AIRSPACE FOR TOMORROW

Developing the United Kingdom's airspace arrangements in a safe, sustainable and efficient way

October 2009

Overview

The CAA intends that this document should give all those with an interest in the way we use UK airspace a summary of:

- How UK airspace is used and controlled today.
- The key factors the CAA thinks will cause our airspace arrangements to evolve.
- The CAA's vision for the UK's future airspace arrangements in 2030 – some of the concepts that will be considered to achieve the vision and the associated benefits.
- The purpose and direction of the Future Airspace Strategy (FAS) the CAA is developing with colleagues from the Department for Transport, Ministry of Defence, NATS and other aviation stakeholders to achieve our vision.

Having read this document you will be:

- Better informed on what the FAS is and how it is being progressed by the CAA.
- Be ready to participate in the FAS consultation process when it is commenced in 2010.

Introduction

Aviation – made possible by effective management of airspace – enables the economy to operate more efficiently, enhances people's opportunity for travel and leisure, and plays a key role in ensuring our national security.

Although infrastructure investments have improved road and rail transport, and advancements in telecommunications are playing an increasing role in helping people to communicate, the demand for aviation in the UK has still grown significantly over the past 60 years.

Successfully meeting the growth in demand for aviation has added complexity to our airspace arrangements, particularly in areas with the highest volumes of traffic such as the south east of England. In turn, added complexity has placed constraints on 'airspace capacity' - the number of aircraft that can move safely through a volume of airspace at any given time.

The UK has an excellent aviation safety record, underpinned by high safety standards and the dedication of people who use and manage UK airspace. Maintaining and improving this record is demanding greater vigilance and enforcement due to the growing levels of airspace complexity.

The current global recession has curbed demand at some UK airports. Experience of previous setbacks, following the September 11th terrorist attacks and during the first Gulf War, suggest demand will increase again as the downturn ends.

Figure 1: Growth in aviation passenger numbers, 1945 – 2009. Aviation Trends. Q2 2009. CAA

It is likely that the pressure on the UK's scarce airspace capacity will continue to grow over the long term. The most recent update to the Department for Transport's air passenger demand forecasts indicate that overall demand is expected to grow from 228 million passengers passing through UK airports per year in 2005 to 465 million by 2030.[1]

Notwithstanding a wide range of mitigation measures, the environmental impact of aviation, including greenhouse gas emissions, local air quality impacts and aircraft noise, causes widespread public concern. The aviation sector recognises the importance of this challenge, in the context of the predicted growth in demand, and is taking steps to address it.

While protecting safety and mitigating the environmental impacts of aviation, delivering greater airspace capacity must also balance the requirements of different airspace user groups (airlines, general aviation and the military). It is the interaction between these factors that provides the impetus to consider how our airspace arrangements should evolve over the next 20 years.

The UK's Future Airspace Strategy (FAS), which is being developed by the CAA, in cooperation with the Department for Transport, Ministry for Defence, NATS and key aviation stakeholders, addresses the development of UK airspace to 2030. The strategy can be regarded as a flexible framework or tool kit of options that will assist us in determining how the operation, management and regulation of our airspace should evolve depending on the circumstances. FAS will determine the key characteristics of a proposed future airspace system and identify the changes required to deliver it, including the policy and regulatory considerations that may need to be made in support of these changes.

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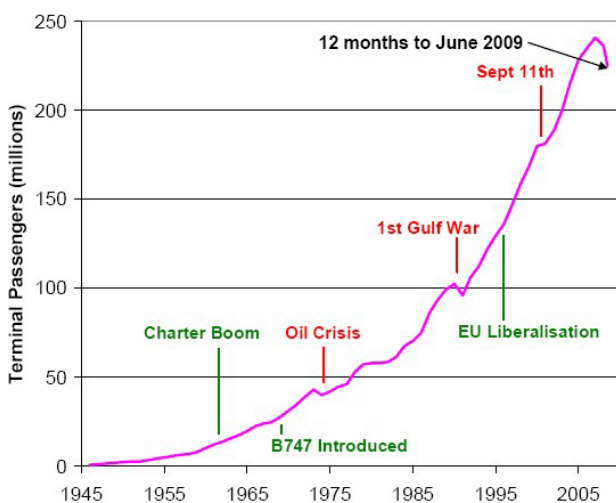
1 UK Air Passenger Demand and CO_2 Forecasts Jan 2009, DfT.

UK Airspace Today

The airspace arrangements we have today are based on a system established during the post-war period when demand for airspace capacity began to grow significantly. The advent of the International Civil Aviation Organisation (ICAO) and the Chicago Convention of 1944 saw the beginnings of the international standards and practices that the UK has continued to apply in developing its sovereign airspace and the international airspace for which it has responsibility.

To coordinate the use of airspace safely, a system of division took shape in the creation of airways. These rigid routes between the zones of the major airports were developed for commercial air traffic with the blocks of airspace between and beneath remaining open and freely available for all. This general concept of controlled and uncontrolled airspace remains today.

Increasing capacity to meet growing demand has resulted in the successful implementation of significant changes to the UK airspace structure, with good engagement across the range of airspace users. These developments have been targeted on:

- Maintaining the highest standards of safety.

- Reducing the impact to people on the ground.

- Reducing the impact on the environment.

- Accommodating the diverse (sometimes conflicting) requirements of different airspace user groups, to the greatest extent possible.

Changes have typically been made in two ways; either by altering the dimensions or design of airspace, or by adopting new technology and operational concepts. Generally the development has been reactive, characterised by small incremental changes made on a piecemeal basis as new demand materialised or new technology became available. Successfully meeting the demand for airspace has often increased the complexity of the system.

The UK's airspace arrangements are now finely balanced. Commercial air traffic is competing with the military and general aviation activity for the same limited resource. In some areas demand for airspace capacity exceeds supply during peak periods and, in order to maintain safe operations, access must be limited – thus airlines experience delays and other airspace users are not able to fly along their preferred routes or at preferred times.

The last chart in the sequence opposite shows the structure of controlled airspace today. Controlled airspace is broadly comprised of two areas, Terminal and En-route.

Controlled Airspace c.1950

Controlled Airspace c.1970

Controlled Airspace c. 2009
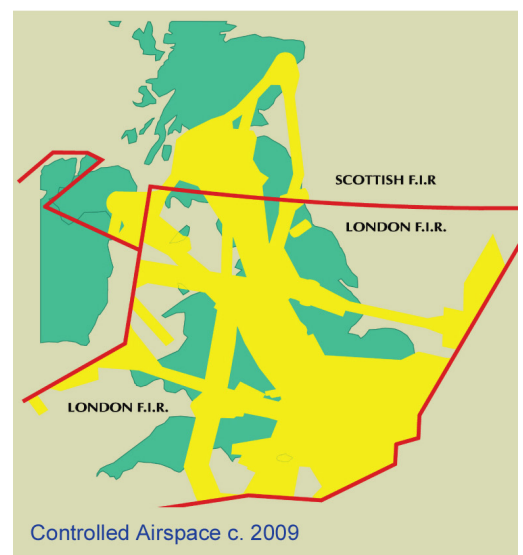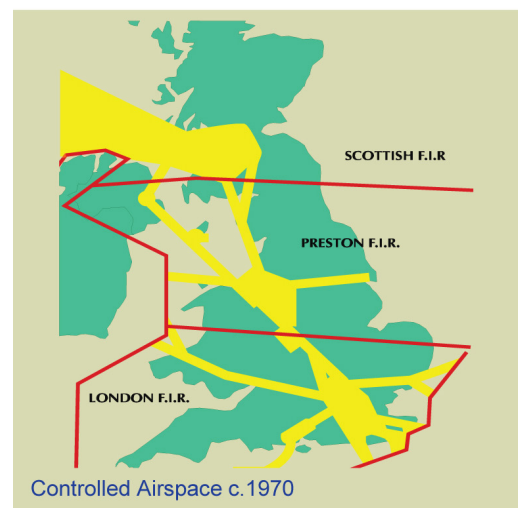
Terminal Control Area (TMA)[2]

A TMA is a managed airspace environment created to assist in achieving safety and efficiency where a number of larger, more complex airports and smaller, local airports operate in close proximity. It is characterised by high numbers of aircraft conducting climbing and descending manoeuvres in a relatively small volume of airspace. Operations within TMA airspace are dynamic and heavily influenced by demand, regularly resulting in the need to delay aircraft in established vertical holding stacks and causing other delays in the air and on the ground.

En-Route Airspace

En-Route airspace is characterised by operations conducted along pre-defined routes or airways in controlled airspace. Key features of today's en-route airspace system include:

- Aircraft entering from a number of different points requiring flow management techniques to integrate them safely and efficiently, often leading to pinch points and delays when demand for airspace capacity is greater than supply.

- Coordination of aircraft operating at high altitude with those climbing from, and descending into, TMAs.

- Significant interaction between neighbouring air traffic control sectors, requiring strict adherence to agreements around the transfer of aircraft between sectors.

- Frequent interaction with areas of restricted access, such as airspace reserved for safety reasons, adding complexity and often preventing aircraft from flying their preferred route.

- Some potential flexibility to re-route aircraft, to accommodate peaks in demand, but leading to a higher Air Traffic Control (ATC) workload.

- Accommodation of the frequent, often daily, changes to the position of optimal routes across the North Atlantic determined by the location of weather systems and the fast flowing air currents known as the 'Jet Stream'.

Classes of Airspace

There are currently six classes of airspace in the UK allocated depending on the need to actively control access to airspace and the nature of the activity taking place within it. Classes A to D[3] require a clearance to enter and an air traffic service is mandated. Class G is uncontrolled in that any aircraft may use the airspace under the rules of the air and although an air traffic service may be available it is not mandated. Large portions of Class G airspace below 19,500 feet are used by the Military and General Aviation. The remaining two Classes, E and F, are not widely used in the UK and the intention is to remove them.

Figure 2: UK Airspace Classifications

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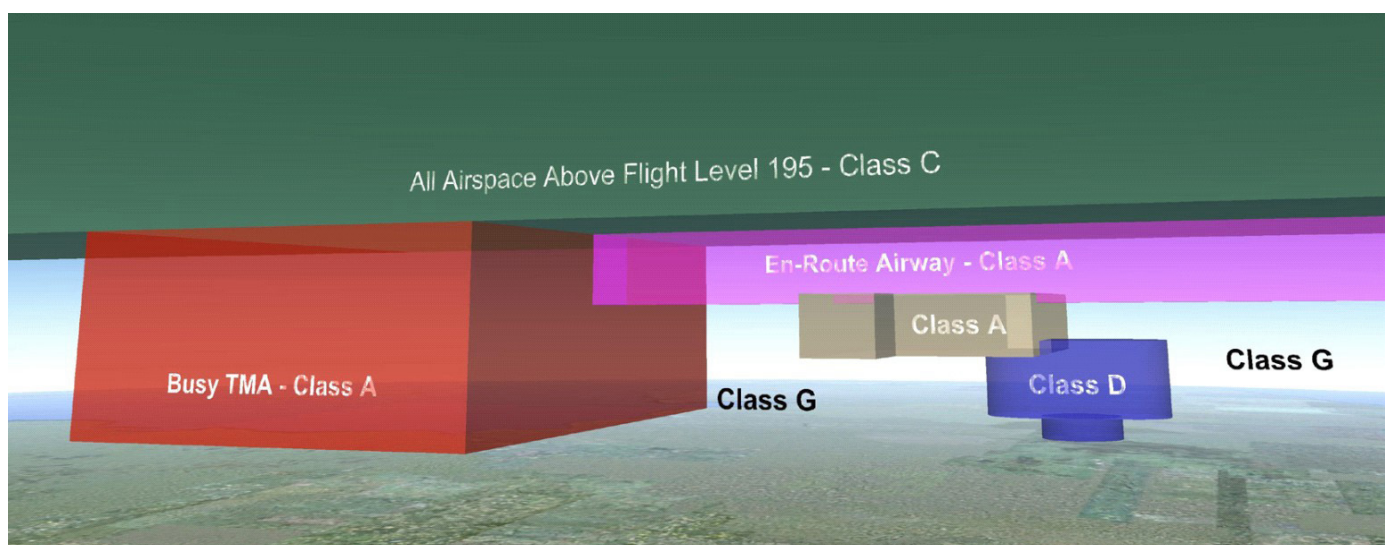
2 TMA (the abbreviation for Terminal Manoeuvring Area) was retained when the term Terminal Control Area was adopted.

3 Class B is not used in the UK.

Key Drivers for Change

The CAA has identified four key drivers that, if not addressed, could adversely affect the efficiency of our airspace arrangements. These are:

- The impact of continued growth in demand for aviation, especially in the Commercial Air Transport sector.

- The need to mitigate the environmental impact of civil aviation.

- The impact of potential future development of UK airports, especially in the south east of England.

- The need to implement new technology to more efficiently manage and control our airspace.

Expanding on each in turn:

Demand Growth

The predicted growth in demand for airspace capacity may potentially outstrip the supply.

Whilst it is recognised that the Department for Transport relies largely on passenger numbers for airport strategy, the CAA considers Air Transport Movements most appropriate for measuring airspace capacity.

Commercial Air Transport – although suffering from the current economic slowdown, demand remains high at around 2.3 million[4] air transport movements per annum in UK airspace. Growth in demand for air transport is generally considered to be related to economic growth, so it can be expected that the number of movements in UK airspace will resume its upward trend in the long term, although the timing and pace of recovery is uncertain. It is not just the level of demand but also the geographical dispersal and nature of the growth that drives the future requirement for airspace capacity.

The Military **–** need to maintain operational effectiveness through access to appropriately sized and sited airspace in the UK, enabling all Arms of the Services to 'train as they would fight'. Whilst the total numbers of military aircraft may have reduced over time, the performance and training requirements of modern aircraft and weapons systems demand greater volumes of airspace to counter immediate national security threats, prepare adequately for operations overseas and to meet any future challenges.

General Aviation **–** serves many purposes including business, leisure and personal transport. It is a diverse sector ranging from business aircraft through to private pilots, gliders and balloonists. A significant proportion of general aviation activity takes place in uncontrolled

airspace. The CAA's Strategic Review of General Aviation in July 2006 estimated the sector contributed around £1.4Bn to the economy in 2005.

Overall general aviation activity is expected to continue to grow out to 2030 and with it the demand for access to Class G airspace. The number of light aircraft on the UK register continues to increase and the number in the 'microlight' category has increased even more quickly in recent times. The pattern of demand is also likely to change - there is potential for an increase in the use of Very Light Jets (VLJs) to serve the personal and air taxi market and unmanned aerial systems (UAS) for both civil and military application.

The Environmental Impact of Aviation

Aviation's environmental impact, both locally in terms of noise and air quality and globally in terms of climate change is a key driver in development of our airspace arrangements. The Aviation sector recognises the impact it has on the environment and is actively taking steps to address that impact. This can be seen in the development of more fuel-efficient engines and the work on bio fuels to name just two initiatives. Government policy is also aimed at addressing this impact, as can be seen in the commitment to bring aviation into the Emission Trading Scheme and the introduction of the UK target to reduce CO_2 emissions to below the 2005 level by 2050. The need to provide airspace arrangements, that have the minimum practicable environmental impact, is likely to involve tradeoffs where addressing one aspect of the problem makes another aspect worse.

UK Airport Developments

The Future of Air Transport White Paper from 2003 sets out the need to expand the UK's **airport** capacity to accommodate forecast growth in demand in a sustainable way. Airport developments cannot be considered in isolation and will need to be matched by corresponding increases in **airspace** capacity. As such, new infrastructure and airport development will be a key driver in the way our airspace arrangements evolve.

The Infrastructure Planning Commission (IPC) is a new independent body that will be responsible for considering and making decisions on nationally significant infrastructure planning applications. The IPC will focus on the ground infrastructure aspects of proposals for airport developments that fall within its remit. Applications will set out illustrative options for airspace design but airspace planning and regulatory decisions will remain the responsibility of the CAA under the Airspace Change Process.

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4 NATS Operational Performance Information

New Technology

The adoption of new technology plays a key role in determining how airspace arrangements can evolve. The Single European Sky Air Traffic Management Research (SESAR) programme is a pooling of current research and development efforts, which aims to develop a pan-European system utilising new technology. The project is currently in its development phase until 2014 and the deployment phase will last from 2014 to 2025. The UK is actively engaged with and committed to this major project to ensure the timing and scale of technological changes are in accord with the UK's airspace arrangements and can be implemented in a safe and efficient way. Investment in any new technology must be accompanied by clearly identified benefits and a viable safety case.

The Federal Aviation Administration, the CAA's counterpart in the USA, is overseeing a project known as NextGen to modernise the American Air Traffic Management arrangements to meet future demand and utilise new technology. It will consider the viability of much of the same technology as SESAR and as such the programmes are working in cooperation to enable interoperability. Compatibility with these developments will have a significant influence on the way the UK's airspace arrangements evolve, in particular, having regard for the strategic location of the UK between continental Europe and North America.
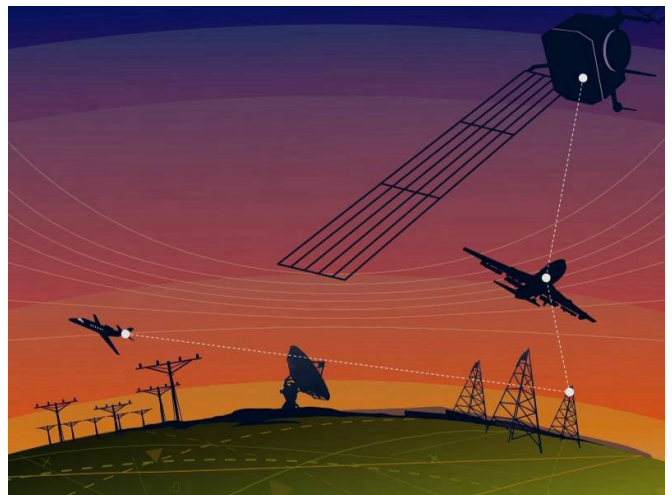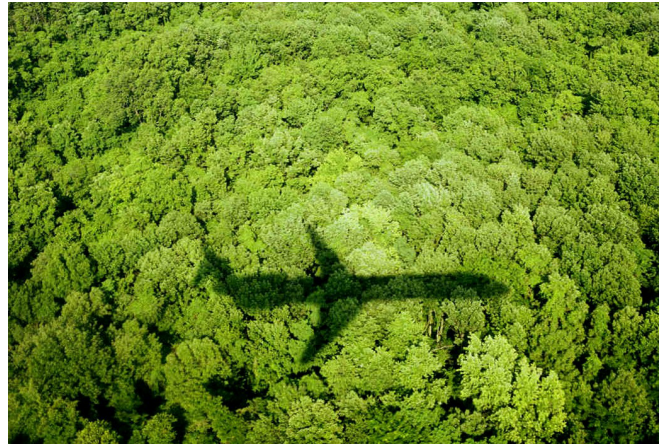
Key Considerations

There are four key areas of consideration that guide and shape the way our airspace arrangements can evolve. These are the need to:

- Maintain and where possible improve the UK's aviation safety record.

- Ensure our national security.

- Align with the Air Traffic Management developments in Europe.

- Comply with government policy and the statutory obligations placed on the CAA.

Expanding on these in turn:

Maintaining and Improving Safety

Safety will not be compromised at any stage as our airspace arrangements develop. All changes must be justified on the grounds that safety will be improved or, at the very least will suffer no deterioration in the current level. We must also consider the developments in European safety regulation and how they are best adopted and enforced within the UK.

National Security

National Security will not be compromised at any stage. Changes to the UK's airspace to deliver additional commercial air transport capacity have to take into account the impact on the Military as an airspace user. The civil/military joint and integrated approach to airspace design and service delivery has served the UK well and must be maintained and if possible improved. This will require further development of the successful Flexible Use of Airspace (FUA) concept to enable even greater dynamic use of military testing and training areas and the tools to enable efficient dissemination of intention of an activity to other airspace users.

The Growing Influence of Europe

As in the UK, European airspace arrangements are increasingly stretched. Although the safety record is good, fragmentation of ATC provision is increasingly perceived to cause inefficiency and delays. The European Commission has introduced legislation aimed at creating an airspace system that is planned, managed and regulated in a harmonised way. The Single European Sky (SES) initiative is implementing common rules that will influence the way our airspace is developed as a central part of the overall European air traffic management network. It is important that we take full account of the relevance and impact of European developments on our ambitions to develop UK airspace arrangements.

UK airspace is a key gateway between Europe and North America, delivering and receiving traffic from the North Atlantic. The airspace structure must also develop in a way that supports the efficient operation of this key interface.

Functional Airspace Blocks (FABs) - are structures now seen as essential to evolving European airspace arrangements. The intent is for states to reconfigure the upper airspace into blocks based on operational requirements, reflecting the need to ensure more integrated management of airspace regardless of national boundaries. FABs will use the technology provided through SESAR to help address the most challenging and congested pinch points.

The UK and Ireland currently have the only operational FAB, presenting an opportunity to lead further FAB development across Europe.

National Policy and Regulation

National aviation policy and regulation must be robust enough to aid the implementation of changes to our airspace arrangements. Some of the changes proposed may require new or updated policy and regulation. To enable their effective, timely implementation, any operational and technological changes must be considered in tandem with any policy and regulatory changes required. Policy must be made clear and the associated regulatory processes must be as succinct as possible.

The evolution of the UK's airspace arrangements will need to consider national policy and regulation in areas outside aviation, for example emerging policy on climate change, sustainable development and renewable energy.

The 2030 vision for the UK's Airspace

"Safe, efficient airspace that has the capacity to meet reasonable demand, balances the needs of all users and mitigates the impact of aviation on the environment"

The table below provides an overview of some of the possible concepts that FAS will consider in examining what is needed to achieve our 2030 vision. The focus will be on air traffic management operations as the driver for change with technology as the main enabler.

Possible Concepts	*Benefits*
Safety	

• Exploiting new communication, surveillance and navigational technology to:
  - Maintain and improve leading edge safety management systems in the context of increasing demand.
  - Enable less complex airspace by reducing route interactions and need for human intervention.
  - Facilitate higher navigation accuracy.
• Incorporating standard procedures for the operation and classification of airspace, reducing the potential for misunderstanding and error.
• Simplifying controlled airspace structures to help reduce infringements.
	Inherently safer airspace through less complex operations and support of leading edge safety management systems.

Capacity	

• Exploiting new surveillance and navigational technology to:
  - Allow users to fly their 'preferred trajectories' to the greatest extent possible.
  - Increase the flow of traffic that can be managed safely through a volume of airspace.
• Maximising dynamic use of airspace with greater civil/military coordination, allowing the military access to appropriately sized and sited airspace and civil traffic to exploit the same airspace when safe to do so.
• Improving resilience to service interruptions (e.g. runway closures & weather impact)
	Balances reasonable demand from users such that airspace is not a constraint on their operations.

Environment	
• Using runway capacity and improved arrival management, including the potential to remove regular holding stacks, to reduce track miles and fuel burn. • Maximising use of continuous climb and descent procedures to reduce fuel burn and aircraft noise. • Develop the route structure to ensure routes are as direct as possible.	*Reduces aircraft emissions and noise by minimising track miles and fuel burn.*
Cost Efficiency	

• Exploiting new surveillance and navigational technology and the capability of modern aircraft to:
  - Reduce the operational workload required to control and manage airspace e.g. through self separation of aircraft.
  - Improve arrival and departure management to minimise bottlenecks in the system.
• Improving information management, providing a robust set of data available to all airspace users to ensure efficient operation within the UK and as part of a wider international network.
• Working in partnership with other nations to optimise methods of operation, including the use of Functional Airspace Blocks (FABs), to create a network that recognises, but is not constrained by, national boundaries.
	Airspace that is more cost effective to control and manage and enables users to operate as efficiently as possible within a UK and international network.

Achieving the Vision - Future Airspace Strategy (FAS)

No changes to the UK's airspace system can be considered in isolation. Many will have a European or international context, and even when purely a national issue, they will invariably involve more than one airspace user group. Almost every change will have an environmental, safety, economic and national security dimension to consider. Changes to our airspace are best planned and implemented as part of a structured programme which aligns with infrastructure developments on the ground, protects safety requirements and manages the necessary tradeoffs in an efficient way.

The UK's Future Airspace Strategy (FAS) will be developed by the CAA in cooperation with the Department for Transport, Ministry of Defence, NATS and key aviation stakeholders and will seek to address the structured development of our airspace out to 2030. FAS will determine the key characteristics of a proposed airspace system and set out many of the changes required to deliver it, identifying policy and regulatory requirements that support and enable their introduction.

The strategy will determine how best to align with and exploit the operational and technological enablers, coming from external influences like SESAR, and implement them in sequences that achieve the greatest potential benefits for the UK.

Due to the degree of uncertainty associated with future airspace developments, the strategy must remain flexible. It can therefore be viewed as the development of a framework or tool kit of options that will assist us in determining how the planning, management and regulation of our airspace should evolve depending on the circumstances.

The FAS is being developed as a programme over the next 12 to 18 months. It will allow the CAA to take a more joined up and proactive approach to the development of our airspace arrangements. These arrangements will need to be integrated with wider Government strategy and balance the needs of different airspace users by understanding and managing trade-offs.

FAS Strategic Objectives

Safety

- Maintain and where possible improve safety.

National Security

- Maintain a joint and integrated approach to airspace design and service delivery in order to achieve maximum airspace efficiency and ensure that Defence and Security objectives are met.

Economic

- Provide airspace capacity to accommodate reasonable demand.

- Ensure value for money through sound regulatory management, robust cost control, and clear appraisal of airspace investment choices.

- Balance appropriate strategic trade-offs to achieve an economically efficient outcome.

- Achieve greater efficiency in the use of airspace to enable sustainable airport growth without introducing undue distortion in airport competition.

Environmental

- Mitigate greenhouse gas emissions as a result of airspace change in order to contribute to successful delivery of the 2050 target.

- Mitigate the impact of noise and other environmental factors associated with aviation, consistent with whatever environmental duty placed on the CAA / guidance from the Secretary of State for Transport.

Consumer

- Improve the reliability of the gate-to-gate passenger experience by enhancing the resilience and flexibility of UK airspace.

- Develop policy for the use of UK airspace so as to balance the needs of all airspace users consistent with the CAA's statutory duties.

What Next?

Due to the size, breadth and complexity of the subject matter, development of the UK's Future Airspace Strategy represents a significant undertaking. The strategy provides a unique opportunity to set the direction for the UK's airspace arrangements against a backdrop of expected growth in demand for aviation, technological advancement and international collaboration in the sector.

Consultation with industry, the General Aviation community and the public, to assist in development of the strategy, will be carried out in 2010 when the initial FAS work is more advanced. Once FAS is launched the consultation process will be on-going and provide stakeholders with regular opportunities to input as the strategy is refined and changes are implemented to deliver against it. This process will give all those with a stake in the way we use our airspace the opportunity to contribute to its strategic direction and understand how any proposed changes may affect them.

Formal consultation on specific changes proposed as part of the strategy will be coordinated by the CAA and conducted in accordance with the Airspace Charter as necessary.

The vision for development of the overall European airspace system is wide-ranging and complex. To ensure optimal outcomes for the UK, Future Airspace Strategy will also need to work with the grain of that vision, anticipating the direction of travel of various initiatives, how they might work together, and the risks and opportunities involved.

The first step in the stakeholder engagement process will come with the launch of this document to the National Air Traffic Management Advisory Committee (NATMAC) on 28 October 2009. A second document in this series, to be published in 2010, will provide an update on work to better understand how demand for airspace capacity may evolve and provide a view of potential changes. The second document will also include a consideration of the safety and environmental impacts of different proposals for change.

This document was authored by the CAA with support from the Department for Transport, Ministry of Defence and NATS. Although is does not form part of the formal Future Airspace Strategy consultation – scheduled for 2010, if you have questions or comments you would like to make please contact the CAA at:
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The CAA is the UK's independent specialist aviation regulator. Its activities include economic regulation, airspace policy, safety regulation and consumer protection.