also be communicated to concerned units and fed back into InDeX so that advantage can be taken of any opportunities for aircraft soon to depart or already in flight.

Figure 1: Overview of Proposed Incremental Operational Improvement Program

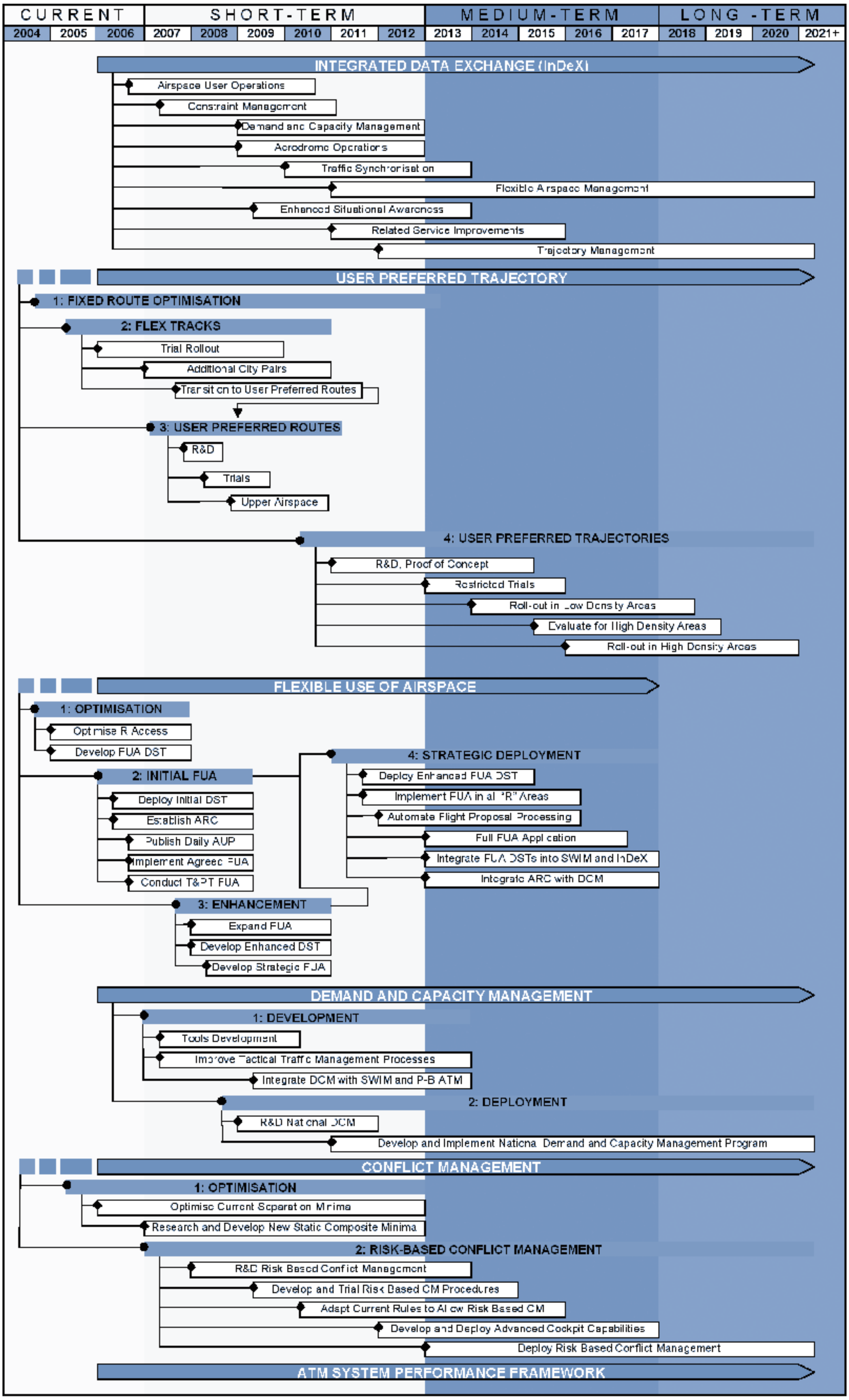

Figure 1: Overview of Proposed Incremental Operational Improvement Program

ANSP Perspective

SHORT-TERM

The ANSP(s) (military and civil) will be a keystone in the short-term evolution with participation extending from improved capacity planning, flexible airspace and sector design to the definition of pre-determined scenarios. Sector supervision and configuration management systems will become sufficiently flexible to support different sector configurations when required.

ANSP(s) will contribute to improved civil/military coordination with a first evolution automatic exchange of flight data between civil and appropriate military units, and by screen-to-screen dialogue for tactical coordination of general and operational air traffic in civil airspace and segregated airspace activity. Flight data processing systems will be capable of processing data across the correct sector sequence for aircraft flying along an updated/flexible routing and of identifying the sector configuration when modular or flexible sectorisation is in place.

MEDIUM-TERM

Sector supervision and configuration management systems will evolve to allow fully dynamic and flexible sectorisation as and when required. This will include a capability to reconfigure sectors geographically where they are only operated for part of a day, thereby increasing console utilisation. After coordination through appropriate flow or traffic management processes to ensure consistency with the network situation, changes to the sector configuration will be notified by air traffic management units to the Airspace Data Repository in InDeX.

Civil and military air navigation service provision equipment and functions will be integrated, as far as is practicable, to increase efficiency and cost-effectiveness. Appropriate arrangements will ensure that such integration is effective without compromising national security and national interest requirements of the affected defence forces.

ATC Perspective

SHORT-TERM

Improvements in flight data provide greater confidence in the flight plan information displayed to the controller. Harmonised procedures will be in place where there are operational needs for cross-border sectors. Preparation to meet traffic demand will be improved through the provision of enhanced information from aircraft operators and other stakeholders.

Flexible sectorisation will mean that sectors are better adapted to meet traffic flows. This does not imply that ATC will be faced with sector configurations that are not known either to them or to the supporting flight data or radar data processor systems. Sector configurations will be part of the pre-determined scenarios of the air traffic control unit. Simulation and training will be conducted prior to adoption.

Human factors studies will ensure the design and implementation of technical, human and/or procedural systems can deliver the desired performance. Training needs will be identified and training conducted before any change.

MEDIUM-TERM

The implementation of the final phase of flexible use airspace and its integration to the InDeX system will offer increased opportunities for flexible tracking and user preferred routes. Tactical application of user preferred routes will have been prevalent in lower density operating environments and will be trialled and rolled out in suitable higher density environments, supported by enhanced decision support tools for ATC.

User preferred trajectory trials will have taken place and rollout in lower density airspace will have commenced. Composite separation minima will be available, based on actual navigation performance, with possible application of the first of a new generation of risk-based conflict management procedures. Initial ASAS applications will be available, reducing ATC's workload in certain scenarios.

As in the short-term, human factors studies will ensure the design and implementation of technical, human and/or procedural systems delivers the desired performance, provides the decision support tools and HMI changes, identifies training needs and delivers training before implementation.

Aircraft Operators Perspective

SHORT-TERM

Aircraft operators will benefit from improved methods to manage demand, extension of local solutions to meet exceptional situations, information sharing and data exchange (accuracy, timeliness and accessibility) but principally, having a greater choice of routes [fixed and flexible] supplemented by alternatives. Route planning will be adapted to the needs of the day of operation and the former role of the repetitive flight plan will no longer be necessary.

Aircraft operators will contribute to improvements in demand and capacity planning by providing enhanced flight intentions and in turn will receive safer, more predictable and more efficient operation with a reduction in ATM-related variations in gate-to-gate transit times.

MEDIUM-TERM

Aircraft operators will play a major role in planning from the Strategic Operations Plan to the Network Operations Plan. They will be linked with airports and their capacity/slot allocation processes. Aircraft operators will be offered the selection of their preferred gate-to-gate routings with associated flight-time or delay indications within an improved and dynamic Network organisation.

Major operators who have appropriate support for enhanced flight planning systems will have direct access to the airspace data base [InDeX] and "what if" planning tools. This will allow aircraft operators to make full use of the flexibility within the system to receive and process data concerning updates of airspace availability.

Military Perspective

SHORT-TERM

Military will continue to require access to airspace sufficient for their needs in accordance with the priorities laid down under their national readiness requirements. Military airspace users will continue to need access to airspace sufficient for their operational and training needs which, when flight safety dictates, must be separated from other air traffic in segregated airspace.

Transparency of operations, civil and military, means there will be mutual recognition of each other's activities to the extent possible. Civil-military real-time coordination enhancements will reduce ATC workload and improve safety, particularly in cross border operations.

Modern aircraft and weapon systems require larger and more diverse volumes of airspace to exploit their capabilities. The military requirements for access to airspace to perform their essential tasks will be identified in both flight operations and/or airspace volumes. This requires effective civil/military coordination and a collaborative decision making process.

Training areas which have defined, fixed dimensions will be reviewed so that these areas could be sub-divided into vertical and lateral temporarily segregated airspace sectors, where operationally acceptable. These divisions/sectors would be managed in differing combinations with the civil traffic flows to meet the needs of specific training scenarios. Positioning of training airspace could be flexible, provided that the distance or flight time to the training airspace is not longer than that acceptable to achieve a productive mission.

With regard to large-scale exercises, in addition to taking into account civil traffic requirements, military requirements will be coordinated at the national/local level and the results considered within the overall coordination process.

The results of any change to capacity and the development of solutions from the pre-defined scenarios would be integrated, to minimise the network effect. This will require the parties to participate in an unambiguous decision making process for route and airspace allocation by an airspace management cell in coordination with the network and local traffic flow management function(s).

MEDIUM-TERM

The dynamic management of airspace will allow the planning and management of military operations much closer to the time of operation. The need for direct coordination and a collaborative dialogue between civil and military agencies will be reduced through more effective integration of airspace and air traffic management systems, functions and service provision.

The air navigation service provision arm of military operations will be more effectively integrated with civil service provision. The integration of technical competency, infrastructure availability, and resource access will increase the effectiveness of military operations, with a commensurate positive effect on national interest response capability.

Airports Perspective

SHORT-TERM

Airport airside operations and airport collaborative decision making will become part of the pan-Australian network with a seamless flow of information between those airports generating international and/or significant levels of domestic traffic and the Australian ATM system. There will be common, consolidated and up-to date information, shared and accessible by all interested parties, to allow airports and ATM providers to plan, anticipate and react to unexpected events.

There will be improved data flow from airport airside with regard to the pre-departure phase, and aircraft turn-arounds. There will also be an enhanced flow of information from air traffic management units and aircraft operators to airport operators.

MEDIUM-TERM

Planned and updated airport capacity figures will be provided systematically. This data will be included in the continuous capacity and demand balancing process. Extension of collaborative decision making from the airports and local ATC to the parent ATC unit(s) is part of a single gate-to-gate strategy.

Interfaces between airport airside operations and the ATM system will be enhanced. The collaborative decision making process will also extend between airports at all levels [major airports, secondary airports, country airports] and their users, to ensure an accurate network picture of capacity and operational efficiency.

Infrastructure Perspective

SHORT-TERM

In the short-term, the Very High Frequency (VHF) and High Frequency (HF) terrestrial radio communications infrastructure will be replaced and modernised. The Aeronautical Fixed Telecommunications Network (AFTN) will be replaced by the Aeronautical Message Handling System (AMHS), supported by the limited introduction of Aeronautical Telecommunication Network (ATN) capabilities for ground-to-ground communications.

Air-to-ground and ground-to-ground communications will be upgraded from analogue to digital systems as required. Vocoder addressable voice systems will be evaluated for possible deployment. The new generation of Global Positioning System (GPS) receiver (FAA TSO-C145 and -C146) is a solution to the present dependence upon the terrestrial network. Studies have pointed to its suitability as an 'only means' navigation system that does not require a ground-based navaid at an alternate aerodrome[2].

The other significant change in the short term will be the introduction of GPS precision approaches. Initially using the Special Category 1 (SCAT-1) system and a developmental (beta+) installation, the Ground-Based Augmentation System (GBAS) will start to provide Global Navigation Satellite Systems (GNSS) precision approaches in Australia. This will be supported by expanding use of Required Navigation Performance – Area Navigation (RNP/RNAV) standards, and possible utilization of existing standards for Approach with Vertical Guidance (APV) and Barometric Vertical Navigation (BaroVNAV).

Initial deployment of 28 Mode S ADS-B ground stations across Australia will see a change in the surveillance paradigm, with radar-like services – including reduced separation minima – introduced. The next few years will also see the increased use of ADS-C and RNP 4 to support reduced separation standards and the introduction of User Preferred Routes. Multilateration surveillance techniques will be assessed for operational application. Surface surveillance will be upgraded at Sydney and introduced to Brisbane and Melbourne airports.

MEDIUM-TERM

In the medium-term, ATN facilities will be progressively introduced. Internet protocol [TCP/IP] will be assessed for implementation, ahead of a longer term transition to a new communications protocol.[3] As system and procedural limitations permit, satellite telephone will be utilised for some applications, such as search and rescue [SAR-time] management. Air-to-ground and ground-to-ground communications will be upgraded from analogue systems to digital systems.

2 - ASTRA has conducted a test program on the new receiver to validate the earlier studies under failure and operational conditions. A recent approval has placed GPS (using TSO-C145 or -C146 equipment) on an equal footing with the other en-route and non-precision approach (NPA) navigation systems presently used in Australia.

3 - ICAO has indicated the need for a new communications protocol for air-ground and ground-ground communication in the period 2015+. It is likely that initial planning work will commence in the short-term, to identify the performance requirements, ahead of any decision to proceed with standards development. Initial assessments of requirement will be used to support arguments for spectrum protection at forthcoming World Radio Conference meetings.

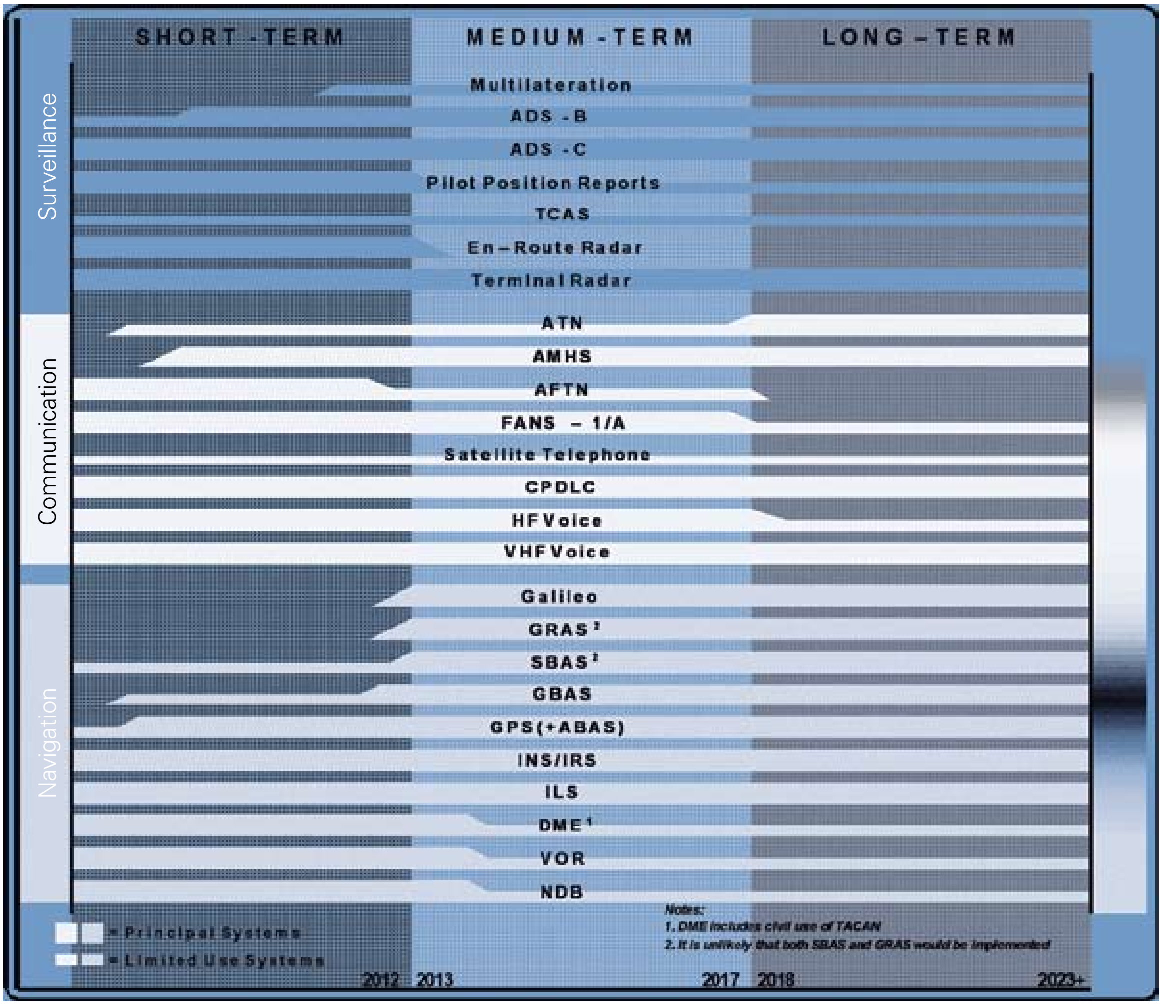

Figure 2: Overview of Proposed ATM Infrastructure Evolution

New GNSS support capabilities, including Space-Based Augmentation Systems [SBAS], Ground-based Regional Augmentation Systems (GRAS) and a new European navigation satellite constellation (Galileo) will have developed to the point where Australia can introduce them to the operational infrastructure. These, in turn, will support Performance Based Navigation[4] using RNP values of ±1NM or less. While it is expected that some limited SBAS benefits can be derived from the WAAS and MSAS geostationary satellites in the short term at no cost, a ground-monitoring infrastructure will be needed to realize the full benefit of those systems.

The Australian GRAS will also require deployment of a ground network and either (full) SBAS or GRAS would constitute a major investment. Galileo is scheduled to become operational in 2010, providing another full GNSS constellation and allowing considerable redundancy protection without reliance on terrestrial systems. It is also expected that during this time the development of MEMS technology will enable the use of inertial navigation in aircraft of any size.

The medium term will also see the phasing out of a substantial portion of the current ground-based navigation infrastructure including Non-Directional Beacon (NDBs), VHF Omni-directional Range (VORs) and Distance Measuring Equipment (DMEs). In general, only components needed to support GNSS will be retained.[5] At the end of the medium term, some phasing out of the instrument Landing System (ILS) will also be considered.

Australia's existing civil radars are approaching the end of their service life. As a result, medium term changes to the surveillance infrastructure will include the commissioning of a new Mode S terminal area radar network and wide scale deployment of ADS-B ground stations for en-route continental surveillance. The move towards a GNSS-based infrastructure will be supported by retention of some conventional navigation and surveillance systems in a 'backup' network.

Apart from en-route applications, the introduction of ADS-B technology will also enable new surveillance capabilities at FIR boundaries, in terminal areas of smaller aerodromes and on aerodrome surfaces.

4 - Under revised ICAO provisions, technical and operational standards for RNP values of 1NM or less will have a requirement for containment integrity which will provide a higher level of assurance of navigation accuracy.

5 - Some systems may also be retained to support legacy military aircraft operations.

In the medium term, a range of Cockpit Display of Traffic Information (CDTI) products will become commercially available and will initially be used for enhanced situational awareness applications. ADS-B [In/Out][6] will be assessed for use in conjunction with the CDTI applications. Enhanced situational awareness and oceanic in-trail climb and descent procedures (ITP) are likely to be the first application of the Airborne Separation Assistance System (ASAS). Towards the end of the medium-term, it is expected that CDTI and ASAS technology will have developed to a point where the more demanding ASAS applications can be introduced. This is likely to include early or trial applications of Airborne Spacing, Airborne Separation (from designated traffic) and Airborne Self-separation (from all traffic).

While these responsibilities are held by pilots flying outside controlled airspace today, the evolution of CDTI is expected to enable similar operations in higher density traffic environments in the interests of efficiency, economy and safety. These concepts are being developed and changes to the traditional relationship between controllers and pilots will need to be carefully managed. Proven multi-lateration techniques may provide solutions to specific applications in en-route, precision approach and surface surveillance.

The medium term will see the gradual phase out of secondary surveillance radar systems in en-route civil application. Primary radar will be retained in safety critical airspace, including high-density terminal areas (civil and/or military), because of its independent or non-cooperative surveillance characteristics. National interest or national security requirements may demand the continuation of non-cooperative[7] surveillance capabilities in certain airspace. Where appropriate, these will be integrated into the national infrastructure network.

6 - Initial development of Automatic Dependent Surveillance – Broadcast [ADS-B] is based around the broadcast of data outwards from an aircraft to ground receiving stations – hence ADS-B out. Global standards have now been completed for a revised concept of use of ADS-B that will allow data to be transmitted to the aircraft using ADS-B as well as the original outward function – this is referred to as ADS-B in/out.

7 - Non-cooperative surveillance means that the 'target aircraft' is able to be detected and surveilled without the need for that aircraft to cooperate i.e. to activate [manually or automatically] any on-board system. In civil application it refers to primary radar. In Defence applications, other techniques may be applied. Cooperative surveillance requires aircraft systems to be activated. Examples include Secondary Surveillance Radar or Multilateration [aircraft transponder must be activated], and Automatic Dependent Surveillance [aircraft systems must be operating].

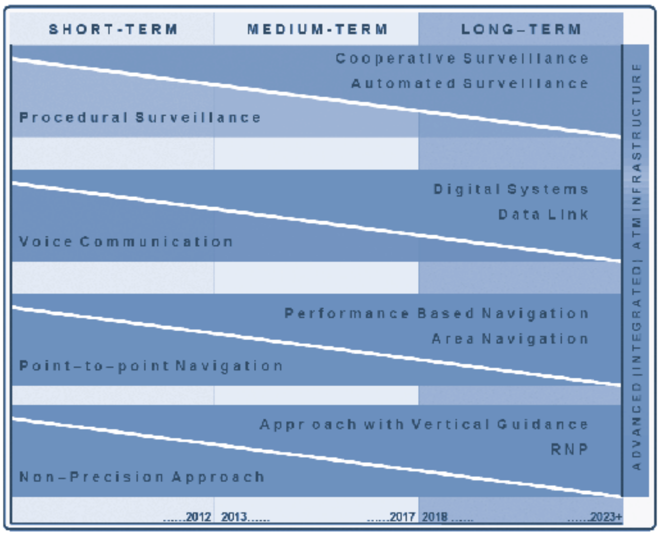

Figure 3: Example of Application Changes Driven by ATM Infrastructure Evolution

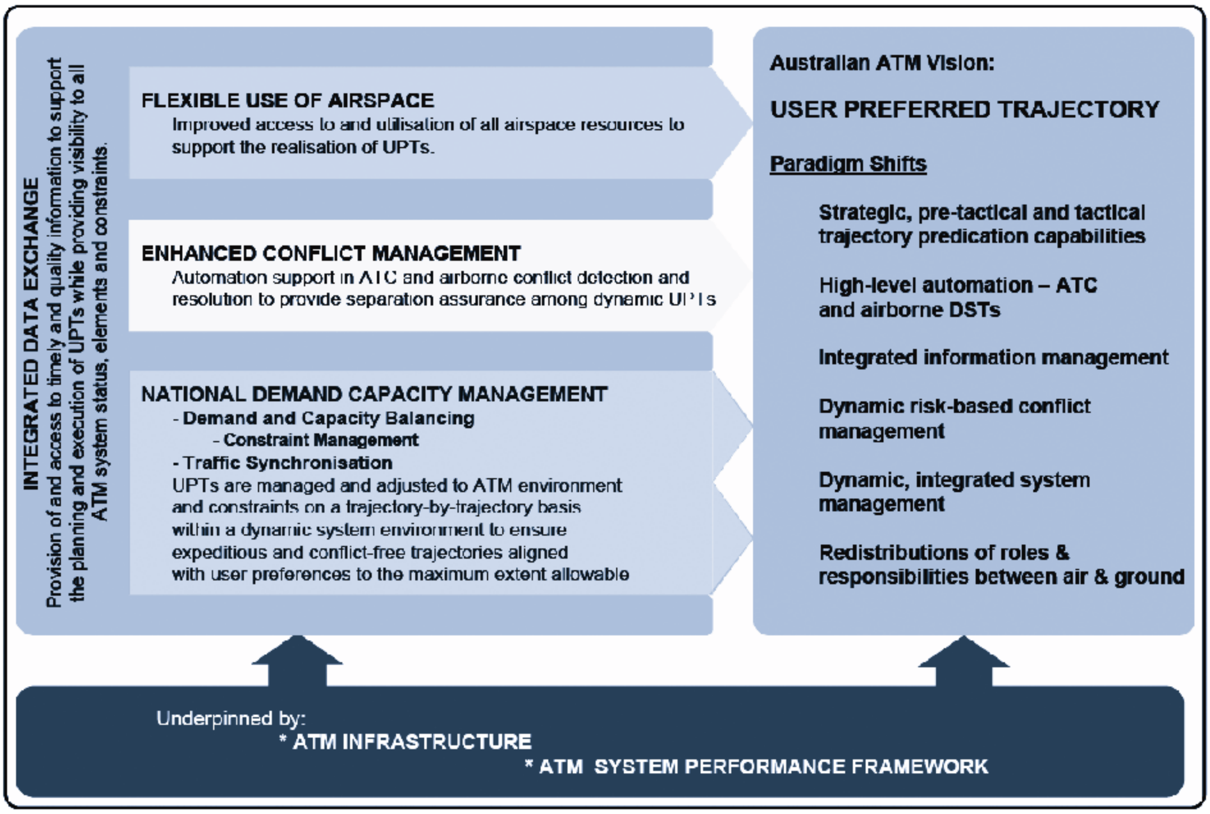

Figure 4: Integrated ATM Strategies

The Australian ATM Strategic Plan identifies the Target Operational Concept for ATM in 2025. The Strategic Planning Framework process has identified seven strategies by which to incrementally achieve the target. Figure 4 shows the overall goal. This chapter discusses the evolution of those strategies through the period of this O**perational Evolution**. It also provides an overview of expected benefits i.e. the contribution of each strategy to the performance of the entire Australian ATM system.

Integrated Data Exchange

The objective of integrated data [and information] exchange (InDeX) is to provide timely and high-quality flight and situational information to all ATM community members that will improve ATM decision making in an information-rich, collaborative planning and operating environment. The implementation of InDeX will progressively deliver the capabilities required of System Wide Information Management (SWIM) that in turn enables the implementation and integration of other ATM System Components.

The implementation horizon of InDeX will see most capabilities necessary for SWIM delivered by 2010 and enable expansion of these capabilities in line with the evolution of ATM components.

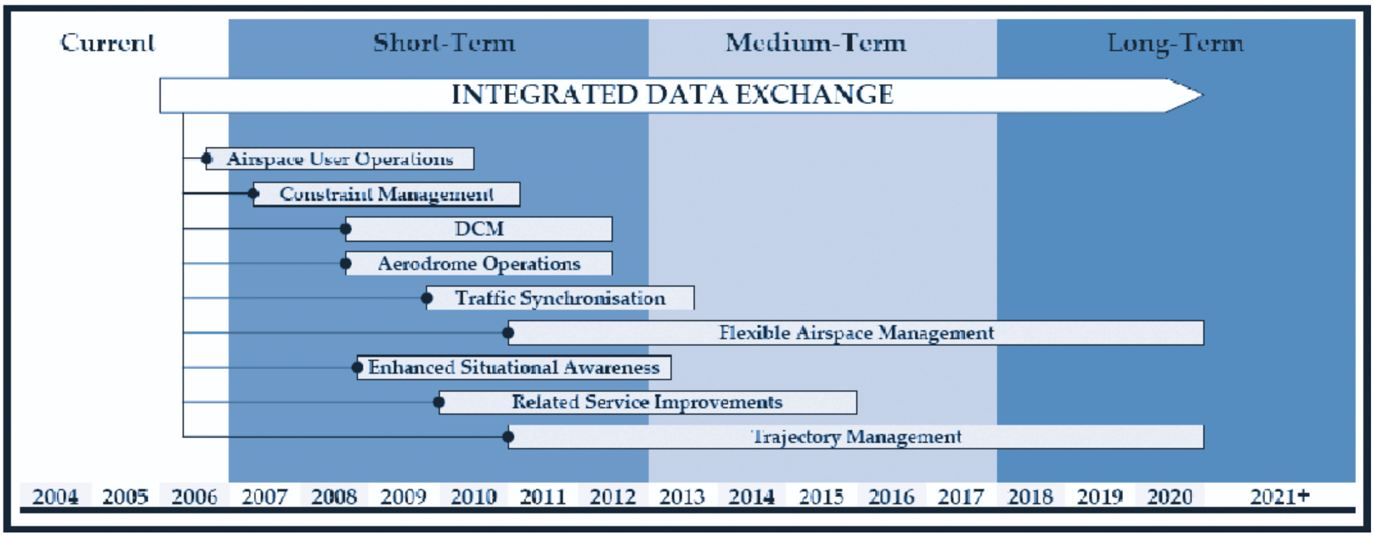

Figure 5: Integrated Data Exchange Evolution

The InDeX capabilities required from each ATM community member's perspective have been categorised into major information exchange groups that include:

- **Capacity:** encompassing the information needs for Demand and Capacity Management and Airspace Organisation and Management
- **Completion and Recovery:** encompassing the information needs for Trajectory Management, Conflict Management and Aerodrome Operations, and
- **Planning:** encompassing the information needs for ATM Service Delivery, Constraint Management and Airspace User Operations.

The InDeX Strategy will be implemented in a phased approach. This will facilitate the development of InDeX capabilities and deliver benefits to stakeholders while ensuring synchronisation with the development of other transition strategies and ATM System Components. Each phase corresponds to the development and implementation of InDeX capabilities to enable specific ATM Components.

The implementation tasks in each phase will develop and obtain industry consensus on:

- the required InDeX operational concepts in relation to the ATM System Component
- stakeholder capabilities required
- progressive realisation of industry benefits
- information standards and protocols
- data exchange capabilities, and
- governance arrangements.

An overview of the InDeX capabilities to be delivered in respect of each ATM System Component is listed in Table 4. Table 5 shows the expected benefits against the ATM Community Expectations and Key Performance Areas.

Table 4: InDeX Integration with Other Strategies

ATM System Component	Progressively Delivered InDeX Capability
Airspace User Operations and Trajectory Management	• To provide a unified method for airspace users to disseminate flight intentions across strategic, pre-tactical and tactical phases of flight. Flight intentions include flight schedules, declarations and confirmations, user preferred trajectories, commercial priorities and variations. • To describe aircraft position and other operational information used by airspace users and service providers to obtain system-wide situational awareness.
Demand & Capacity Management and Constraint Management	• To provide the capabilities of receiving and disseminating information on system constraints (e.g. adverse weather conditions, demand/capacity constraints, facility outage and military airspace availability) from/to airspace users and service providers. • To aggregate and provide strategic and operational information on flight intentions and airspace and aerodrome capacities to determine the demand and capacity balance of the ATM System across all constrained resources and timeframes.
Aerodrome Operations	• To provide information to enable facility allocations (e.g. gates, runways and taxiways) to be made and adjusted to meet flight requirements within constraints across strategic, pre-tactical and tactical timeframes.
Airspace Organisation and Management	• To integrate flight intentions and airspace characteristics (e.g. airspace availability and access constraints) to enable effective and efficient negotiation, allocation and management of airspace resources.

Table 5: InDeX Integrated Benefits

Community Expectation	Expected Benefits of InDeX Implementation
Access and equity	✔ Provide non-discriminatory access to information by all ATM community members, subject to confidentiality, security and safety constraints.
Capacity	✔ Increase overall ATM system capacity and enhance the balancing between capacity and demand by enabling all stakeholders to access accurate flight and situational information to optimise flight planning, facility allocation and terminal services, and improve airways and infrastructure planning.
Efficiency	✔ Promote efficiency within the aviation industry. Efficiency encompasses both the way information is exchanged and used to ensure efficient on-time operations and reduced disruption and congestion. ✔ Enable ATM community members to streamline their internal systems and processes and consolidating external information interfaces.
Cost effectiveness	✔ Improve flight planning decisions to reflect all available situational information impacting on a flight at strategic, pre-tactical and tactical stages thus optimising fuel burn and flight time and reducing associated operational costs.
Environment	✔ Contribute to reduction in greenhouse emissions and noise pollutions due to optimised flight profiles and reduction in holdings and diversions
Predictability	✔ Provide effective information to enable airport capacity and constraints to be reliably predicted for determining demand and capacity and for planning and monitoring aircraft operations.
Safety	✔ Provide timely and accurate information throughout a flight's lifecycle to improve system-wide situational awareness, thus improving safety.
Security	✔ Provision of and access to information by ATM stakeholders will be based on industry-agreed business rules and protocols to protect the security, authority and confidentiality of ATM data and systems.
Global Interoperability	✔ Support the standardisation of aeronautical information management that supports the realisation of a global, seamless ATM system.

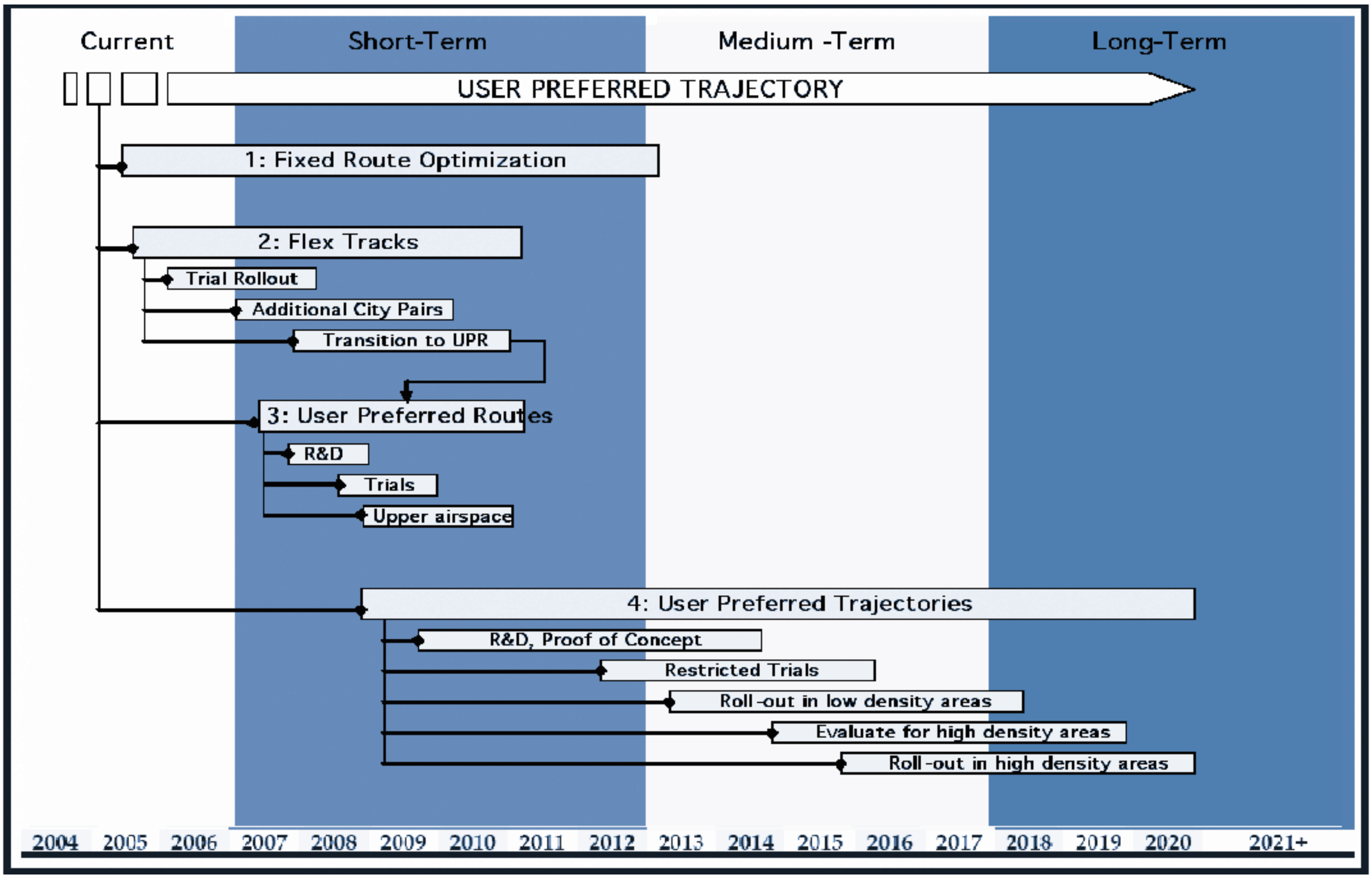

Figure 6: User Preferred Trajectory Evolution

User Preferred Trajectory

User Preferred Trajectory is the primary strategy to achieve the Target Operational Concept. It will enable users to optimise flight trajectories seamlessly within gate-to-gate context in 4D, consistent with their business or individual priorities while taking into account traffic complexity, weather, physical environmental considerations and other system constraints.

The concept of user preferred trajectories implies fundamental paradigm changes to current ATM operational and technical features, thus requiring an evolutionary transition path. A four-stage implementation is planned.

STAGE 1: OPTIMISATION OF FIXED ROUTE STRUCTURES

Fixed route structures will continue to be applied where traffic density necessitates, but these will be progressively optimised. This will enable airspace users to fly more efficient and economic routes less constrained by ground-based navigation aids, which will be progressively rationalised in the short to medium term.

Optimisation of fixed routes will enable airspace users to exploit existing and emerging communications, navigation and surveillance capabilities. Supported by collaborative decision-making, fixed route structures will be optimised to meet changing capacity demands and accommodate traffic flow fluctuations.

STAGE 2: IMPLEMENTATION OF FLEX TRACKS

Flex Tracks are the non-fixed air traffic services routes calculated and promulgated daily by the air navigation service provider to provide the most efficient operational flight conditions between specific city pairs, taking advantage of prevailing wind conditions. The Flex Track will commence and terminate at designated waypoints to allow for transition to the fixed route network for arrivals and departures.

The phased implementation of Flex Tracks will incrementally offer fuel savings and environmental benefits to the ATM community as the building block towards achieving user preferred routes.

STAGE 3: IMPLEMENTATION OF USER PREFERRED ROUTES

User preferred routes are the routes generated and flown by an airspace user that reflect the optimum point-to-point flight path subject to overriding system constraints with links to waypoints from/to structured routes at both ends. They provide further flexibility, efficiency and cost effectiveness to airspace users compared to Flex Tracks that are pre-determined and agreed by a service provider.

Supported by appropriate automation tools for conflict detection, user preferred routes will enable airspace users to meet specific operational/business objectives (e.g. minimum flight time, distance or fuel burn) subject to overriding ATM system constraints. User preferred routes will initially be trialled on a city-pair by city-pair basis in selected airspace.

With the gradual maturity of the operational concept, procedures, air traffic controller automation tool proficiency and enhanced ATC/AOC/flight crew collaboration, user preferred routes will be progressively rolled out. Flex Tracks will be gradually phased out as user preferred routes are fully implemented.

STAGE 4: IMPLEMENTATION OF USER PREFERRED TRAJECTORIES

User preferred trajectories aim to optimise all trajectories in four dimensions, with a complete system perspective from inception until arrival at the destination parking position. This will be supported within a dynamic system environment and a high degree of collaborative decision making among ATM stakeholders.

This final stage of the user preferred trajectory strategy implementation encompasses significant research and development, concept development/design and evolutionary implementation processes whilst synchronising with the development of enabling ATM system components and strategies.

Collaboration with international ATM community members will be a crucial contributor to the success of user preferred trajectories within Australia and ensure global ATM harmonisation.

Table 6: User Preferred Trajectory Integrated Benefits

Community Expectations	Expected Benefit of Implementing User Preferred Trajectory
Access and equity	✔ Four dimensional trajectory knowledge and prediction will support the determination of priority for user preferred trajectories based on the principle of access and equity, taking into account operational/economic preferences while accommodating ATM system constraints and conflicts in demand.
Capacity	✔ Maximise the use of existing airspace capacity and potentially increase airspace capacity to handle more flights safely by accommodating user preferences and minimising undue restrictions on airspace user operations.
Efficiency	✔ Allow users to plan and fly optimal routes, flight levels and speeds consistent with business or individual priorities, thus minimising flight time, mileage and/or fuel consumption.
Cost effectiveness	✔ Enable airspace users to fly more efficient trajectories taking advantage of prevailing weather conditions, thus reducing operating costs (e.g. fuel, aircraft maintenance cost). ✔ Reduce ATC and pilot workload through the support of advanced conflict detection and flight management tools with greater levels of automation.
Environment	✔ Contribute to the reduction in greenhouse emissions from reduced fuel consumption as a result of more efficient flight profiles and reduced aircraft noise through Continuous Descent Approaches.
Flexibility	✔ Enable airspace users to plan and fly optimal trajectories taking advantage of prevailing wind conditions and based on business or individual priorities.
Predictability	✔ Visibility to all elements and activities of the ATM system at strategic, pre-tactical and tactical levels through SWIM and collaborative decision making to enhance predictability of the intent and gate-to-gate evolution of user preferred trajectories.
Safety	✔ Enhance safety features of the ATM system through: - increased spread dispersion of aircraft operations and reduction of "choke-point" traffic load; - increased airspace capacity; - decrease in local traffic density; and - reduced ATC and pilot workload due to automated decision support and communications, navigation, and surveillance advances which enable user preferred trajectories.
Global Interoperability	✔ Harmonise with the ICAO Operational Concept and supports the global vision to achieve an interoperable ATM system for all users during all phases of flight that provides for optimum economic operation and meets acceptable levels of safety, environmental and security performance. ✔ Support the global facilitation and interaction of user preferred trajectories.

Flexible Use Airspace

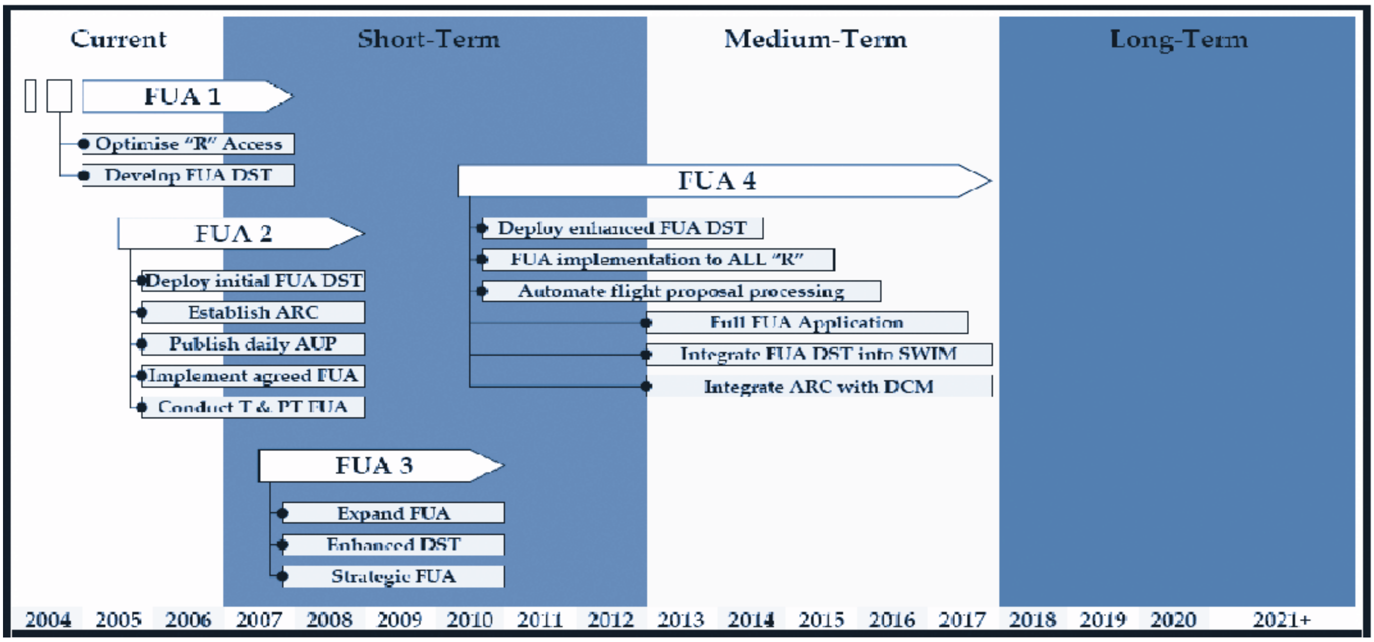

Figure 7: Flexible Use Airspace Evolution

FUA is intended to enable the adaptable and flexible management of airspace providing improved access to restricted airspace as a resource, increased ATM capacity to meet forecast growth in air traffic, support for the transition to user preferred trajectory, and roam-free capability for Australian Defence Force operations. It is anticipated that due to national defence and security requirements, airspace segregation will continue to accommodate different types of airspace activities. FUA will ensure that such restricted airspace segregations will be managed dynamically and restrictions on the use of any particular volume of airspace will be minimised, thereby optimising user access to airspace resources and enhancing airspace capacity.

Implementation of FUA is dependent upon enhanced collaboration between airspace users and managers and a transparent model of airspace planning intent. FUA operating procedures and working practices complemented by appropriate decision support tools will deliver the concept of FUA at three levels:

- strategic level – the long-term, strategic definition and review of national airspace usage and organisation
- pre-tactical level – the day-to-day airspace allocation according to user requirements, and
- tactical level – the real-time allocation/reallocation and usage of airspace resources.

Table 7: Flexible Use Airspace Integrated Benefits

Community Expectation	Expected Benefits of Implementing FUA Strategy
Access and equity	✔ Allow maximum shared use of airspace through airspace users and managers' coordination and cooperation.
Capacity	✔ Enable dynamic and flexible resizing and reshaping of airspace, leading to increases in airspace capacity while minimising undue restrictions on airspace user operations.
Efficiency	✔ Facilitate optimisation of flight trajectories by allowing users to share airspace planning intent well in advance of preparing flight plans as well as providing the dynamic mechanisms for negotiating and adjusting airspace usage in the tactical environment.
Cost effectiveness	✔ Enable airspace users to design more efficient route structures, thus reducing flight time, fuel burn and related operational costs. ✔ Balance national defence and security priorities with civil airspace users' business imperatives.
Environment	✔ Contribute to the reduction in greenhouse emissions from reduced fuel burn as a result of more efficient flight profiles.
Flexibility	✔ Enable airspace users to collaboratively plan and modify flight trajectories and activities at strategic, pre-tactical and tactical phases of flight. ✔ Reduced constraints for UPR/UPTs. ✔ Roam-free capabilities for ADF operators.
Predictability	✔ Provide airspace users and managers with a shared view of airspace planning intent and actual airspace activity and availability through the daily promulgation of Airspace Use Plan (AUP) for agreed access.
Safety	✔ Greater visibility into actual airspace activities, increased dispersion of air traffic load and increased airspace capacity.
Security	✔ Support national security imperatives by providing airspace administering authorities with more detailed knowledge and visibility over airspace user operations at strategic, pre-tactical and tactical levels.
Global Interoperability	✔ Facilitate harmonisation in flexible and dynamic airspace organisation and management in line with global planning.

Demand and Capacity Management

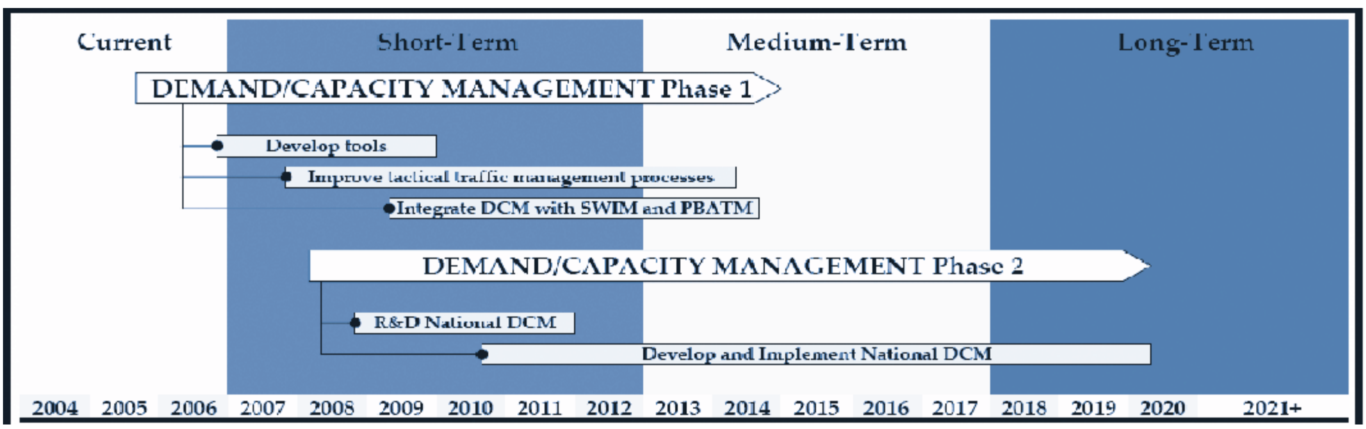

Figure 8: Demand and Capacity Management Evolution

National Demand and Capacity Management aims at maximising the ATM system capacity whilst minimising the effects of constraints to achieve system-wide traffic optimisation. Its application will require:

- optimal balancing of capacity and demand through collaborative planning and management at strategic, pre-tactical and tactical levels, taking into account airspace and aerodrome limitations and uncontrollable events (e.g. adverse weather, ATM system failure, aircraft emergency), and
- traffic synchronisation to ensure the safe, orderly, expeditious and integrated flow of traffic during all phases of flight.

Collaborative decision making (involving civil and military ANSPs, aerodrome operators, air space users, meteorological information provider, etc) supported by SWIM will be a key enabler to achieve optimised demand and capacity management.

Implementation envisages a transition in traffic management from today's emphasis on tactically adjusting demand to fixed capacity towards a more strategic and collaborative approach to managing system-wide resources and capacities to match capacity with, rather than constrain, demand. The nature of tactical flow management will be more dynamic and adaptive to operate to finer capacity and time limits and responsively cope with real-time events.

STAGE 1: SYSTEM-WIDE DEMAND AND CAPACITY MEASUREMENT AND ASSESSMENT

Key activities in this stage include:

a. Develop processes and tools to identify, collect, analyse, validate and distribute demand and capacity data to produce an accurate picture of the system-wide capacity, constraints and demand patterns through all phases of flight. The ATM system capacity will be determined based on all available inputs, including inter alia:
   - airport infrastructure
   - runway configurations and capacity
   - terminal capacity
   - surveillance data
   - weather conditions
   - airspace structure and availability, and
   - service provider (e.g. ANSP, aerodrome operators) capacity and capabilities.

b. Develop methodology and data processing tools for assessing ATM performance in terms of how effectively capacity is utilised to meet demand and identify potential improvement measures.

Note: -The outputs of activities outlined above will pinpoint the key shortcomings in the existing traffic management system (e.g. major bottlenecks in the overall ATM system; trends in delay; diversions; holding) and help identify the causes of capacity and demand imbalance.

c. Progressively improve existing tactical traffic management processes and systems to close the identified performance gaps by:
   - increasing capacity (e.g. through re-sectorisation, improved utilisation of existing runway and taxiway resources), and
   - reducing constraints on demand and delivering more efficient and expeditious traffic synchronisation (e.g. optimisation of SIDs, STARs, implementation of tailored arrivals and continuous descent arrivals) by optimising existing capabilities such as A-SMGCS, LAHSO, PTL, CTMS, airborne and ground CNS capabilities.

STAGE 2: NATIONAL CAPABILITY FOR AIR TRAFFIC DEMAND AND CAPACITY MANAGEMENT

This capability will become a national traffic management 'nerve centre', enabling ANSPs (civil and military), aerodrome operators, airlines, meteorological information providers and other ATM community members to collaboratively manage the demand for and resources of the ATM System. This will in turn lead to the balancing and optimising of the business and operational outcomes of all ATM community members. The national air traffic management capability will:

- facilitate the integration and sharing of system-wide intent and situational information to improve the predictability and balancing of demand and capacity, and
- provide the operational and technical mechanisms for:
  - collaborative flight scheduling
  - aggregating and releasing constraint information (e.g. activation of restricted areas and adverse weather conditions)
  - trajectory negotiations through all phases of flight
  - determination of dynamic system trajectories (i.e. user preferred trajectories modified to accommodate system constraints), and
  - national contingency planning.

Key activities in Stage 2:

a. Research and develop the concept for a national approach to air traffic demand and capacity management linking en-route, terminal area and aerodrome resources, capacity and traffic management processes into a new, integrated function

b. Establish national air traffic demand and capacity management protocols, methodology, procedures, roles/ responsibilities and facilities covering:
   - strategic capacity planning and demand forecasting
   - pre-tactical demand/capacity balancing (e.g. optimised daily airspace and aerodrome capacity plans to enable all parties concerned to fine-tune their activities and resources according to the latest available information), and
   - tactical demand/capacity balancing and traffic synchronisation for optimising air traffic flow from gate to gate.

c. Develop and deploy decision support tools and utilise ground and air systems to support national demand and capacity management.

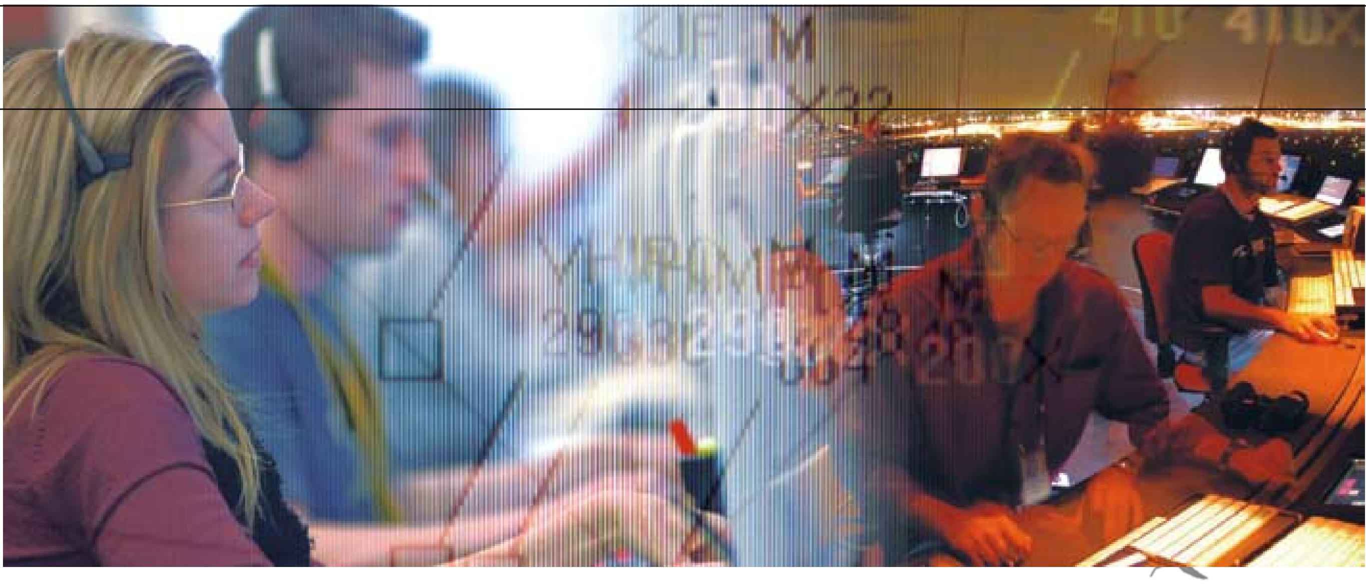

Table 8: National Demand and Capacity Balancing Integrated Benefits

Community Expectation	Expected Benefits of National Demand and Capacity Management
Access and equity	✔ Balance user needs against available capacity and constraints.
Capacity	✔ Improve utilisation of airspace and aerodrome resources and capacities as a result of improved system-wide knowledge of capacity, demand and constraints. ✔ Minimise the effects of constraints through strategic, pre-tactical and tactical collaborative decision making among ATM community members.
Efficiency	✔ Improve flight efficiency and punctuality. ✔ Improve efficiency in: - system-wide resource planning and allocation, - development and maintenance of schedules; and - air traffic flow/movement around/at airports and in en-route areas.
Cost effectiveness	✔ Reduce fuel consumption costs and other operational costs from improved flight efficiency and reduction in demand/capacity-related delays.
Environment	✔ Contribute to reduction in greenhouse emissions and noise pollutions due to a reduction in holdings and diversions.
Flexibility	✔ Optimise demand/capacity balancing and traffic synchronisation to accommodate user requirements that in turn supports maximum operational flexibility by airspace users. ✔ Information-rich and collaborative national traffic management environment allows users to determine preferred mode of operations (e.g. which flight to expedite, which flight to delay and more efficient re-route to cope with real-time traffic conditions and constraints).
Predictability	✔ Collaborative decision making and sharing of system-wide demand/capacity information improves predictability of the decision intent of airspace users and service providers through all phases of flight.
Safety	✔ Protect the ATM System from traffic overload. ✔ Optimised demand and capacity balancing at strategic and pre-tactical levels reduces reliance on tactical intervention. ✔ Improve response to real-time events through better interactions among all community members.

Conflict Management

Conflict management aims at limiting, to an acceptable level, the risk of collision between aircraft and hazards along the aircraft's trajectory. The implementation of the conflict management strategy will:

- effect the transition from today's rigid conformance-based separation standards to more dynamic risk-based conflict management
- reduce the need for tactical separation by focusing more on strategic conflict management which encompasses airspace organisation and management and demand/capacity management, and
- implement new procedures enabled by decision support tools for conflict detection and resolution to:
  – support UPTs by minimising restrictions to user operations, in particular to avoid where possible, tactical changes to trajectories, and
  – redistribute separation roles and responsibilities between ground and air to optimise ATM system efficiency, flexibility and capacity within safety requirements.

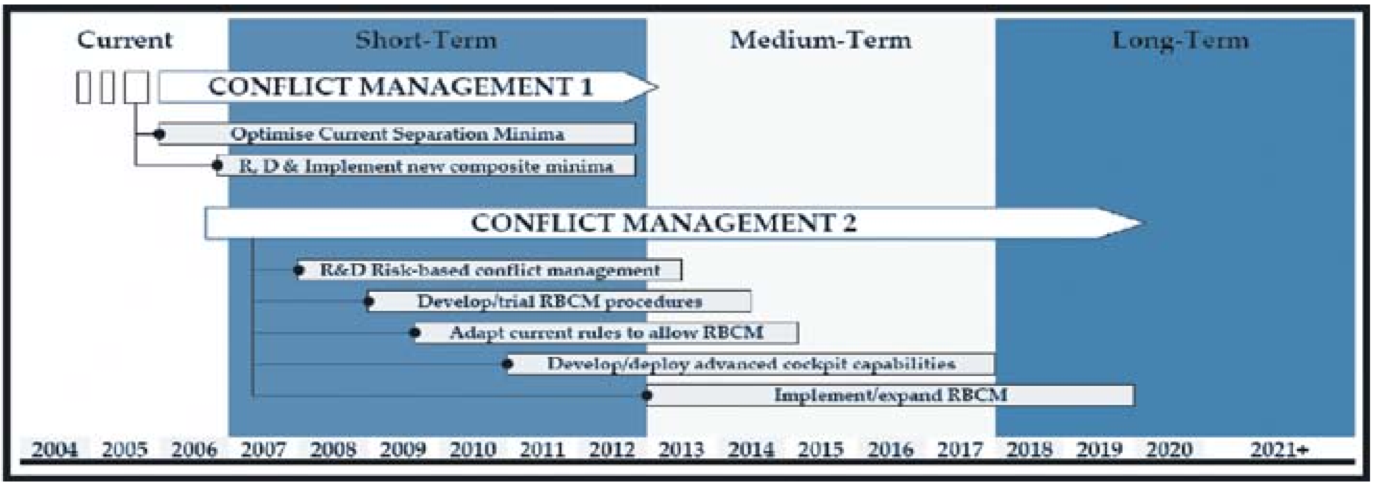

Figure 9: Conflict Management Evolution

STAGE 1: REVIEW AND REFINE CURRENT SEPARATION STANDARDS

The key activities in this stage include:

a. review and optimisation of existing separation standards and procedures utilising:
   - decision support tool(s) for conflict detection
   - improved cockpit situational awareness as a result of advanced airborne and ground-based CNS capabilities
   - improved weather forecasting capabilities, and
   - enhanced airspace organisation and aerodrome configurations.

b. research and development of new separation standards to enable distributed separation, cooperative separation and self-separation in addition to separation service provision. The new standards will utilise aircraft capabilities and ground infrastructure to efficiently and safely achieve required minimum aviation system performance standards without excessive separation buffers. The new standards will also take into consideration ongoing deployment of conflict detection and resolution decision support tools, re-sectorisation and runway configuration changes to support user preferred routes and trajectories.

STAGE 2: R&D AND IMPLEMENTATION OF RISK-BASED CONFLICT MANAGEMENT

This stage aims to develop and implement a new concept of separation based on overall conflict risk between trajectory and hazards to provide maximum flexibility, efficiency and capacity benefits to users. Risk-based conflict management will involve continuous comparisons between aircraft trajectory and hazards to assess, evaluate and mitigate conflict risks using system-wide information shared among all relevant parties through air-air, air-ground and ground-ground communications. This new paradigm, in contrast to traditional static 3-D quantum spacing of aircraft, will require sophisticated conflict risk calculation algorithms and modelling as well as more integrated, dynamic and real-time communications, information sharing and collaborative decision making among air traffic controllers, flight crew and airline operations centre. There will also be an increased emphasis on strategic conflict management through demand/capacity management and airspace management and organisation to prevent conflicts and reduce tactical separation workload.

Table 9: Conflict Management Integrated Benefits

Community Expectation		Expected Benefits of Conflict Management
Capacity	4	Improve airspace and runway capacity as a result of reduced separation requirements.
Efficiency, flexibility and cost effectiveness	4	Reduced separation minima support more efficient and economic airspace user operations (e.g. flight level optimisation, reduced flight time and fuel consumption).
	4	Increased focus on strategic conflict management reduces the probability of conflict risk, thus minimising in-flight route changes and associated flight time and fuel penalties.
Environment	4	Environmental benefits from reduced fuel burn due to more efficient and economic flight trajectories.
Predictability and safety	4	System-wide sharing of aircraft-derived and ground-system-generated data on flight intent and position, traffic, constraint and airspace/aerodrome capacity provides improved intent and situation predictability that in turn reduces tactical interventions and improves safety.

ATM System Performance Framework

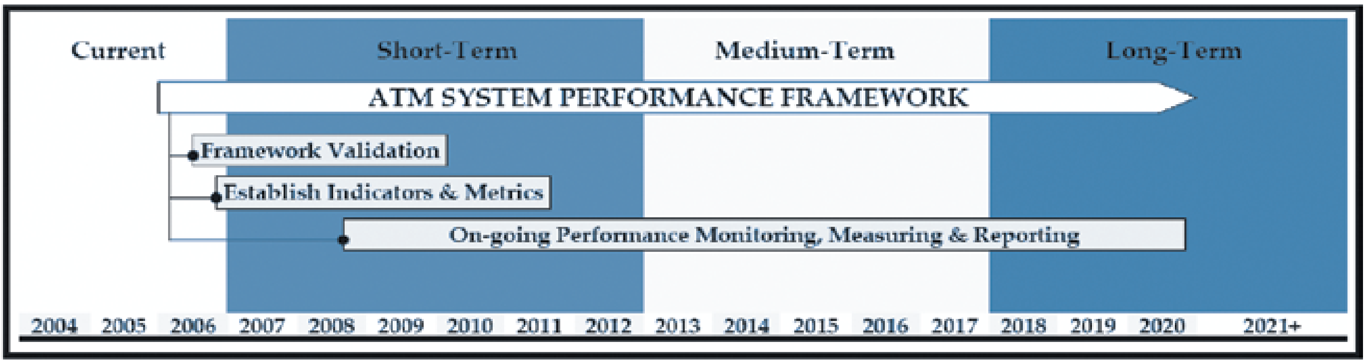

Figure 10: ATM Performance Framework Evolution

According to ICAO[8], the objectives of a performance framework are to "…establish and measure performance outcomes in order to:

- design, develop, operate and maintain a system that can meet the expectations of its users
- determine that the [ATM] system is operating in accordance with its design, and
- determine when and where action is to be taken to enhance performance levels when the [ATM] system is not meeting, or is predicted not to meet, expectations…"

An integrated performance framework sets the foundation for implementing common sense solutions aimed at mitigating, or eliminating, performance gaps, and providing a starting point to guide the actions of affected ATM community members in the right direction [i.e. towards satisfaction of expectations and continuous performance improvement].

STAGE 1: FRAMEWORK VALIDATION

Stage 1 of the ATM System Performance Framework strategy will involve the validation and population of steps 1 to 3 of the framework described in the ATM Strategic Plan and illustrated in figure 11 below. This will involve cross-stakeholder coordination and survey to establish generic performance areas and objectives. This will also be integrated with ICAO developments and global best practice to establish a basis on which to benchmark Australian ATM system performance against the rest of the world.

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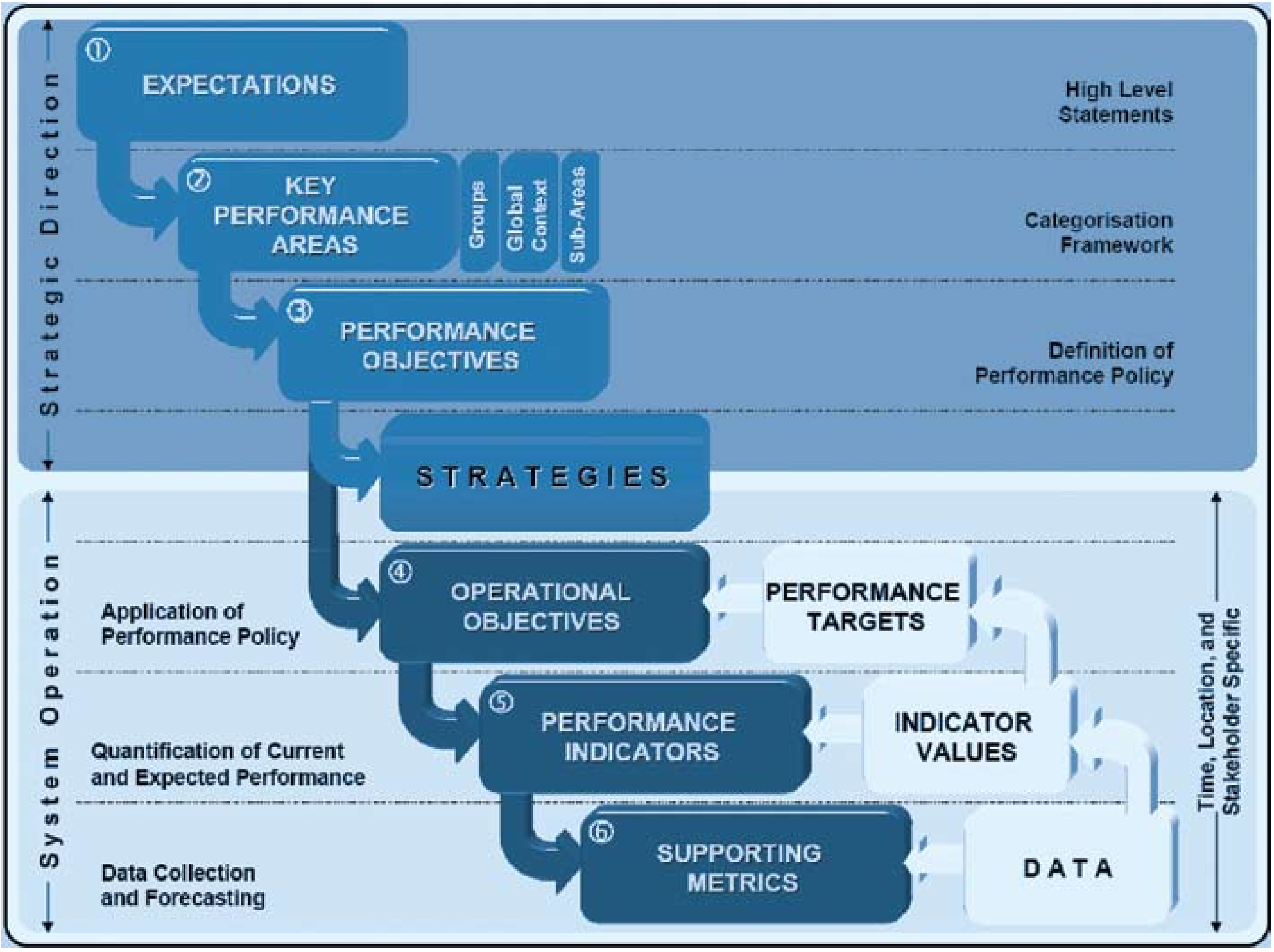

Figure 11: Performance Framework

STAGE 2: ESTABLISHMENT OF INDICATORS AND METRICS

Stage 2 of the ATM System Performance Framework involves the determination, testing, validation and implementation of performance indicators and metrics as shown in steps 4, 5 and 6 of Figure 11. Some of the indicators and metrics developed will be applicable across the entire ATM system; however, many more will be time, location, or stakeholder specific. All indicators and metrics will be developed in accordance with common principles established by ASTRA and agreed by the stakeholders. Data and information requirements for system monitoring will be coordinated through the InDeX strategy.

STAGE 3: PERFORMANCE MONITORING, MEASURING AND REPORTING

Stage 3 of the strategy will see the ongoing operation of the ATM performance framework in support of performance based ATM. This will involve using performance cases to establish performance based justification for ATM system change and enhancement.

Table 10: ATM System Performance Framework Integrated Benefits

Community Expectation	Expected Benefits of National Demand and Capacity Management
Access and equity	• Measurement of past and current performance is prerequisite to the improvement of future performance. • Holistic treatment of performance is prerequisite to understanding trade-offs and externalities. • Performance Cases provide a focus for coordination and justification.
Capacity	
Efficiency	
Cost effectiveness	
Environment	
Flexibility	
Predictability	
Safety	
Security	
Global interoperability	

ATM Infrastructure

The capabilities of the infrastructure supporting the delivery of services from the ATM system – in particular those relating to communication, navigation, and surveillance[9] – and its development, is an essential pre-requisite for the introduction of any new ATM initiative.

The ATM infrastructure strategy is intended to coordinate the future development, procurement and implementation of technical and technological infrastructure systems across government, industry and the wider ATM community. It sets out the agreed strategic direction of the stakeholders and is subject to on-going review. The nature of technological development makes it impractical to attempt to prescriptively define the technological base or implementation schedule for infrastructure facilities much beyond 15 years.

The ATM infrastructure strategy covers the civil and joint civil-military communication, navigation and surveillance systems and capabilities used in Australian territory, in airspace administered by Australia and onboard Australian aircraft. It does not cover systems that are used exclusively for military purposes except where legacy systems are retained for specific military or national interest purposes. However, it is expected that, as the strategies evolve, the number of purely military systems will be reduced to the minimum set required for specific national interest purposes and that military and civil infrastructure will be merged to the maximum extent possible.

The specific objectives of this strategy are to:

- identify the communications, navigation and surveillance infrastructure required to ensure a safe, economic and efficient ATM system that accommodates demand, is globally interoperable, environmentally sustainable and satisfies national interests including defence and security
- provide ATM stakeholders with timely notification of expected changes to ATM infrastructure
- provide guidance in the selection and introduction of new ground and airborne infrastructure systems, and
- provide guidance in the retention or removal of existing infrastructure systems or capabilities.

Supporting the objectives, high-level operational goals[10] have been identified. Specifically, the infrastructure must:

- Allow aircraft to operate within Australian airspace, at least to that level of individual system performance possible at the planning baseline[11]
- Be capable of providing communication, navigation and surveillance services and capabilities such that present levels of safety are maintained or exceeded
- Enable operations at lesser individual system performance to those operators defined by CASA, Airservices Australia or other authority, and
- Harmonise operations through integration of systems and regional communication, navigation and surveillance infrastructure.

9 – The capabilities provided by communications, navigation and surveillance have been referred to as CNS capabilities, and the acronym CNS has frequently been used in advance of ATM as CNS/ATM, implying some hierarchical dominance of infrastructure over ATM outcome. In this OED, communications, navigation and surveillance are recognised as dominant capabilities in a suite of enabling capabilities; however, it also recognises the blurring of traditional lines of division between communication, navigation and surveillance. In this context, the OED eschews the use of the acronym CNS, and instead refers to ATM Infrastructure.

10 – Developed by ASTRA through the ATM Strategic Planning Framework and its working groups

11 – The planning baseline in this instance is January 2006.

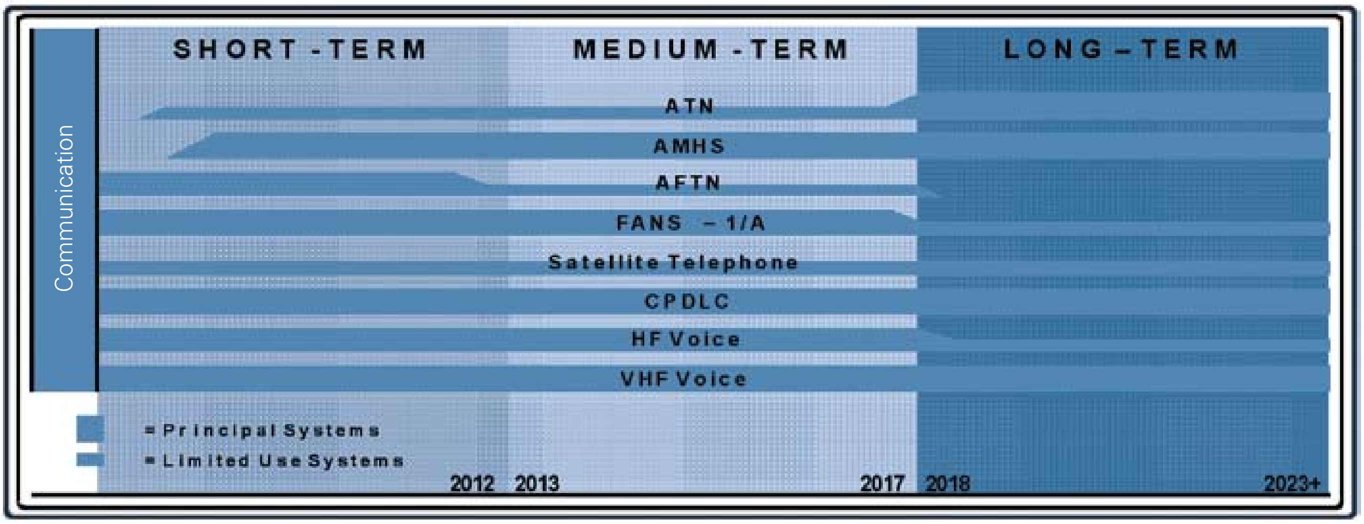

Figure 12: Communication Infrastructure Evolution

COMMUNICATION

Specific operational goals relating to communication have also been identified. The infrastructure must:

- provide aeronautical information to all airspace users
- be capable of supporting future Air Traffic Services (ATS) by:
  - providing clear, timely air-air and air-ground voice communications with coverage commensurate with the operations conducted in the area, and
  - meeting en-route terminal and specialist communication requirements, such as long haul flexible routes and Precision Runway Monitoring (PRM) operations, and
- be capable of supporting non-ATS communication services such as:
  - dissemination of operational information i.e. meteorological information
  - air-air communications outside controlled airspace
  - Unicom and company communication, and
  - Airport services – fuel etc.

The ATM community expects that the functional needs for communication services will continue over the next fifteen years without significant change. Hence, changes to voice communication infrastructure will be predominantly associated with equipment replenishment, modernisation and service improvements. The utilisation of data-link techniques will grow rapidly enabling improvements to existing air/ground communications, supporting new surveillance services and progressing towards the more fully integrated communication capabilities proposed under the ATN.

Voice communications will continue to be predominately based on VHF in continental airspace utilising 25 kHz channel spacing to accommodate traffic density. HF voice will continue to be used in areas outside VHF voice coverage. Air/ground traffic will progressively move from voice services to data-link communications such as CPDLC and PDC. AMHS and ATN data link communication services will be introduced to eventually replace the existing FANS-1/A and AFTN systems. Integration of data services towards SWIM will require suitable data communication services.

NAVIGATION

Specific operational goals relating to navigation have also been identified. The infrastructure must:

- be capable of supporting en-route and terminal area navigation requirements
- be capable of providing approach navigation guidance to non-precision minima at any location within Australian airspace and dependent Australian territories, and
- be capable of providing or supporting approach navigation guidance to precision minima at any major aerodrome within Australian airspace and dependent Australian territories.

The ATM community expects that, while functional requirements for navigation will continue largely unchanged, the infrastructure required for its support will undergo significant change over the next fifteen years. The conclusions of studies undertaken by ASTRA on the future direction for navigation infrastructure were:

- current infrastructure does not satisfy future requirements
- the current system is not easily upgradeable to meet future requirements
- no single system fully meets all requirements
- scenarios based on GPS in combination with other systems provided the most favourable cost-benefit and risk outcomes.

The plan for the development of navigation infrastructure outlined in the OED is aligned with the Government's GNSS policy. In ten to fifteen years the Australian navigation infrastructure will be based upon GNSS, Inertial and the ILS navigation systems, with a backup network of terrestrial navaids to meet contingency requirements. This approach is consistent with ICAO plans for the Asia Pacific Region and will ensure global and regional harmonisation.

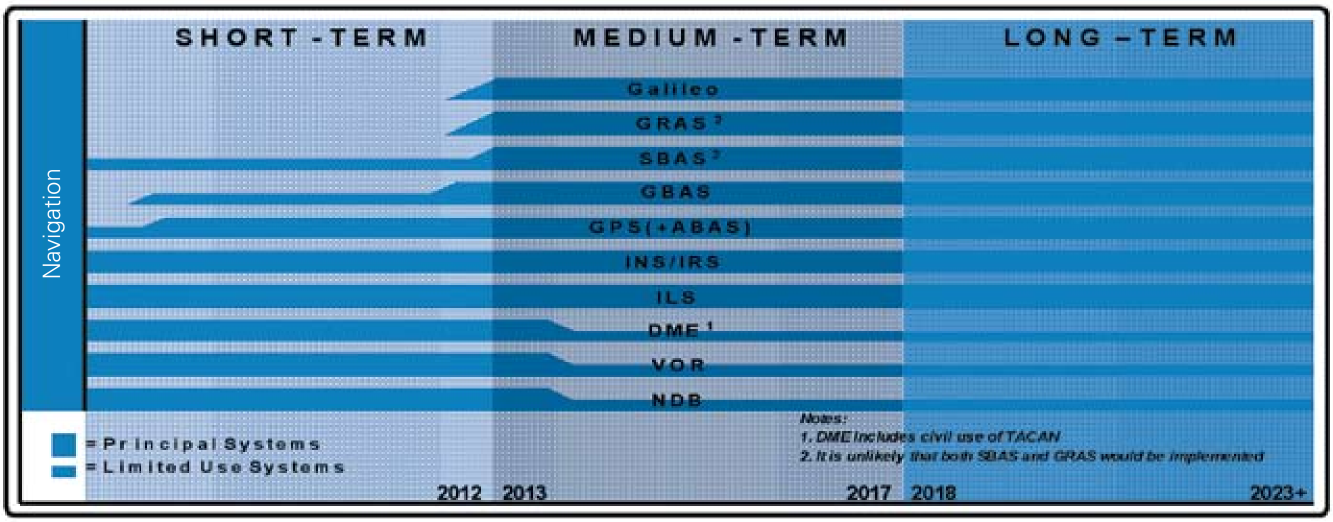

Figure 13: Navigation Infrastructure Evolution

SURVEILLANCE

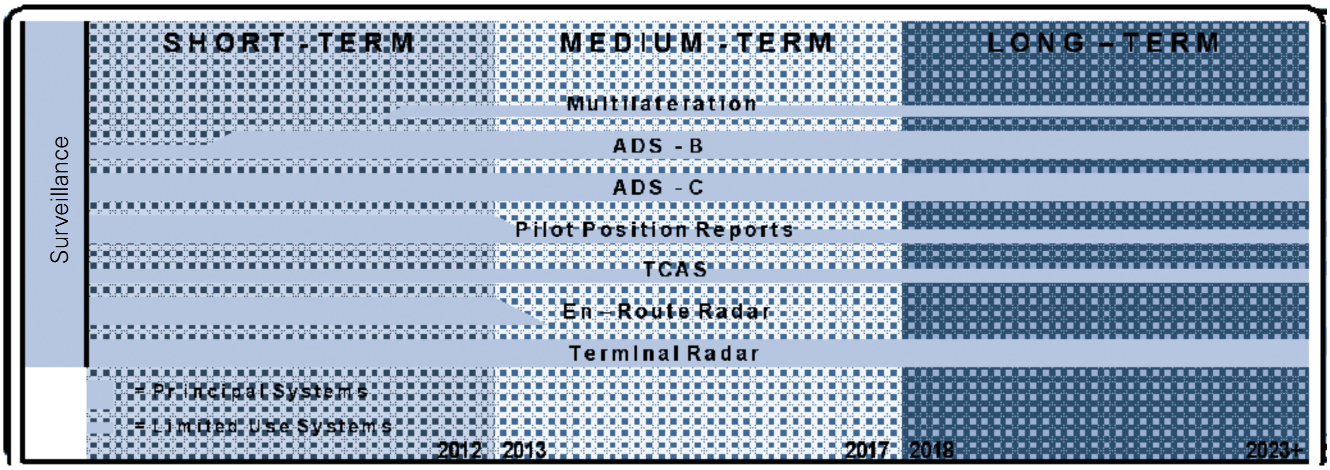

Figure 14: Surveillance Infrastructure Evolution

Specific operational goals relating to surveillance have also been identified. The infrastructure must:

- be capable of supporting air traffic services throughout Australian airspace
- be capable of providing ground-based independent surveillance at designated controlled aerodromes
- be capable of providing or supporting ground-based automatic dependent surveillance at major aerodromes and in controlled airspace throughout Australian airspace
- be capable of supporting airborne automatic dependent surveillance throughout Australian airspace, and
- be capable of integration with national defence and security agencies.

ASTRA has commenced preparation of a cross-industry business case and cost-benefit analysis of the implications of widespread ADS-B surveillance in Australia. While indications are that implementation will be cost-beneficial, equity issues will require consideration in decisions regarding the funding of mandatory fitment.

In the next fifteen years there will be an increase in the use of automatic surveillance techniques and a corresponding decline in pilot position reports. Both primary and secondary surveillance radar will continue to be used in busy terminal environments and Mode S capability will be a feature of the future ground-based surveillance infrastructure. ADS-C will remain a core component of Australia's oceanic surveillance infrastructure. ADS-B will be used widely to provide both ground and airborne surveillance and its introduction will enable the introduction of significant changes to ATM in Australia. Emerging multilateration techniques will potentially offer new approaches to surveillance requirements.

4. achieving the operational improvements

The implementation maps in Chapter 3 are ATM System maps – they show the operational improvements that need to be made across the ATM system to realise the ATM strategies. They are also focussed across the short and medium terms to show the evolutionary path for each strategy and for the strategies as a whole.

This chapter breaks the operational improvements down across stakeholder groups, identifying the main activity or improvements for which each stakeholder will be responsible. It also focuses on the short-term improvements, allowing the stakeholders to develop their individual implementation roadmaps, and allowing the change management process maps to be constructed.

The tables in the following pages are in matrices, showing on one axis the strategy and, where applicable, the sub-strategy or stages, and on the other axis, the relevant stakeholder group. The tasks listed are those required by each stakeholder to achieve the strategy or sub-strategy.

The tables also include a cross-reference or inter-dependency chart showing which other strategies are linked to the referenced activity or improvement grouping.

Bundled together within the table and across the strategies the tasks form an Operational Improvement Group or OIG.

USER PREFERRED TRAJECTORY [UPT]- SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	Policy and Regulation – CASA/ OAM/ Defence/ DOTARS	ANSP's – Airservices/ Defence	Airspace Users – Airlines/ Regional/ GA/ Defence	Aerodrome Operators	Support – BoM/ AMSA	2	3	4	5	6	7
Fixed	• Refine RNP regulation/policy • Refine regulation/policy to reflect navigation infrastructure rationalisation	• Implement East Coast, Upper Airspace and Regional Service Delivery Environment • Navigation infrastructure rationalisation • Implement of fixed route optimisation program	• Utilise optimised fixed routes in planning and operating more efficient/economic flights	• Navigation infrastructure rationalisation	• N/A						✓
Flex Tracks	• N/A (MATS and AIP currently cover Flex Tracks, thus no change to existing regulatory requirements)	• Implement Flex Track Management System • Trial Flex Tracks • Flex Tracks expansion • International coordination • Operational enhancement to maximise benefits to airlines	• Cooperate in the design of Flex Tracks (advising agreed airline parameters) • Utilise Flex Tracks in planning and operating more efficient flights	• N/A	• Optimise existing weather forecasting		✓			✓	
UPR	• Refine RNP and RNAV standards and issue related policy/regulation changes to be applied in User Preferred Service Delivery Environment • AIP changes to support UPRs	• Implement conflict detection DST to support UPRs • Trial UPRs in agreed airspace • UPR expansion across User Preferred Service Delivery Environment • Implement RNP and emerging CNS infrastructure • Refine airways clearance delivery format and flight notification methodology for UPRs • Enhance collaborative decision making • International consultation and collaboration (concept harmonisation and system interoperability)	• Identify needs • Utilise RNP 4 Capability • Enhance flight planning/FMS • Enhance collaborative decision making • Adapt to refined airways delivery format and flight notification methodology for UPRs • Enhance airborne CNS capabilities to support conflict-free UPR operations.	• N/A	• Enhance forecasting capability • Publish more timely and quality weather information shared on a system-wide basis through SWIM to support the planning and execution of UPRs	✓	✓	✓	✓	✓	

UPT	• ASAS Trial
	• UPT research
		• UPT Research:
		  • UPT definition
		  • Specification of constraints
		  • Trajectory Prediction (incl. trajectory ownership protocols)
		  • High-level conceptual blueprint of the future ATM system in support of UPTs
		  • Conflict detection and resolution DSTs and other ATFM DSTs to support UPTs
		  • Interdependent ATM system components & strategies
		• International consultation and collaboration (concept harmonisation and system interoperability)
		• UPT concept modelling and simulation (desktop modelling and real-time data collection and evaluation)
			• ASAS trial
			• UPT Research
			• Provide AOC data to facilitate TP research
			• Research flight planning/FMS and flight deck capabilities required to implement UPTs
				• UPT Research
				• Research & analyse aerodrome infrastructure and departure/arrival procedural change requirements to support UPTs in gate-to-gate context
					• UPT Research
					• Research of further enhancement to weather forecasting & reporting capabilities.
						✓	✓	✓	✓	✓	✓

NATIONAL DEMAND AND CAPACITY MANAGEMENT STRATEGY - SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	**Policy and Regulation CASA/ OAM/ Defence/ DOTARS**	**ANSP's – Airservices/ Defence**	**Airspace Users – Airlines/ Regional/ GA/ Defence**	**Aerodrome Operators**	**Support – BoM/ AMSA**	1	2	3	5	6	7
Performance assessment and optimisation of existing capabilities	• ATM operational performance analysis	• ATM operational performance analysis. • Improve existing traffic management processes by optimising existing capabilities (e.g. CTMS, DMAN, ADS-B, integrated arrival and departure management, tailored arrivals, optimised SIDs, STARs, CDAs) • Improve flight plan processing capabilities.	• Integrate flight plan data with ANSP and aerodrome operators' systems. • Introduce new procedures/standards to utilise improved aerodrome configurations.	• Aerodrome operational performance analysis. • Improve aerodrome configurations (e.g. increase runway width, double storey aerobridges, increase runway to taxiway clearances, parallel runways, multiple configuration parking bays) to make better use of existing resources and increase aerodrome capacity. • Implement and optimise existing systems (e.g. A-SMGCS, multilateration, LAHSO).	• Weather trend analysis. • Improve weather forecasting and reporting capabilities. • Integrate weather data within InDeX.				✓	✓	
National air traffic management Capability implementation	• Develop, in conjunction with Service Providers and Users, the policies and regulations for the operation and use of the national air traffic management facility	• Research and develop, in conjunction with Users and other Service Providers, the concept for a national approach to air traffic demand and capacity management. • Develop, in conjunction with Users and other Service Providers, the operational and technical requirements for national demand/capacity balancing and traffic synchronisation (including protocols, methodology, procedures for collaborative scheduling, trajectory negotiation, promulgation of constraint data and determination of dynamic system trajectories).	• Research and develop, in conjunction with Service Providers, the concept for a national approach to air traffic demand and capacity management. • Develop, in conjunction with Service Providers, the operational and technical requirements for national demand/capacity balancing and traffic synchronisation (including protocols, methodology, procedures for collaborative scheduling, trajectory negotiation, promulgation of constraint data and determination of dynamic system trajectories).	• Research and develop, in conjunction with Users and other Service Providers, the concept for a national approach to air traffic demand and capacity management. • Develop, in conjunction with Users and other Service Providers, the operational and technical requirements for national demand/capacity balancing and traffic synchronisation (including protocols, methodology, procedures for collaborative scheduling, trajectory negotiation, promulgation of constraint data and determination of dynamic system trajectories).	• Research and develop, in conjunction with Users and other Service Providers, the concept for a national approach to air traffic demand and capacity management. • Develop, in conjunction with Users and other Service Providers, the operational and technical requirements for national demand/capacity balancing and traffic synchronisation (including protocols, methodology, procedures for collaborative scheduling, trajectory negotiation, promulgation of constraint data and determination of dynamic system trajectories).				✓	✓	

FLEXIBLE USE OF AIRSPACE STRATEGY - SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	Policy and Regulation CASA/ OAM/ Defence/ DOTARS	ANSP's – Airservices/ Defence	Airspace Users – Airlines/ Regional/ GA/ Defence	Aerodrome Operators	Support – BoM/ AMSA	1	2	3	5	6	7
N/A	• Analyse needs for policy/regulation changes to support more efficient airspace organisation and management. • Set policies/regulations for the implementation of Special Use Airspace (SUA). • FUA in the current operational environment is conducted in the tactical phase of flight on an ad-hoc, flight-by-flight basis. Enhancement to FUA does not envisage any changes to existing regulatory regulations, requirements or policies regarding airspace management.	• Optimise access to existing agreed Restricted Areas. • Enhance civil/military collaborative decision making in airspace management facilitated by SWIM. • Develop, deploy and progressively enhance FUA DST (AirRes). • Establish Airspace Reservation Cell (ARC), if necessary, and gradually introduce automation of flight data processing. • Develop and promulgate Airspace Use Plans (AUPs). • Progressively introduce FUA across all agreed Restricted Areas in strategic, pre-tactical and • Incorporate FUA into SWIM and integrate ARC with Demand/Capacity Management.	• Interface with FUA DST (AirRes) and utilise AUPs to optimise access to Restricted Areas and take advantage of FUA in planning flexible and efficient flight profiles. • Utilise FUA information and share AOC data with ANSPs via SWIM to obtain timely knowledge of airspace allocation and usage. • Where beneficial, analyse needs for and implement enhancement to flight planning systems.	• Not Applicable.	• Not Applicable.	✓	✓	✓	✓		

INTEGRATED DATA EXCHANGE - SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	Policy and Regulation CASA/ OAM/ Defence/ DOTARS	ANSP's – Airservices/ Defence	Airspace Users – Airlines/ Regional/ GA/ Defence	Aerodrome Operators	Support – BoM/ AMSA	1	2	3	5	6	7
Capacity		• Demand capacity information available across stages of flight for major constrained resources e.g. TMA	• Airspace reservations reflected in flight intentions	• Constraints impacting demand capacity balance available to users	• Impacting weather associated with a flight operation	✓	✓	✓	✓	✓	✓
Completion And Recovery		• UPT evaluated against known constraints and conflicts e.g. weather	• UPT provided as part of flight intention	• Information available to support sequencing of departures and arrivals and resource usage	• Impacting weather associated with aerodrome operation	✓	✓	✓	✓	✓	✓
Planning		• Situational information integrated and associated with flight intentions	• Flight intentions made available to support SWIM			✓	✓	✓	✓	✓	✓

ATM SYSTEM PERFORMANCE FRAMEWORK - SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	Policy and Regulation CASA/ OAM/ Defence/ DOTARS	ANSPs – Airservices/ Defence	Airspace Users – Airlines/ Regional/ GA/ Defence	Aerodrome Operators	Support – BoM/AMSA	1	2	3	5	6	7
N/A	• Develop and implement Required Total System Performance RTSP, associated performance indicators and data collection requirements including automation and transfer protocols.	• Develop and implement Required Total System Performance RTSP, associated performance indicators and data collection requirements including automation and transfer protocols.	• Develop and implement Required Total System Performance RTSP, associated performance indicators and data collection requirements including automation and transfer protocols.	• Develop and implement Required Total System Performance RTSP, associated performance indicators and data collection requirements including automation and transfer protocols.	• Develop and implement Required Total System Performance RTSP, associated performance indicators and data collection requirements including automation and transfer protocols.	✓	✓	✓	✓	✓	✓

CONFLICT MANAGEMENT - SHORT TERM

	Stakeholders					Strategy Interdependencies					
Stages	Policy and Regulation CASA/ OAM/ Defence/ DOTARS	ANSP's – Airservices/ Defence	Airspace Users – Airlines/ Regional/ GA/ Defence	Aerodrome Operators	Support – BoM/ AMSA	1	3	4	5	6	7
Review, refine existing separation standards and introduce new separation standards	• Approval of new composite and non-composite separation standards.	• Develop and implement new composite and non-composite separation standards • Conduct/participate in ASAS trials. • Reduce en-route and runway separation standards, making use of existing CNS and conflict detection capabilities to ensure that minimum aviation system performance standards (RNPs, RSPs and RCPs) are achieved without excessive separation requirements. • Research and develop new separation standards to enable distributed, cooperative and self separations in addition to separation service provision.	• Conduct/participate in ASAS trials. • Upgrade avionics equipage, where proven beneficial, of CDTI, ADS-B, ASAS, CPDLC to enhance and situational awareness (position and intent) and support airborne separations. • Develop and implement procedures and processes for equipped aircraft to conduct airborne separation under defined circumstances.	• Improve aerodrome configurations to support reduced runway separation minima. • Implement/utilise aerodrome infrastructure (e.g. A-SMGCS) to improve ground situational awareness.	• Improve weather forecast and reporting capabilities. • Integrate weather data within InDeX.	✓		✓	✓		✓
Transition to risk-based conflict management	• Research and develop, in conjunction with Service Providers and Users, risk-based conflict management concept	• Research and develop, in conjunction with other Service Providers and Users, risk-based conflict management concept.	• Research and develop, in conjunction with Service Providers risk-based conflict management concept	• Research and develop, in conjunction with other Service Providers and Users, risk-based conflict management concept	• N/A	✓		✓	✓		✓

5. linkages to stakeholder plans

The Australian ATM Strategic Plan and the Concept of Operations provide a 'whole of ATM system' view of the evolution of the Australian air traffic management environment. Each contributing stakeholder has either provided an upward input to the documents from their own individual organisations strategic plans or will incorporate the information into their organisational plans. This section provides a link to the individual stakeholder plans, strategies, Concepts of Operation, Concepts of Use, roadmaps or other relevant documents.

DEFENCE

The 2006-16 *Defence Capability Plan: Public Version* represents Defence's capability needs for the next 10 years. It builds on the Government's commitment to keep industry abreast of Defence's acquisition planning so that it can effectively perform its role as a crucial component of our national Defence capability.

The Defence Capability Plan identifies the major capability needs of the Australian Defence Force. It allows a greater range of options and flexibility to consider the total capability effort outcome rather than a platform centric approach. Providing a public version of the Defence Capability Plan to Australian industry is a key part of ensuring that the Australian Defence Force will continue to have the major equipment and systems it needs.

The 2006-16 *Defence Capability Plan: Public Version* can be accessed at: http://www.defence.gov.au/dmo/id/dcp/dcp.cfm

DEPARTMENT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT AND LOCAL GOVERNMENT

The Department's Aviation and Airports Division advises the Government on the policy and regulatory framework for Australian airports and the aviation industry. It also manages the continuing relationship between the Government and the Civil Aviation Safety Authority, Airservices Australia, Australia's airlines and other aviation stakeholders. In addition, it manages Australia's participation in the work of the International Civil Aviation Organization and provides the secretariat for the International Air Services Commission.

The Department's website is at: http://www.infrastructure.gov.au.

CASA

The Civil Aviation Safety Authority (CASA) was established on 6 July 1995 as an independent statutory authority. Under Section 8 of the, Civil Aviation Act 1988, CASA is a body corporate separate from the Commonwealth. CASA's primary function is to conduct the safety regulation of civil air operations in Australia and the operation of Australian aircraft overseas.

CASA's Corporate Plan contains the guiding principles overlying its strategic approach and covers the intended means of achieving its ongoing program. It is designed to ensure that CASA is best able to meet public expectations about aviation safety and to ensure that CASA is best positioned to most effectively and efficiently contribute to managing aviation safety risks.

The Corporate Plan represents CASA's latest thinking on future directions. It draws from lessons learned, it fine tunes the regulator's approach to ongoing programs. It makes allowance for changes in what is a dynamic aviation environment and it incorporates new thinking and initiatives.

The *CASA Corporate Plan 2006-07 to 2008-09* can be accessed at: http://www.casa.gov.au/corporat/corpplan/index.htm

AIRSERVICES AUSTRALIA

Airservices Australia is an independent statutory authority established under the Air Services Act 1995. Airservices Australia was established for the prime purpose of providing, inter alia, in Australian-administered airspace:

- air traffic services
- an aeronautical information service
- an aeronautical radio navigation service
- an aeronautical telecommunications service, and
- aviation rescue and fire fighting services.

Airservices Australia is a body corporate separate to the Commonwealth.

Airservices Australia's Corporate Plan sets out the strategic direction for Airservices Australia and the initiatives that will be adopted to implement that direction.

The *Airservices Australia Corporate Plan 2006 to 2011* can be accessed at: http://www.airservicesaustralia.com/media/default.asp

ASAC

The Australian Sport Aviation Confederation (ASAC) is a national confederation of sport and recreational aviation organisations. ASAC is Australia's representative on the Federation Aeronautique Internationale.

ASAC's mission is to foster, promote and encourage safe, enjoyable and unrestricted sport and recreational flying. Its members include the Australian Aerobatic Club, the Australian Ballooning Federation, the Australian Parachute Federation, the Gliding Federation of Australia, the Hang Gliding Federation of Australia, and the Model Aeronautical Association of Australia.

ASAC notes that Australia is fortunate in having the space to provide for the needs of the air transport industry and to foster the development of GA and Sport and Recreational Aviation. ASAC endorses the Australian ATM Strategic Plan, noting the need for implementation on a risk management and cost benefit basis, and targeting those areas of identified capacity limitation first. A strategic view of ATM issues for sport and recreational aviation can be accessed at http://www.asac.asn.au.

appendix a:
reconciling the icao global plan and the strategies

The strategies are the key enablers of ATM system change that will achieve the TOC. They have been developed to convert the expectations of the future ATM system into reality. The individual strategies are linked in support of a total system approach to ATM evolution that takes mutual influences into account and are not intended to be progressed in isolation. Just as the strategies influence each other, so too will they affect achievement of different ATM community expectations (performance outcomes) to a greater or lesser extent.

The ICAO Global Air Navigation Plan for CNS/ATM Systems (Doc 9750) (known as the Global Plan) was amended by ICAO in 2006. The amended version contains a series of evolutionary Global Plan Initiatives [GPIs] aimed at achieving global realisation of the ICAO Global ATM Operational Concept by the year 2025. According to ICAO[12], "…the GPIs are options for ATM improvements that, when implemented, would result in direct performance enhancement. States and regions would choose initiatives that meet performance objectives, identified through an analytical process, specific to the particular needs of a State, region, homogeneous ATM area, or major traffic flows…".

The Australian ATM strategic planning process is entirely consistent with this philosophy and it is useful to identify the 'stronger' links that each GPI has with one or more of the Australian strategies. This is because it helps to identify the system objectives of each strategy (i.e. the expected system enhancement). The following table shows the linkage between the ICAO GPIs and the strategies developed for Australia. This integration of strategies, system outcome and performance outcome is detailed in the Operational Evolution Document and in each of the various ATM community member implementation roadmaps.

ICAO Global Plan Initiative[13]		Links to Australian Strategy	OED Completion Period
GPI-1	Flexible use of airspace	Flexible Use Airspace	Short-Term and Medium-Term
GPI-2	Reduced vertical separation minima	User Preferred Trajectory	**Completed**
GPI-3	Harmonize level systems	User Preferred Trajectory	**Completed**
GPI-4	Align upper airspace classifications	User Preferred Trajectory	**Completed**
GPI-5	Performance-based navigation	ATM Infrastructure	Short-Term and Medium-Term
GPI-6	Air traffic flow management	National Demand/Capacity Management	Short-Term and Medium-Term
GPI-7	Dynamic and flexible ATS route management	User Preferred Trajectory	Short-Term
GPI-8	Collaborative airspace design and management	InDeX , Flexible Use Airspace User Preferred Trajectory	Short-Term and Medium-Term
GPI-9	Situational awareness	Enhanced Conflict Management, InDeX	Medium-Term
GPI-10	Terminal area design and management	User Preferred Trajectory, Enhanced Conflict Management, Flexible Use of Airspace, National Demand/Capacity Management	Short-Term and Medium-Term
GPI-11	RNP and RNAV SIDs and STARs	ATM Infrastructure	Short-Term
GPI-12	FMS-based arrival procedures	User Preferred Trajectory, ATM Infrastructure	Short-Term and Medium-Term
GPI-13	Aerodrome design and management	User Preferred Trajectory Enhanced Conflict Management	Short-Term and Medium-Term
GPI-14	Runway operations	User Preferred Trajectory Enhanced Conflict Management	Short-Term and Medium-Term
GPI-15	Match IMC and VMC operating capacity	National Demand/Capacity Management, User Preferred Trajectory, InDeX	Medium-Term
GPI-16	Decision support systems	InDeX, Flexible Use Airspace, User Preferred Trajectory	Short-Term and Medium-Term
GPI-17	Implementation of data link applications	ATM Infrastructure	Short-Term and Medium-Term
GPI-18	Electronic information services	InDeX	Short-Term and Medium-Term
GPI-19	Meteorological systems	InDeX	Short-Term and Medium-Term
GPI-20	WGS-84	User Preferred Trajectory	**Completed**
GPI-21	Navigation systems	ATM Infrastructure	Short-Term and Medium-Term
GPI-22	Communication network infrastructure	ATM Infrastructure	Short-Term and Medium-Term
GPI-23	Aeronautical spectrum	ATM Infrastructure	Short-Term and Medium-Term

12 – ICAO State Letter regarding the proposed amendment to the ICAO Global Air Navigation Plan for CNS/ATM Systems (Doc 9750) – January 2006

13 – For a full description of the Global Planning initiatives, refer to the proposed amendment to the ICAO Global Air Navigation Plan for CNS/ATM Systems (Doc 9750) circulated by State Letter in January 2006.

appendix b:
generic change management process for implementing atm strategies

This appendix describes a generic framework to guide the planning and execution of change management processes for implementing the ATM strategies. By setting the foundation for the transition roadmap for each ATM strategy, the framework ensures consistency, coherence and synchronisation in the implementation of various ATM strategies and change initiatives in the evolutionary progression towards the long-term TOC. The framework breaks each component of strategy implementation lifecycle (i.e. research, development, implementation and finalisation) into detailed processes and activities. It also highlights the expected inputs from key stakeholders, emphasising the need for cross-industry cooperation and collaboration. The process is consistent with developmental work being undertaken by ICAO in the development of ATM performance-based transition guidelines, and with the expectations of the revised Global Plan[14] both expected to be published in late 2006/early 2007.

Research Phase

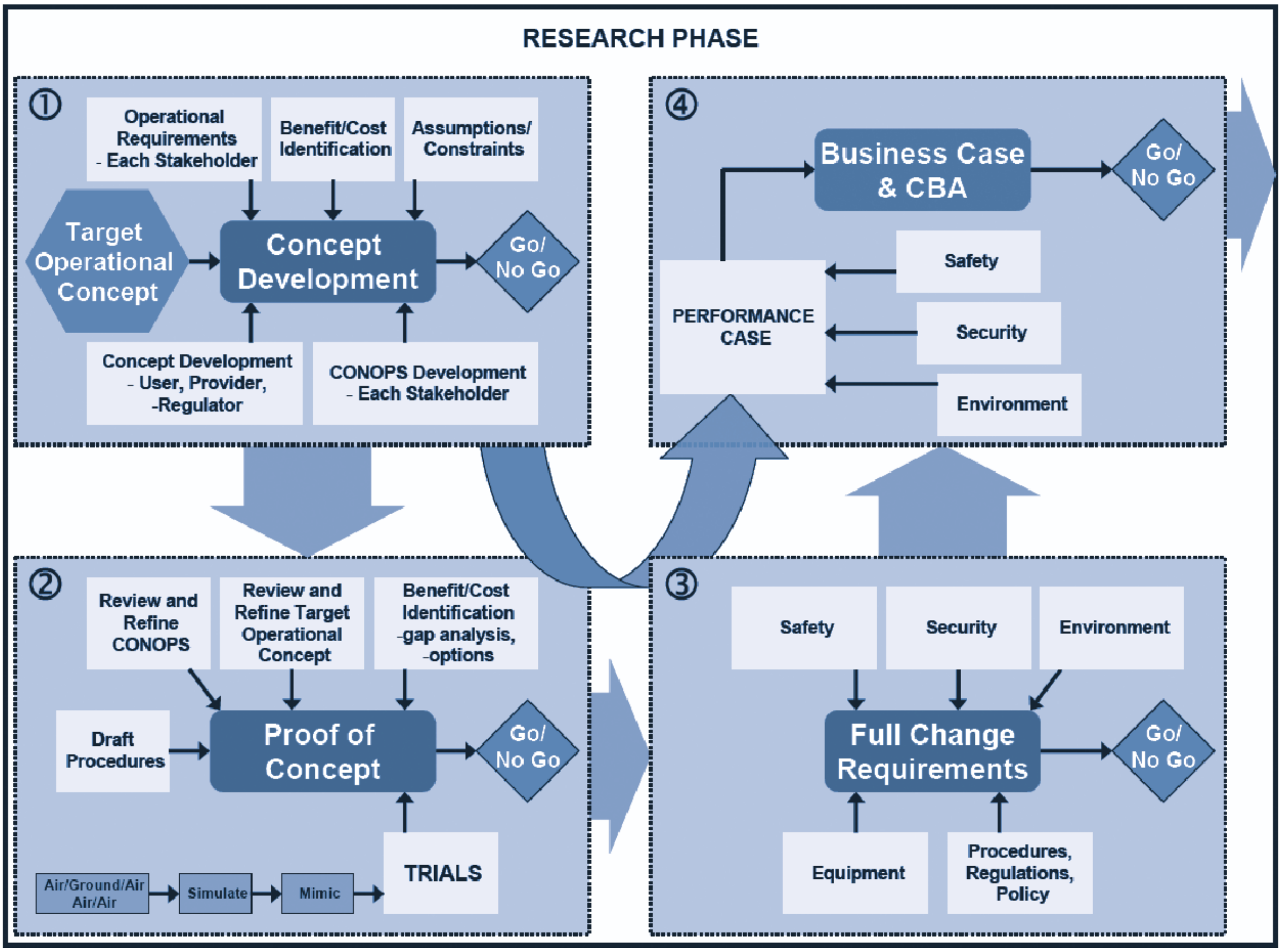

Figure B1: Research Phase

The Target Operational Concept forms the overarching focal point and driver for initiating the development and implementation of each ATM strategy. Concept development, and the associated adjustment or redevelopment of ATM strategies, requires the cooperation and collaboration of all relevant industry stakeholders to determine, both at the industry level and individual stakeholder level, paradigm changes and operational requirements associated with the introduction of an ATM strategy. For new or emerging performance enhancing capabilities, enablers or technologies that represent significant paradigm shifts, research and development will be required. The research phase is a 4 step process, with a go/no go decision point at the end of each step.

Step 1 is the concept development step. Through preliminary feasibility analysis, benefits/costs, assumptions and constraints will be identified and articulated as a performance case to justify the rationale for implementing the proposed change. This must align with the ATM community expectations to ensure that the strategy implementation will contribute to the performance-based, user-focused ATM system envisioned in the strategic plan and associated Target Operational Concept. Step 1 adds developmental elements to the Target Operational Concept, including:

- definition of stakeholder operational requirements
- initial benefit/cost identification
- development of the assumption and constraint set
- development of the concept of use, or the necessary adjustments to the concept of operation, and
- stakeholder concept development into their individual operational scenarios, roadmaps and strategic plans.

Step 2 is the proof of concept stage. Once the high-level operational change requirements are identified and justified, the overarching concepts of operation need to be developed, proven for operational and technical feasibility and validated against ATM community expectations by way of a performance case. This involves an iterative process of desktop and/or live trials/simulations, concept review and, where necessary, concept refinement. Stakeholder collaboration and cooperation in this process is crucial to achieve whole-of-industry consensus and commitment to any change proposals. Elements included in step 2 include:

- review and refining of the concept of operation
- review and refining of the Target Operational Concept
- more detailed cost and benefit analysis, performance gap analysis and mitigation option evaluation
- drafting of new or revised procedures for evaluation, and
- if necessary, system trials which may range from desk-top exercise to full scale simulation or live trial.

Upon the successful completion of proof of concept, industry stakeholders will individually and collectively determine the more detailed operational, regulatory and technical change requirements.

Step 3 is the definition of these full system change requirements. This includes definition of changes to:

- safety procedures
- security procedures
- environmental effect mitigation
- equipment and systems, and
- regulations, procedures, policy and practices.

Step 4 is the preliminary performance case [which includes the preliminary Cost Benefit Analysis, Business Case, Safety Case, Security Evaluation and Environmental Assessments]. It should be noted that the performance case is started at Step 1 and evolves through the 4 step process to provide continuity and to fulfil the requirement that a performance case be a "…living argument/document that must be updated along the life-cycle of any change…".

Development Phase

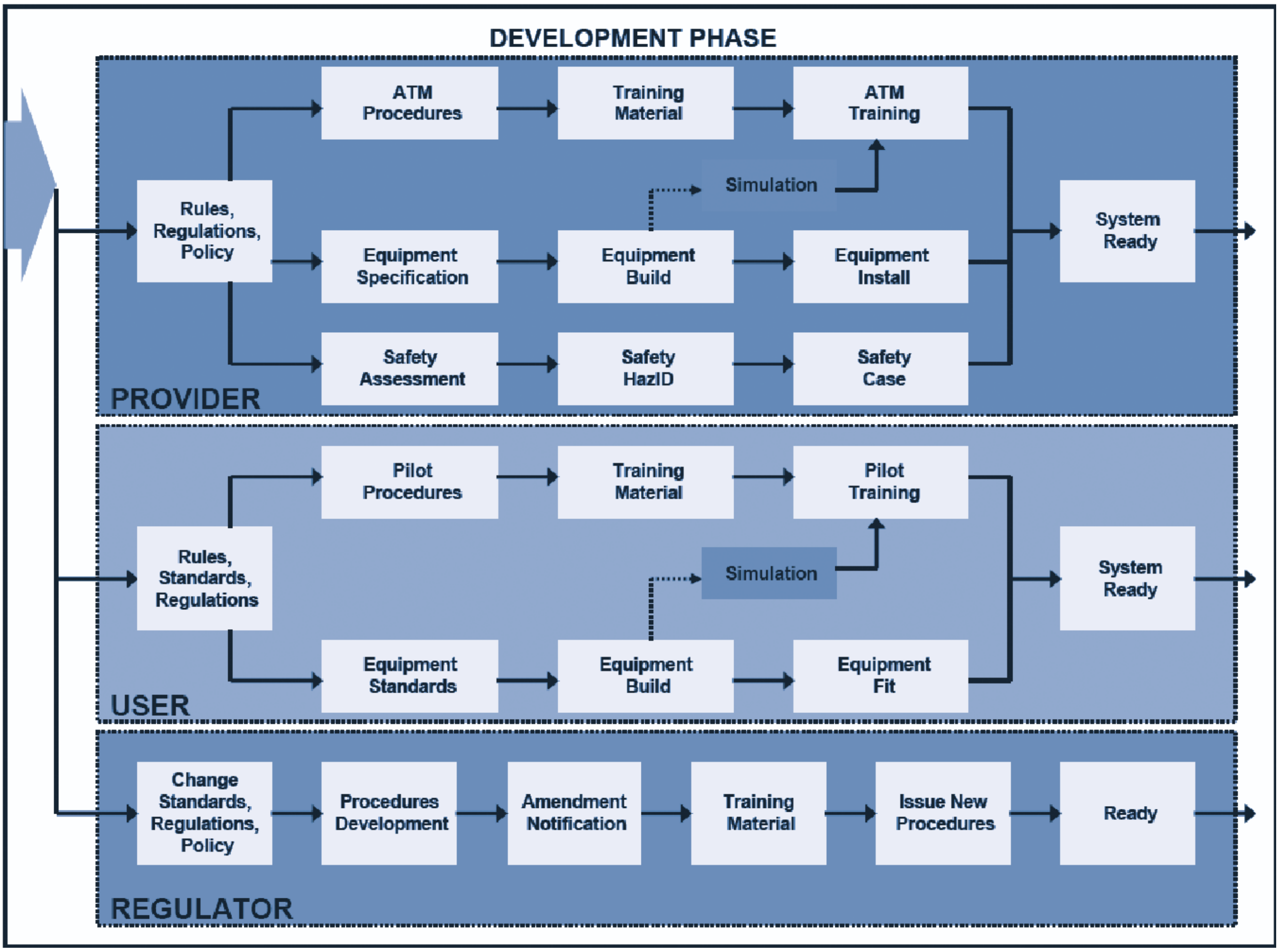

Figure B2: Development Phase

Once the cross-industry performance case is endorsed, and assuming appropriate authorisation to proceed has been received from the appropriate stakeholder executive management, a coordinated individual stakeholder change process can be commenced. The development stage requires each key stakeholder (provider, user and regulator) to design and develop detailed processes and activities of implementing an Operational Concept (operational, technical and regulatory changes). The processes and activities undertaken by each stakeholder need to be closely coordinated to expedite implementation. Each stakeholder may need to adapt and modify the processes outlined in figure B2 above to suit its specific change management requirements (e.g. airlines may need to develop separate safety case to validate procedural changes as a result of implementing new technology). It should be noted that the diagram shows a simplified flow process. Each individual change will need to be carefully mapped to ensure that all steps are captured – including the sometimes complex inter-relationships between stakeholders.

Note: - The performance case remains a 'living document' and will continue to be used and updated in the development, implementation and finalisation phases, via a post phase review process.

Implementation and Finalisation Phases

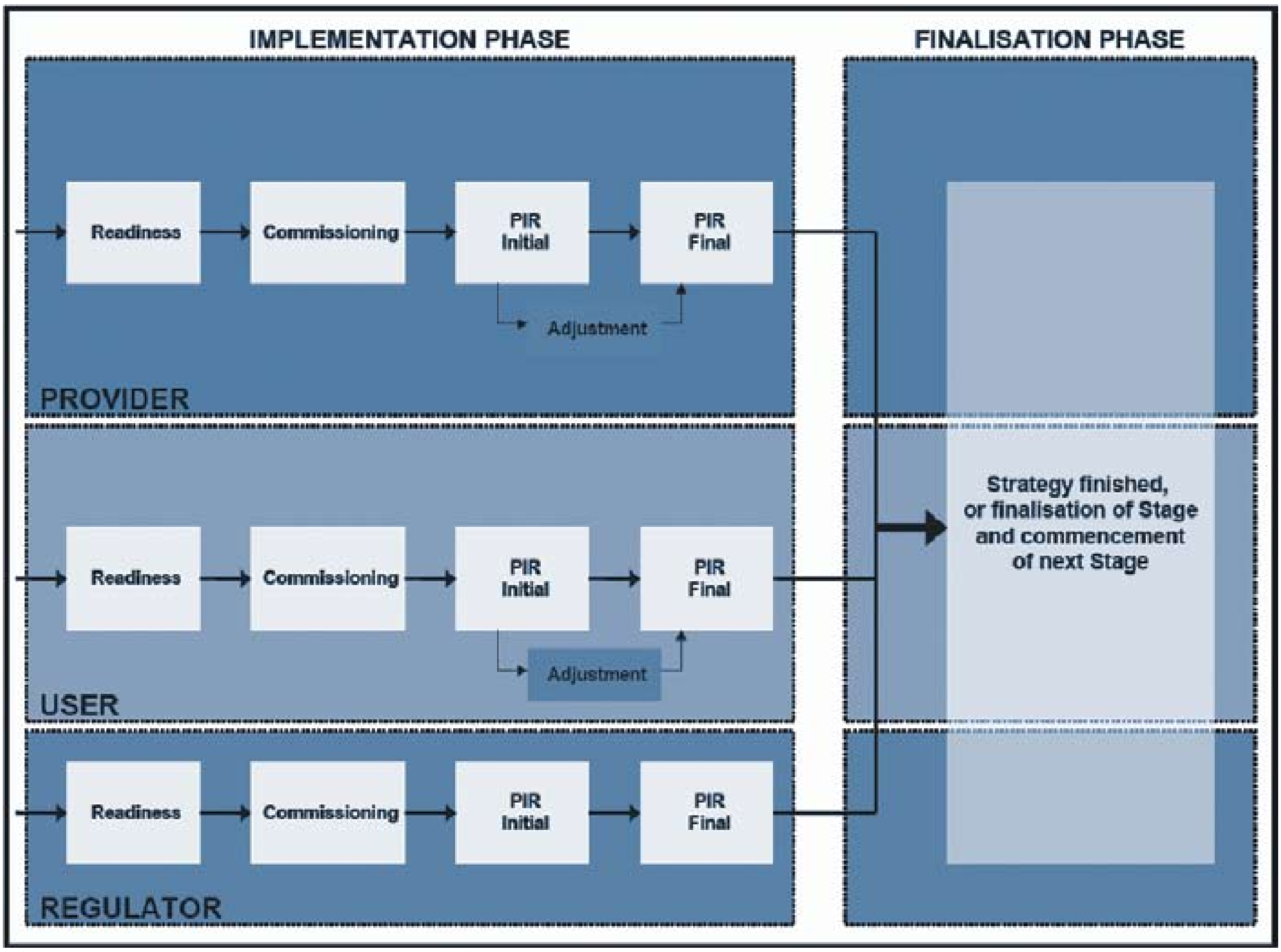

Figure B3: Implementation and Finalisation Phases

Subject to completion of operational and technical readiness review, detailed change requirements will be implemented in operational environments within each stakeholder organisation. Post implementation review across industry and within each stakeholder organisation is required to identify any enhancement requirement. Where required, changes will be coordinated and applied to continuously improve the implementation outcome. Where the implementation strategy envisages multiple stages or phases, the change processes for subsequent stages or phases will follow the change management framework outlined above by starting at the development stage or the research/concept stage.

After the final project implementation reviews, the change becomes part of the overall system, and is therefore subject to the ongoing performance monitoring mechanisms of the system.