Directorate of Airspace Policy

Proposal to Amend the Air Navigation Order 2000 for the Purpose of Introducing Secondary Surveillance Radar Mode Select in Notified Terminal Manoeuvring Areas and En-Route Airspace in the UK From 31 March 2005

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17 February 2005

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Directorate of Airspace Policy

All NATMAC Representatives

17 February 2005

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LETTER OF INTENT

Dear Colleague,

PROPOSAL TO AMEND THE AIR NAVIGATION ORDER 2000 FOR THE PURPOSE OF INTRODUCING SECONDARY SURVEILLANCE RADAR MODE SELECT IN NOTIFIED TERMINAL MANOEUVRING AREAS AND EN-ROUTE AIRSPACE IN THE UK FROM 31 MARCH 2005

In my Letter of Consultation, published on 20 January 2004, I invited comment on a proposal to amend the Air Navigation 2000 and the Air Navigation (General) Regulations 1993 to require the carriage and operation of Secondary Surveillance Radar Mode Select (Mode S) equipment in notified Terminal Manoeuvring Areas (TMAs) and en route airspace from 31 March 2005. In response to that Letter of Consultation, 14 replies were received, of which 12 were from representatives of UK organisations. Of the 12 UK responses, 4 organisations indicated full support for the proposal, 3 indicated qualified support but raised a number of queries, 2 made no substantive comment and 3 General Aviation (GA) organisations objected. These objections were raised on the grounds that the requirements for Mode S equipage should not be extended to the GA sector, as the operators would gain no benefits from Mode S despite significant expenditure being required. A detailed summary of all the responses has been included at Appendix 4 in the enclosed Full Regulatory Impact Assessment (RIA).

In light of the comments received, the proposed regulatory amendments have been modified and issues relating to the applicability criteria and the requirement for aircraft to provide antenna diversity have been clarified. Furthermore, the costs and benefits that were set out in the Partial RIA have been refined and incorporated into the Full RIA. The objections from the GA sector have been noted but the CAA does not believe that this proposal will have a significant overall impact on this particular sector. Moreover, those GA aircraft operating in the notified airspace would benefit from all the safety enhancements that Mode S provides. Nevertheless, the CAA does accept that the impact of the equipage costs for individual GA operators will be proportionately greater than that for larger commercial organisations.

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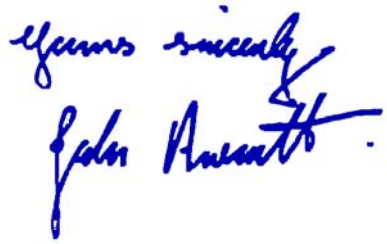
Notwithstanding, the CAA is content that the applicability and exemption criteria will provide reasonable mitigation against this impact and believes that the interoperability of all aircraft in the busy notified Controlled Airspace can only be maintained through Mode S equipage across the board. Full equipage will be needed to ensure that all the required safety and capacity benefits can be realised as quickly as possible.

The CAA is satisfied that the views expressed by interested parties have been taken fully into account. The CAA will now recommend to the Secretary of State that: Article 15, Schedule 5 of the ANO 2000; and 18B(1) and 18B(2) of the Air Navigation (General) Regulations 1993 be amended, as detailed in Enclosure 1. The required Full RIA, which will accompany the proposed legislation to Parliament for scrutiny, is at Enclosure 2.

It is expected that the amendments will come into force on 31 March 2005.



J R D ARSCOTT
Director

Enclosures:

1. Proposed Regulatory Amendments.
2. Full Regulatory Impact Assessment.

Proposed Regulatory Amendments

AIR NAVIGATION ORDER 2000 SCHEDULE 5 Article 15

Radio and radio navigation equipment to be carried in aircraft

2 Table

Aircraft and Circumstances of Fflight	*Scale of Equipment Required*								
	A	B	C	D	E	F	G	H	J
(1) All aircraft (other than gliders) within the United Kingdom:									
(a) when flying under Instrument Flight Rules within controlled airspace	A*				E1 *	F*#			
(b) when flying within controlled airspace	A*								
(c) when making an approach to landing at an aerodrome notified for the purpose of this sub-paragraph							G*		
(d) when flying for the purpose of public transport on and after 1st January 2004					E1 *				
(2) All aircraft within the United Kingdom:									
(a) when flying at or above flight level 245	A*								
(b) when flying within airspace notified for the purposes of this sub- paragraph	A*								
(3) All aircraft (other than gliders) within the United Kingdom:									
(a) when flying at or above flight level 245					E1 *	F*			
(b) when flying within airspace notified for the purposes of this sub- paragraph					E1 *				
(c) when flying at or above flight level 100					E1 *				
(3A)(a) All aeroplanes having a maximum take-off weight authorised not exceeding 5,700kg and a maximum cruising true airspeed capability not exceeding 250 knots when flying under Instrument Flight Rules within airspace notified for the purposes of this sub- paragraph					E2 *				
(b) All rotorcraft when flying under Instrument Flight Rules within airspace notified for the purposes of this sub-paragraph					E2				
(c) All aeroplanes having either a maximum take-off weight authorised of more than 5,700kg or a maximum cruising true airspeed capability of more than 250 knots when flying under Instrument Flight Rules within airspace notified for the purposes of this sub- paragraph					E3*				
(d) All aircraft required to carry Scale E2 or E3					EE				
(4) All aircraft registered in the United Kingdom, wherever they may be:									
(a) when flying for the purpose of public transport under Instrument Flight Rules:									

Aircraft and Circumstances of Fflight	*Scale of Equipment Required*								
(i) while making an approach to landing	A		C	D				H	
(ii) on all other occasions	A		C					H	
(b) when flying for the purpose of public transport on and after 1st January 2004					E1				
(c) subject to sub-paragraph (e), multi-engined aircraft when flying for the purpose of public transport under Visual Flight Rules	A							H	
(d) subject to sub-paragraph (e), single-engined aircraft when flying for the purpose of public transport under Visual Flight Rules:									
(i) over a route on which navigation is effected solely by visual reference to landmarks (ii) on all other occasions	A A	B							
(d) when flying under Instrument Flight Rules within controlled airspace and not required to comply with paragraph (4)(a) above	A*								
(5) All aeroplanes registered in the United Kingdom, wherever they may be, and all aeroplanes wherever registered when flying in the United Kingdom, powered by one or more turbine jets or turbine propeller engines and either having a maximum take-off weight exceeding 15,000 kg or which in accordance with the certificate of airworthiness in force in respect thereof may carry more than 30 passengers									J
*Unless the appropriate air traffic control unit otherwise permits in relation to the particular flight and provided that the aircraft complies with any instructions which the air traffic control unit may give in the particular case. #Provided that non-public transport aircraft flying in Class D and E airspace shall not be required to be provided with distance measuring equipment.									

3 The scales of radio and radio navigation equipment indicated in the foregoing Table shall be as follows:

Scale E1

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and is capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale E2

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and has the capability and functionality prescribed for Mode S Elementary Surveillance and is capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale E3

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and has the capability and functionality prescribed for Mode S Enhanced Surveillance and is

capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale EE

The aircraft shall, in the circumstances specifed in paragraph 2.1.5.3 of Volume IV of Annex 10 (Z Edition) to the Chicago Convention, comply with the requirements for antenna diversity set out in that paragraph.

AIR NAVIGATION (GENERAL REGULATIONS) 1993

Mode S Transponder

18B (1)(a) For the purposes of paragraph 2(3A) of Schedule 5 to the Air Navigation Order 2000, the capability and functionality prescribed for Mode S Elementary Surveillance shall be that specified for a level 2 transponder in Volumes III and IV of Annex 10 (Z Edition) to the Chicago Convention together with the additional functionality specified in sub-paragraph (b).

(b) This is the additional functionality referred to in sub-paragraph (a):

(i) Capability to support the Interrogator Identifier (II) Code and Surveillance Identifier (SI) Code functionality;
(ii) Extended Squitter functionality; and
(iii) ACAS Active Resolution Advisory.

(2)(a) For the purposes of paragraph 2(3A) of Schedule 5 to the Air Navigation Order 2000, the capability and functionality prescribed for Mode S Enhanced Surveillance shall be that specified for a level 2 transponder in Volumes III and IV of Annex 10 (Z Edition) to the Chicago Convention together with the additional functionality specified in sub-paragraph (b) and the additional downlinked parameters specified in sub-paragraph (c).

(b) This is the additional functionality referred to in sub-paragraph (a):

(i) Capability to support the Interrogator Identifier (II) Code and Surveillance Identifier (SI) Code functionality.
(ii) Extended Squitter functionality.
(iii) ACAS Active Resolution Advisory.

(c) These are the additional downlinked parameters referred to in sub-paragraph (a):

(i) Reporting of the Magnetic Heading Downlinked Aircraft Parameter.
(ii) Reporting of the Indicated Airspeed Downlinked Aircraft Parameter.
(iii) Reporting of the Mach Number Downlinked Aircraft Parameter.
(iv) Reporting of the Vertical Rate Downlinked Aircraft Parameter.
(v) Reporting of the Roll Angle Downlinked Aircraft Parameter.
(vi) Reporting of the Track Angle Rate Downlinked Aircraft Parameter.
(vii) Reporting of the True Track Angle Downlinked Aircraft Parameter.
(viii) Reporting of the Ground Speed Downlinked Aircraft Parameter.
(ix) Reporting of the Selected Vertical Intent Downlinked Aircraft Parameter (including Barometric Pressure Setting).

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Full Regulatory Impact Assessment

PROPOSAL TO AMEND THE AIR NAVIGATION ORDER 2000 FOR THE PURPOSE OF INTRODUCING A NEW SECONDARY SURVEILLANCE RADAR SYSTEM IN NOTIFIED TERMINAL MANOEUVRING AREAS AND EN-ROUTE AIRSPACE IN THE UK FROM 31 MARCH 2005

Contents

1 Title of Proposed Measure

"PROPOSAL TO AMEND THE AIR NAVIGATION ORDER 2000 FOR THE PURPOSE OF INTRODUCING A NEW SECONDARY SURVEILLANCE RADAR SYSTEM IN NOTIFIED TERMINAL MANOEUVERING AREAS AND EN-ROUTE AIRSPACE IN THE UK FROM 31 MARCH 2005."

2 Purpose and Intended Effect of the Measure

2.1 The Issue and Objective

2.1.1 **Issue**. The technological principles behind the Secondary Surveillance Radar (SSR) system that is currently employed to support Air Traffic Control (ATC) in the UK date back to the post-World War II development of the military Identification Friend or Foe (IFF) system. Over the last 2 decades, an increase in traffic levels within UK and core European airspace has highlighted the inherent limitations of this technology and stretched the capacity and capability of the system to its limits. To ensure the efficient ATC handling of the forecast future traffic volumes in a safe, orderly and expeditious manner, a new and more advanced SSR system must be introduced in the UK from 2005.

2.1.2 **Objective**. It is the intention of the CAA to propose the introduction of a new SSR system throughout all airspace in the UK in a 2-stage approach. The first stage would be to introduce it in the controlled airspace around the major UK airports and along the major UK air routes incrementally from 31 March 2005. The second stage would be to introduce the new system in the remaining UK airspace from 31 March 2008. The objective of this Regulatory Impact Assessment (RIA) is to assess the options for implementing the first stage of this strategy and to formulate a proposal to amend Article 15, Schedule 5 of the Air Navigation Order 2000 and the Air Navigation (General Regulations) 1993. The second stage of the strategy will be covered under a separate RIA in the future. The implementation strategy aims to deliver safety and capacity benefits to the aviation sector in the short to medium term while providing a mechanism with which to satisfy the medium to long term ATC airspace surveillance requirements in UK and Europe.

2.2 Risk Assessment

2.2.1 **Accurate Detection of Aircraft**. The information that current SSR ground radars can obtain from aircraft comprises position, height and a 4-digit identity code. A general request for this information is sent out by the radars on one radio frequency and the replies from aircraft flying within the coverage of the radars are received on a second frequency. As the number of radars installed in the UK and adjacent European States has increased and traffic levels have grown, there are now more aircraft being asked to provide replies containing this information more often. This is leading towards a saturation of the 2 radio frequencies used for SSR. If frequency saturation occurs on either of these 2 frequencies, the ability of the radars to detect and identify aircraft accurately is compromised. The National IFF/SSR Committee, which is the body responsible for the day-to-day management of the SSR frequencies, believes that a new SSR system must be deployed gradually over the next 6-8 years in order to reduce the loading on the SSR frequencies and facilitate

safe detection of increasing levels of traffic. Another important limitation of the current SSR system is that information received simultaneously from multiple aircraft flying in close proximity can overlap and false radar responses may be produced. This is a particular risk in busy airspace, such as that over London and the South East. Height information received from aircraft can also be corrupted, denying information to Air Traffic Controllers that is critical to the safe conduct of flights. Furthermore, while in the process of replying to one radar, the aircraft cannot respond to other requests. This can, therefore, affect the ability of radars to detect aircraft, or update the position of the aircraft, quickly. As traffic levels are forecast to increase still further, this situation could become unsustainable in the busiest portions of UK airspace from as early as 2005/2006. Currently, these risks are managed by employing ATC constraining procedures to limit the flow of aircraft. Without a new technology, the delays associated with these flow controls will increase, resulting in increased costs to the aviation industry and passengers. In addition, as the current SSR technology is old, the techniques for correcting information errors are relatively basic. This can result in instances where false radar tracks are created when the radio waves that are carrying the information are reflected from large objects, such as tall buildings. The ability to allow the military to employ new IFF systems in peacetime could also eventually be compromised if the congestion on the SSR radio frequencies becomes unsustainable. This is because these military IFF systems utilize the same frequencies.

2.2.2 **Use of SSR Identity Codes**. The replies of the 4 digit identity codes that are received from aircraft are used on ATC displays to identify individual flights. Unfortunately, the current SSR system was designed to support a total of only 4096 codes. Consequently, with current traffic levels, ATC units already run out of codes to allocate to flights during peak periods and aircraft have to be held on the ground until spare codes becomes available. This increases delays and costs to the aviation industry and passengers. As the levels of traffic are set to increase still further in the future, this situation will become progressively worse. Recent studies estimate that severe code shortages are likely to occur from 2005/2006 onwards. Currently, increasingly complex procedural methods and ATC system functionality are employed to reduce this risk. These activities impact on both controller and pilot workload and hence reduce traffic handling capacity. Furthermore, with the current SSR system, there is a phenomenon whereby ATC tracking systems can accidentally transfer the four-digit information between aircraft tracks that have crossed on radar displays. There is also the risk that one code could be allocated accidentally to 2 aircraft at the same time. If either situation occurs, controllers can lose their situational awareness of aircraft. To protect against these situations, procedural measures that constrain traffic currently have to be employed, thereby further contributing to delays and costs.

2.2.3 **Controller Workload**. Using an SSR system, information received from aircraft can be employed to automatically alert controllers when conflicts arise between aircraft. Ground-based systems such as ‘Short Term Conflict Alert’ rely on the data provided by SSR being accurate. SSR frequency congestion and height data corruption increase the incidence of false alarms on these systems. False alarms increase the workload of controllers significantly and produce distractions. Increased controller workload means that less traffic can be handled safely and so these false alarms already contribute to delays and costs to the aviation industry and passengers. This situation will worsen as traffic levels continue to rise. Moreover, the current complexity of ATC procedures and the need for many radio messages increases the workload of pilots and controllers. Currently, controls on the flow of traffic have to be introduced to alleviate this workload. This high workload also means that there is

limited spare capacity available to implement measures that would increase traffic flow in the UK. Mindful of the recent White Paper on 'The Future of Air Transport' in the UK, it is vital that airspace design and the Air Traffic Management system can handle the flow of traffic necessary to ensure that these airport capacity benefits are delivered. A new SSR system is therefore needed as soon as possible to bring in more automated technology with which to reduce the amount of radio calls that need to be made in high traffic density airspace. Currently, ATC and airspace capacity issues cause about 66% of all delays in the UK.

2.2.4 **Interoperability with European Neighbours**. ATC systems throughout the European mainland are currently being modernized to incorporate SSR Mode Select (more commonly known as Mode S). If a new SSR system is not implemented in the UK, the current SSR systems will cease to be effectively interoperable with those of neighbouring States. Therefore, workload at the UK airspace boundaries will be increased significantly as controllers transfer traffic to and from the more modern ATC systems. Current plans for the countries neighbouring the UK are to implement Mode S from 31 March 2005. Potentially, the UK's ability to take maximum advantage of the opportunities offered by the 'Single European Sky' initiative would be at risk if the UK SSR system was not completely interoperable with these new European mainland Mode S systems.

2.2.5 **Level Busts**. Between 1997 and 2002, there were 2,340 incidences in UK airspace where aircraft did not level off correctly at the altitude instructed by ATC. The aircraft continued to climb or descend through the cleared level without permission. These incidents are known as 'Level Busts'. Despite a publicity and education campaign, which is ongoing, the annual number of 'Level Busts' has remained broadly the same since 2000. During 2002, there were 394 reported 'Level Busts' in UK airspace, which equates to 197 incidents per million aircraft movements. Of these 394 'Level Busts', 51 (13%) resulted in incidents where the required minimum separation standards between aircraft were not maintained. Furthermore, approximately half of all 'Level Busts' reported in the UK in 2002 occurred in the crowded airspace above London and the South East of England. All the 2002 figures show an increase over the 2001 statistics and so the risk is not currently reducing. The current SSR system does not provide controllers with an ability to monitor the height selected by pilots on the aircraft on-board Flight Management Systems. Consequently, there is currently no mechanism to assist controllers in their efforts to prevent such potentially dangerous incidents from arising.

2.2.6 **Airborne Collision Avoidance Systems (ACAS)**. On 1 Jan 2000, ACAS II fitment was mandated within the UK and the rest of Europe for all civil fixed-wing turbine-powered aeroplanes having a maximum take-off mass exceeding 15,000 kg, or a maximum approved passenger seating configuration of more than 30. Moreover, the CAA is currently undertaking an additional consultation process, as part of a European-wide initiative, to propose that all civil fixed-wing turbine-powered aeroplanes having a maximum take-off mass exceeding 5,700 kg, or a maximum approved passenger seating configuration of more than 19, should also be equipped with ACAS II with effect from 1 January 2005. ACAS equipment operates on the same radio frequencies that are used by SSR systems. Due to the congestion problems on the SSR frequencies, and the fact that ACAS shares some common technical aspects with more modern SSR systems, ACAS cannot currently operate to maximum efficiency. Therefore, the full benefits of having this widespread ACAS fitment are not currently being maximized.

3 Options

3.1 The following 4 options have been identified and were set out in the Initial RIA for consideration:

3.1.1 **Option 1**. Do nothing and continue to rely on existing SSR systems despite the risks.

3.1.2 **Option 2**. Introduce SSR Mode Select (Mode S) Elementary Surveillance in the controlled airspace around the major UK airports and along the major UK air routes incrementally from 31 March 2005. This would only apply to aircraft operating under ATC control as 'General Air Traffic' applying 'Instrument Flight Rules' within the notified terminal and en route airspace structure. This option would not apply to aircraft operating 'Visual Flight Rules'.

3.1.3 **Option 3**. Introduce SSR Mode S Enhanced Surveillance in the controlled airspace around the major UK airports and along the major UK air routes incrementally from 31 March 2005. This would only apply to aircraft operating under ATC control as 'General Air Traffic' applying 'Instrument Flight Rules' within the notified terminal and en route airspace structure. This option would not apply to aircraft operating 'Visual Flight Rules'.

3.1.4 **Option 4**. Await the maturity of alternative technologies to SSR Mode S, such as 'Automatic Dependent Surveillance – Broadcast (ADS-B)', and implement them at a later date.

3.2 There was no support for Option 1 in the responses received during the first period of consultation on the Initial RIA. The safety risks outlined in Section 2 would become intolerable in the short term if the traffic levels increase in line with forecasts. Moves to introduce more efficient airspace management procedures and design would also be compromised by the limitations of the existing SSR system. Furthermore, opportunities for future technical interoperability and the use of collision avoidance systems could not be maximized. Therefore, the CAA has decided to rule out Option 1 from any further consideration in this proposal.

3.3 SSR Mode S is a development of the existing SSR technology but it provides much more information and has a significantly increased level of data accuracy and integrity. The CAA and the other core European States consider that Mode S is the only mature replacement SSR technology available in the short and medium term. The Elementary Surveillance version of Mode S provides only the basic Mode S functionality. Implementing Option 2 would, therefore, provide only the minimum level of functionality from the new SSR technology with which to mitigate some of the risks of the existing system.

3.4 The Enhanced Surveillance version of Mode S provides all the basic Mode S functionality that is provided by Elementary Surveillance but it also provides the capability to extract a large amount of additional information about the actual and intended flight profile of aircraft. This additional ability to obtain extra information from aircraft could be used to improve safety and reduce the impact of increasing traffic levels on controller and pilot workloads. It would also provide a means with which to implement emerging technologies in the future. As the avionics of many small aircraft would not support the extraction of the required additional information, the CAA proposes to adopt the applicability criteria set out in the Exemption Policy at Appendix 1. By applying these criteria, small aircraft would still be able to gain

access to the airspace if they were equipped with at least Mode S Elementary Surveillance and would not need to apply for exemptions from the requirement to support Mode S Enhanced Surveillance functionality. In addition, under the Exemption Policy, the CAA would not expect operators to replace or upgrade the entire avionics in an aircraft for the sole reason of providing the additional Mode S Enhanced Surveillance information. Nevertheless, where avionics are subsequently upgraded for other reasons, operators would then be expected to provide the functionality.

3.5 Option 4 would defer the required equipage costs for operators in the wake of the recent financial downturn being experienced by the industry. Future technology may also eventually prove to be cheaper while still delivering some, or in time, most of the same benefits as Options 2 and 3. For example, ADS-B is a system that is often mooted in aviation circles as being a potentially cheaper option than Mode S, especially for the General Aviation community. Indeed, the only support for this strategy in the responses received during the first period of consultation on the Initial RIA came from private pilots and General Aviation user groups. The timescales for the implementation of an ADS-B system that would be suitable for use in the highly congested UK airspace is uncertain. The CAA has not seen any evidence that ADS-B would be realistically available for use in the high-density airspace of the UK or core Europe prior to 2015. Furthermore, the CAA has not received any information that ATC service providers would be prepared to invest in an ADS-B ground infrastructure to support operations in major TMA and En Route airspace prior to 2015. The costs and risks of waiting for this new technology to mature, in terms of delays and safety, are considered to be intolerable. Moreover, Option 3 provides a suitable migratory path towards future ADS-B functionality and so the initial implementation of Mode S would enhance the ability to deploy ADS-B in the medium to long term when the technology was sufficiently mature. Indeed, at the recent ICAO 11th Air Navigation Conference there was almost global acceptance that 'Mode S 1090 Extended Squitter' should be employed as the initial step towards ADS-B enabled services. Mindful of the above, the CAA has decided to rule out this Option 4 from further consideration in this proposal.

4 Benefits

4.1 Identify the Benefits

4.1.1 **Option 2**. Option 2 reduces all the risks that are set out in the aforementioned paragraphs 2.2.1, 2.2.2, 2.2.4 and 2.2.6 significantly. In turn, this would help to realize some of the requirements outlined in paragraph 2.2.3. Option 2 would help to reduce the number of false alarms on conflict alert systems and ensure that the UK Air Traffic System would be interoperable with the developing European systems. The implementation of Option 2 would also capitalize on the significant investment being made by National Air Traffic Services (En Route) plc (NATS) in replacing its existing radars with new Mode S radars. Furthermore, under some of the recent ACAS mandates many aircraft are already equipped with Mode S equipment, which could be modified quickly and easily to meet the Mode S Elementary Surveillance requirements. Indeed, the CAA is aware of some operators who have already completed these modifications to meet Mode S mandates in other European states.

4.1.2 **Option 3**. Option 3 provides all the benefits that Option 2 would realize. In addition, it would reduce all the risks that are set out in the aforementioned paragraphs 2.2.3

and 2.2.5 significantly. It would reduce controller workload by further reducing the false alarm rates on conflict alert systems and it would automate some aspects of the current radio communications needed between controllers and pilots. Air Traffic Controllers would also be able to employ more efficient traffic handling methods and use new tools to more effectively manage holding pattern 'stacks' and final approach sequencing. Moreover, the overall reduction in controller workload could release spare capacity with which to handle an increased traffic flow in UK airspace efficiently and safely. It is therefore also an enabler to support government initiatives to increase the handling capacity of UK airports. Furthermore, Option 3 provides an element of 'future-proofing', as aircraft would be equipped with state-of-the-art equipment. This would enable operators to capitalize on operational and technological advances in the medium to long term, without incurring significant additional costs. For example, Mode S Enhanced Surveillance provides a migratory path towards the implementation of ADS-B. Option 3 is much cheaper to install on aircraft in a single stage rather than implementing Option 2 as an interim measure and then upgrading the aircraft to be capable of supporting Options 3 or 4 at a later stage. The CAA has noted that some UK aircraft operators are already investing in aircraft that support Option 3.

4.2 Quantifying and Valuing the Benefits

4.2.1 In 1998, Eurocontrol published a Business Case and a Cost Benefit Analysis (CBA) to support the case for the implementation of Mode S Enhanced Surveillance in Europe. These documents were revised in February 2001 and December 2000 respectively and are available on the Eurocontrol website. A summary of the methodology and assumptions used in the Business Case is at Appendix 5. Both Eurocontrol and the CAA consider the benefit estimates to be conservative. However, it is extremely difficult to quantify the benefits that are directly attributable to Mode S. Mode S technology is an enabler from which benefits can be derived by reducing controller workload and then by using this reduced workload to introduce new measures to increase capacity. Mode S does not in itself increase capacity. Moreover the extensive safety benefits that Mode S provides cannot be realistically quantified in monetary terms.

4.2.2 **Option 2**. By 2017, the authors of the Eurocontrol CBA estimated that the cumulative benefits of implementing Option 2 throughout Europe would be approximately £2132M (€3495M). The amount attributable to the UK is not available and no updates on these benefits were received from industry during the 2 consultation periods. However, the CAA estimates that the cumulative benefits to the UK from increased traffic capacity could be in the order of £500M to £800M between 2005 and 2017, if the availability of Mode S data was used to the maximum extent to improve ATC procedures and airspace design. Notwithstanding the capacity benefits, the safety benefits are also significant and a major aim of this proposal.

4.2.3 **Option 3**. A Eurocontrol fast time simulation has indicated significant capacity benefits can be achieved from the implementation of Option 3. The CAA believes that Option 3 could help prevent flight delays increasing as the traffic levels grow. For example, the Eurocontrol CBA identified that in the year 2000, actual flight delays for the UK were 1.90 minutes per flight. Without the implementation of Option 3, the CBA authors estimated that these flight delays could rise to 2.65 minutes per flight by 2008. By 2017, the authors of the Eurocontrol CBA estimated that the cumulative benefits of Option 3 across core Europe would be approximately £4066M (€6666M). The difference of £1934M (€3171M) between Options 2 and 3 would result from the

productivity benefits of reduced controller workload provided by Option 3. At the time the CBA was written, it was believed that £1032M (€1691M) of the overall difference in the benefits between the options was attributable directly to the UK. This is because the introduction of Option 3 is most beneficial in extremely busy and complex airspace, such as the London Terminal Manoeuvring Area. The actual overall benefit of Option 3 that would be attributable to the UK is not available and no updates were received from industry during the 2 consultation periods. However, the CAA estimates that the cumulative benefits to the UK from increased traffic capacity could be in the order of £1500M to £1800M between 2005 and 2017, if the availability of Mode S data was used to the maximum extent to improve ATC procedures and airspace design. Notwithstanding these capacity benefits, the safety benefits are also significant and are a major aim of this proposal. It is estimated that the implementation of Option 3 could help to prevent 2 out of every 3 'Level Busts' that are reported in the UK every year. Furthermore, of the 'Level Busts' filed as air miss (AIRPROX) reports, 60-70% might have been detected earlier and, therefore, been avoided or reduced in severity. Research conducted by NATS has also identified that around 16% of all mandatory incident reports raised by UK Air Traffic Controllers could be avoided by implementing Option 3.

5 Compliance Costs for Business, Charities, and Voluntary Organizations

5.1 Business Sectors Affected

5.1.1 The business sectors affected would be those companies engaged in the provision of ATC services, including some airport operators, commercial air transport operators, the emergency services, the Ministry of Defence (MOD), some areas of the General Aviation (GA) community and aviation design and maintenance companies. In total, the CAA estimates that there are about 250 companies or commercial organizations, ranging from large airlines to small air charter operations, operating approximately 1000 UK-registered aircraft. However, not all of these operators will require access to the airspace to which this proposal applies. Charities and voluntary organizations involved in the chartering of humanitarian aid flights may also be affected indirectly by this regulation, through the passing on of airline operating costs in charter or hire fees. However, of these sectors, only those requiring access to the airspace in the vicinity of the major UK airports and along the major UK air routes will be affected by this proposal.

5.1.2 In addition to businesses, a small number of private recreational aviators will require access to the notified airspace as General Air Traffic operating under Instrument Flight Rules with civil Air Traffic Controllers. This requirement is extremely difficult to quantify and no feedback was provided by the General Aviation sector during the 2 consultation periods. Therefore, when estimating costs for this sector, broad assumptions have had to be made. Mindful of the applicability and exemption criteria that are set out in the Exemption Policy at Appendix 1, the vast majority of these aircraft would only need to equip with Mode S Elementary Surveillance, whichever of the 2 remaining options was implemented.

5.2 Compliance Costs for a Typical Business

5.2.1 The detailed assumptions and estimated costs for the equipage of the UK Commercial Air Transport and the General Aviation fleets with Mode S functionality

are at Appendices 6 and 7 respectively. Due to the applicability and exemption criteria, commercial air transport operators should be able to equip the vast majority of aircraft within scheduled maintenance periods. Therefore, the high costs associated with 'special inputs' can be minimized. In addition, most General Aviation aircraft will only need to equip with Mode S Elementary Surveillance under both remaining options. Therefore, the equipage costs for most typical General Aviation business will not be significantly different for Option 3 than would be required for Option 2.

5.2.2 The cost of replacing the NATS radars with a Mode S capability is estimated to be between £120M to £150M. However, this will occur even if Mode S is not implemented in the UK and, therefore, these costs are not a direct consequence of this proposal. There will be costs associated with modifying ATC systems and controller displays but this cannot be quantified accurately and quantitative inputs from industry were not received during the consultation periods. MOD is equipping the vast majority of its fleet with Mode S capable transponders as part of a wider upgrade of its IFF capability. The cost of this military equipage that is directly attributable to Mode S is not known but will now occur independently of this proposal being approved.

5.2.3 Mindful of the lack of substantial quantitative inputs received from industry during the consultation periods, the cost of equipping aircraft to meet the 2 options has been based on some very broad assumptions. The 'High' calculations included in the detailed cost estimates in Appendices 6 and 7 are worst-case scenarios and the CAA believes that the actual costs could be substantially less.

5.2.4 **Option 2**. The estimated equipage costs for aircraft to meet the requirements of Option 2 are as follows:

Modern Passenger Aircraft (e.g. B777)	£2,000 (modify existing transponder) to £20,000 (new transponder)
Older Passenger Aircraft (e.g. B737)	£7,000 (modify existing transponder) to £32,000 (new transponder)
Small Business Jet (e.g. Cessna CJ1/2)	£2,600 (modify existing Transponder to £20,000 (new transponder)
Light Aircraft (less than 5,700kg)	£2,600 to £6,000

The estimated total cost to a typical aviation business for Option 2 would be as follows:

Large Commercial Airline (40-70 aircraft)	£80,000 to £2M (Depending on the age of the fleet.)
Small Commercial Airline (10-20 aircraft)	£20,000 to £640,000 (Depending on the age of the fleet.)
General Aviation Business (5-10 aircraft)	£13,000 to £60,000 (Depending on the size and type of aircraft operated.)
Private Recreational Pilot	£2,600 to £6,000

5.2.5 **Option 3**. The estimated equipage costs for aircraft to meet the requirements of Option 3 are as follows:

Modern Passenger Aircraft (e.g. B777)	£12,000 (modify existing transponder) to £28,500 (new transponder)
Older Passenger Aircraft (e.g. B737)	£42,000 (modify existing transponder) to £60,000 (new transponder)
Small Business Jet (e.g. Cessna CJ1/2)	£20,000 (modify existing Transponder to £40,500 (new transponder)
Light Aircraft (less than 5,700kg)	£2,600 (Elementary Surveillance) to £25,000 (Enhanced Surveillance)

The estimated total cost to a typical aviation business for Option 3 would be as follows:

Large Commercial Airline (40-70 aircraft)	£300,000 to £4M (Depending on the age of the fleet.)
Small Commercial Airline (10-20 aircraft)	£120,000 to £1M (Depending on the age of the fleet.)
General Aviation Business (5-10 aircraft)	£13,000 to £400,000 (Depending on the size and type of aircraft operated.)
Private Recreational Pilot	£2,600 to £40,500

5.3 Total Compliance Costs

5.3.1 Total compliance costs will mainly comprise aircraft equipage, maintenance, ATC system changes and training costs. The vast majority of the total costs will fall on the Commercial Air Transport sector and on ATC providers, with most of the airborne equipage costs being realized by 2007/8. All costs have been extremely difficult to quantify and there has been little feedback from industry during the consultation periods. Therefore, the estimated total costs have been calculated by making broad assumptions and by adding large margins on to the directly attributable aircraft equipage costs. The CAA therefore believes that actual total costs could be significantly less than the 'worst-case' figures estimated in this section.

5.3.2 **Option 2**. In the Revised Eurocontrol CBA, the total cost of implementing Option 2 in Europe between 2001 and 2017 was assessed as being approximately £699M (€1145M). The total amount attributable to the UK is not available and little quantitative cost data was received from industry during the 2 consultation periods. However, the CAA estimates that the overall cost of implementing Option 2 in the UK would be between £75M and £150M by 2017. Of this amount, the estimated overall costs for aircraft equipage is as follows:

Commercial Air Transport (Approximately 1000 UK-registered aircraft)	£1.8M to £28.5M
General Aviation (Approximately 400-1400 UK-registered aircraft affected)	£750,000 to £8M

5.3.3 **Option 3**. In the Revised Eurocontrol CBA, the total cost of implementing Option 3 in Europe between 2001 and 2017 was assessed as being approximately £872M (€1429M). The total amount attributable to the UK is not available and little quantitative cost data was received from industry during the 2 consultation periods. However, the CAA estimates that the total overall cost of implementing Option 3 in the UK would be between £100M and £200M by 2017. Of this amount, the estimated overall costs for aircraft equipage is as follows:

Commercial Air Transport (Approximately 1000 UK-registered aircraft but only 75% of these requiring Mode S Enhanced Surveillance)	£8.5M to £47M
General Aviation (Approximately 400-1400 UK-registered aircraft affected but only a small proportion of these requiring Mode S Enhanced Surveillance)	£2M to £12M

6 Consultation with Small Business: "The Litmus Test"

6.1 The Small Business Service, the British Chamber of Commerce and the Confederation of British Industries were contacted with a view to identifying suitable small businesses with which to consult on this regulatory proposal. As a result, many companies were issued with a copy of both the Initial RIA and Partial RIA documents. To try and capture as many small businesses as possible, the Partial RIA was issued to holders of Air Operators Certificates and to companies annotated in the UK CAA General Aviation Department and Flight Operations Department consultation distribution lists. Regrettably, very few quantitative responses were received from small aviation businesses during the consultation process.

7 Identify Any Other Costs

7.1 Eurocontrol have set up a Mode S Exemptions Co-ordination Cell (MECC) to handle the aircraft exemption applications that will result from the European implementation of Mode S. The UK CAA intends to make use of this facility for UK operators that require exemptions to operate both in Europe and the UK. However, there may be additional costs to the CAA through the requirement to employ additional staff for the issuing of purely national exemptions and certifications. A mechanism already exists within the CAA for processing exemptions within the current existing national transponder carriage requirements. Although this regime would be used to process UK national Mode S exemptions, additional temporary staff might need to be employed during the 2-year Transition Period to handle an increased workload. The cost of employing these staff is estimated to be in the region of £30,000 per year.

7.2 There may be some additional costs involved with training aircrew, Air Traffic Controllers and maintenance staff to use, equip and maintain Mode S systems. In addition, businesses could incur costs associated with updating manuals and providing logistics during the embodiment programme. Furthermore, there will be costs to operators associated with replacing spares and the subsequent loss in value of currently held stock. Unfortunately, no quantitative data was submitted for these areas during the consultation periods but the large margins have included in the overall estimated costs to take account of these issues.

8 Issues of Equity and Fairness

8.1 It is envisaged that this regulation would have a greater financial impact on the smaller Commercial Air Transport operators and General Aviation businesses. However, the Exemption Policy at Appendix 1 would alleviate some of this burden. Furthermore, the cost required to meet the mandatory equipage of aircraft and ATC systems comes at a time when the aviation industry has undergone a severe financial downturn. The application of the airborne exemption principles would therefore be applied realistically to match the deployment of Mode S in the ground ATC systems. It is recognized that, as many of the benefits of Mode S are safety related, some operators may struggle to devise a business case for the purchase of Mode S equipment. In addition, at a time of restricted defence expenditure, the MOD would be required to divert financial resources to upgrade military aircraft and its own ground SSR infrastructure in order to permit continued peacetime operations in UK airspace. However, co-ordinated European exemption criteria will also be applied to military aircraft. Finally, without the introduction of Mode S, ACAS users will continue to be denied the full system and capacity benefits and protection that would be afforded to flights in a wholly Mode S environment.

8.2 **Competition Assessment.** In order to assess whether or not the proposed regulatory options will have an impact on competition within the UK, the CAA has first had to identify specific aviation markets that may be affected. The CAA has identified several markets where the application of the Office of Fair Trading's (OFT) Competition Filter suggested that there might be potential competition concerns with these markets. A detailed analysis of the competition issues considered for these markets is attached at Appendix 2. Due to the lack of quantitative data received from industry during the consultation periods, the CAA has had to make some broad assumptions about the markets for which it does not have readily available access to economic information. Overall, the CAA does not consider that competition in any sectors of the aviation industry would be adversely affected by this regulatory requirement. Notwithstanding, it recognises that the proportional financial impact on regional operators and General Aviation will be greater than that for large airlines and low cost carriers. In addition, although the proposed regulatory change would result in an increase in demand for Mode S installation to be undertaken by aircraft maintenance and support businesses, no distortion of the healthy competition already existing within this market is anticipated. Nevertheless, it is recognized that this regulatory change would generate increased demand for Mode S equipment. Notwithstanding this, the impact upon what is understood to be a market already subject to healthy competition is likely to be minimal, as equipage would be spread over a number of years in accordance with the Transition Period and associated Exemption Policy. The OFT has been consulted on these issues throughout the RIA process.

8.3 **Exemption Policy.** A draft UK exemption policy has been devised to provide alleviation from the requirements for some types of aircraft to equip with Mode S equipment or to provide full Mode S Enhanced Surveillance functionality. This is attached at Appendix 1 for information. The policy recognizes issues of technical feasibility to incorporate Mode S into certain older airframes and it is being co-ordinated with the aviation authorities of those European neighbours also intending to implement Mode S. The application of the policy would balance the cost of equipage against hours that aircraft would spend in the notified airspace. The effect that non-compliance would have on the realization of safety and capacity benefits by the aviation industry would also be calculated. Nevertheless, the policy aims to realize the benefits provided by Mode S at the earliest opportunity.

8.4 **Transition Period.** The implementation of Mode S in the UK is a major undertaking and will require a suitable period of transition. A 'Transition Period' is recognized as best practice within the aviation industry and this will be co-ordinated with European partners. The application and implication of the 'Transition Period' is explained more fully in the Exemption Policy at Appendix 1. Currently, 2-year Transition Period for this proposal is being planned from 31 March 2005 to 31 March 2007.

9 Consultation With Industry

9.1 Throughout the consultation that has been conducted on this proposal, the CAA has adhered to the consultation criteria contained in the Cabinet Office Code of Practice. Initial notification of the proposals was published in Aeronautical Information Circulars in 1989, 1997 and 2001. The CAA also published a consultation paper in January 2000, which set out broader information on the future employment of SSR in the UK. Moreover, the CAA has conducted informal consultation and briefings on this proposed regulation over the last few years within the National Air Traffic Management Committee (NATMAC) forum and other departmental consultation fora. Briefings to many individual organizations, such as PPL/IR Europe, British Airways, MOD and AOPA have also been undertaken. One-to-one briefings have also been given to aviation journalists to enable them to include factual information in articles published in aviation journals. Furthermore, through Eurocontrol, organizations such as the International Air Transport Association, the Association of European Airlines and the International Aircraft Operators and Pilots Association have also been consulted.

9.2 An initial RIA document was issued for formal consultation on 31 October 2002. A total of 28 external replies were received during this first formal consultation period and a summary of these responses is at Appendix 3. As a result of this consultation, 2 out of the 4 original options were discounted and several areas of the proposal were reviewed and clarified. A Partial RIA was then issued with a Competition Assessment on 20 January 2004. A total of 14 responses were received during this second consultation period and a summary of these responses is at Appendix 4. Unfortunately, very little quantitative data on the costs and benefits of Options 2 and 3 was received from the UK industry during the consultation periods. In particular, only a handful of responses were received to the specific questions that were posed in the Partial RIA. Although the costs for the equipage of the ground ATC infrastructure were not provided, these will mainly only affect NATS (En Route) plc and the responses from this company to the Mode S proposals were positive and very supportive. However, as a result of this consultation the detailed applicability criteria for aircraft equipage were reviewed and simplified, and the proposed regulatory amendments were clarified. Furthermore, additional consultation was then initiated with PPL/IR Europe to develop estimated impact costs for the General Aviation sector. These have been included at Appendix 7.

10 Enforcement, Sanctions, Monitoring and Review

10.1 The CAA, through the NATS (En Route) plc Licence process, would ensure that the appropriate Mode S SSR ground infrastructure and enabled ATC services would be provided. Through its responsibility to issue permits under ANO 2000 Article 113, the Department for Transport could enforce the requirement for operators of foreign registered public transport aircraft to equip with Mode S, before being allowed to fly in

UK airspace. Similarly, permits for foreign registered aircraft conducting aerial work could be issued under ANO 2000 Article 115. The issue and renewal of Certificates of Airworthiness to aircraft operators in the UK and the conduct of 'Ramp' inspections of aircraft to confirm equipage would supplement this process. Staff from the CAA's Safety Regulation Group conduct both of these functions. Furthermore, the Cabinet Office-sponsored National IFF/SSR Policy Board conducts both the licensing of SSR radars and the real-time monitoring of the SSR frequencies. It is considered that these mechanisms will be sufficient for monitoring the effectiveness of this regulation.

11 Summary and Recommendation

11.1 Due to the widespread deployment of Mode S systems across the rest of Europe it has not been possible to accurately identify the costs and benefits to UK industry that will directly attributable to this regulatory proposal. Indeed, many aircraft operators will need to equip to meet the requirements of Option 3, whether or not this proposal goes ahead. Furthermore, very little quantifiable data on equipage costs associated with this proposal was submitted by industry during the consultation periods. Therefore, the CAA has had to make broad assumptions and add large margins to the estimated costs of this regulation.

11.2 By 2017, the estimated cumulative costs and benefits for the proposed Options 2 and 3 at net present value are as follows:

Option	Costs	Benefits
2	£75-£150M	£500M-£800M
3	£100-£200M	£1500-£1800M

A significant proportion of these costs and benefits will relate to the commercial airline sector and ATC providers. Furthermore, most of the costs will have to be borne by 2008. Much of the cost to NATS (En Route) plc and MOD will occur whether or not these options are implemented, as considerable investment has already been committed. The estimated cost to the General Aviation sector will be between £750,000 to £8M for Option 2 and £2M to £12M for Option 3. However, it is thought that the actual cost would be considerably less than the worst-case estimate. It is this industry sector that includes the vast majority of the small businesses that would be affected by this regulation. Most of the benefits for General Aviation would be related to safety and continued interoperability with commercial airlines in the increasingly congested airspace to which this regulation would apply.

11.3 The CAA is minded to recommend to the Secretary of State for Transport that the Air Navigation Order be amended to adopt Option 3, the implementation of SSR Mode S Enhanced Surveillance in notified major terminal and en route controlled airspace from 31 March 2005. This would mitigate against all the safety and capacity risks associated with the current SSR system and provide a foundation for the further introduction of emerging technology as and when it becomes available in the future. The proposed regulatory amendments are at Appendix 8.

12 Declaration

I have read the Regulatory Impact Assessment and I am satisfied that the benefits justify the costs.

Signed:

……

Date: 17 February 2005

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Appendix 1

UK MODE S EXEMPTION POLICY

IFR FLIGHTS OPERATING AS GAT IN NOTIFIED TMA AND EN ROUTE MODE S AIRSPACE FROM 31 MARCH 2005

Version 1.0

Important Note

The CAA has made many of the documents that it publishes available electronically (in addition to traditional printed format). Where practical, the opportunity has been taken to incorporate a clearer revised appearance to the documents. Any significant changes to the content of this document will be shown in the Explanatory Note. If no such changes are indicated the material contained in this document, although different in appearance to the previously printed version, is unchanged. Further information about these changes and the latest version of documents can be found at www.caa.co.uk.

17 February 2005

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The latest version of this document is available in electronic format at www.caa.co.uk, where you may register for e-mail notification of amendments.

Printed copies and amendment services are available from: Documedia Solutions Ltd. 37 Windsor Street, Cheltenham, Gloucestershire, GL52 2DG.

List of Effective Pages

Contents

Explanatory Note

1 Introduction

1.1 The purpose of this document is to detail the Exemption Policy for the implementation of Mode Select (Mode S) for Instrument Flight Rules (IFR) flights operating as General Air Traffic (GAT) in notified UK Terminal Manoeuvring Area (TMA) and En Route airspace from 31 March 2005.

1.2 The document sets out the policy and procedures for providing aircraft operators with alleviations from the requirement to equip with Mode S transponders on aircraft employed on applicable flights within the UK Flight Information Regions (FIRs) and Upper Information Regions (UIRs). It provides essential information to enable organizations to understand the equipage requirements, timescales and the procedures for applying for exemptions.

1.3 This is a living document and it will be revised at intervals to take account of changes in regulations, progress in the implementation of Mode S in ground systems, feedback from industry, and recognized best practice. Should you have any comments concerning the content of this document or wish to obtain subsequent amendments, contact addresses are given on the inside cover of this publication.

2 Technical Changes

The following Sections have been amended as shown:

Section	Page	Description

Amendment Record

Amendment Number	Amendment Date	Incorporated by	Incorporated on

Foreword

Secondary Surveillance Radar (SSR) Mode Select (Mode S) is a civil aviation initiative to overcome deficiencies associated with SSR Mode A (Military IFF Mode 3) and Mode C, currently in use by Air Traffic Services (ATS) within the European Core States. The successful introduction of Mode S will enable more efficient airspace utilization and it will improve safety while coping with increased traffic growth. The implementation of Mode S will be a phased enhancement to existing radar based surveillance services in Europe over a period of time. Consequently, a Transition Period will be implemented during which exemptions will be granted to aircraft operators who, despite best endeavours, are unable to equip their aircraft by the required implementation dates.

Mindful of the need to realize the benefits of Mode S as quickly as possible, but also taking into account the current difficulties being faced within the aviation industry, the award of exemptions will be necessarily sympathetic and realistic. The requirements for airborne equipage will be managed to take account of the progress made by Air Navigation Service Providers in deploying and using Mode S within the ground Air Traffic Management infrastructure. Consequently, any delays in the installation of Mode S on the ground will be taken into account when assessing any continued need or requests for airborne exemptions.

The policy set out in this document will be reviewed before the end of the Transition Period. If necessary, exemptions will then continue to be granted after the Transition Period to take account of prevailing circumstances within the industry. In certain circumstances, the CAA may award initial exemptions that are valid for periods beyond the end of the Transition Period.

Section 1: Overview

1 Overall Objectives

1.1 The UK Mode S Exemption Policy for IFR flights operating as GAT[1] in notified TMA and En Route Mode S airspace from 31 March 2005 supports the following objectives:

a. The Policy will encourage fitment of Mode S in aircraft while being realistic about the equipage timescales and the implementation of Mode S in the ground systems.

b. The Policy will balance the 'out-of-service'[2] dates for civil and military aircraft with the implementation and coverage level of Mode S in the civil ground systems.

c. The Policy will balance the requirement for limited access to notified TMA and En Route Mode S airspace with cost of equipage and the level of disruption that non-compliance will cause to service providers and compliant commercial air transport operators.

d. All exemptions will be made on a case-by-case basis[3].

e. In all but exceptional circumstances[4], exemptions will be temporary in nature.

f. The Policy will aim to realize the benefits of Mode S implementation in the UK as early as possible.

1.2 Where possible, the Policy will be co-ordinated and harmonized with the exemption policies of the other European partner States implementing Mode S. This is consistent with the provisions of ICAO Regional Supplementary Procedures[5]. For information, the current Mode S equipage requirements for other European States have been included in Section 6.

1.3 The Exemption Policy will take into account and be consistent with the ACAS II mandates.

2 Transition Period

2.1 A 2-year Transition Period from 31 March 2005 to 31 March 2007 will be applied. This Transition Period is the period during which these exemption principles will be applied fully to facilitate the transition to SSR Mode S Surveillance in the notified TMA and En Route airspace. At the end of the period, the exemption principles and the Policy will be reviewed and redefined as necessary.

[1] GAT is defined as flights conducted in accordance with the Regulations and Procedures for flight promulgated by the CAA and operating under the control or authority of the Civil ATS organization.

[2] 'Out of Service' is taken to mean that the aircraft is scheduled to be scrapped, returned to the Lessor, sold from the fleet, re-routed to non-ECAC airspace or there is a reduction in expected operational service to less than 30 hours per year in the notified airspace.

[3] A group of identical aircraft may be considered as an individual case, whereby the operator would be required to submit a single exemption request together with a detailed list of the particular aircraft.

[4] There may be circumstances whereby aircraft are awarded exemptions for the remaining life of the airframe.

[5] ICAO Doc 7030/4-EUR, Part 1, Rules of the Air, Air Traffic Services and Search and Rescue, 28 August 2002, Amendment 204.

2.2 Some exemptions will continue to be granted after the end of the Transition Period. However, these are likely to be necessarily more restrictive in order to ensure that the benefits of Mode S can be delivered as quickly as possible. In addition, it can be foreseen that a limited number of exemptions may need to be granted that will have a period of validity beyond the end of the Transition Period.

2.3 During the 2-year Transition Period, any exemptions will be temporary in nature. The aim will be to allow reasonable time for operators to achieve compliance within the bounds of sensible and economic compliance. Operators will be required to provide documentary evidence that plans have been made to equip aircraft with the relevant Mode S functionality as soon as possible after the implementation date. Every effort will be made to award appropriate exemptions to those operators who have a clear intent to equip their aircraft but are experiencing genuine technical difficulties or supply problems.

Section 2: General Principles

1 Applicability Criteria

1.1 The applicability criteria for determining the UK Mode S equipage requirements for IFR GAT flights in notified TMA and En Route airspace have been included in a matrix format at Section 6. In detail, the applicability criteria are as follows:

a. **All fixed-wing aircraft** having **either** a maximum take-off mass in excess of 5,700kg **or** a maximum cruising true airspeed capability in excess of 463 km/h (250 kts)[6], and which require **regular access**[7] to notified TMA and En Route Mode S airspace[8] under IFR and operating as GAT from 31 March 2005, must have **Mode S Enhanced Surveillance functionality**[9] in accordance with ICAO Annex 10 Amendment 77 International Standards and Recommended Practices (SARPs), Volumes III and IV.

b. **All fixed-wing aircraft** having a maximum take-off mass of 5,700kg or less **and** a maximum cruising true airspeed capability of 463 km/h (250 kts)[6] or less, and **all rotary-wing aircraft**, which require **regular access** to notified TMA and En Route Mode S airspace under IFR and operating as GAT from 31 March 2005, must have a minimum of **Mode S Elementary Surveillance functionality** in accordance with ICAO Annex 10 Amendment 77 SARPs, Volumes III and IV. However, compliance with Mode S Enhanced Surveillance functionality, or partial compliance where full compliance is not possible, will be encouraged.

1.2 This Policy is not applicable to flights that only require access to notified TMA and En Route Mode S airspace under Special Visual Flight Rules (SVFR), or who are not otherwise operating under the rules for IFR GAT flights. These types of flights do not require Mode S functionality while operating in the notified TMA and En Route Mode S airspace from 31 March 2005. Consequently, operators of these flights will not need to apply for an exemption from the requirement to provide Mode S functionality. However, from 31 March 2008 a minimum of Mode S Elementary Surveillance could be required to comply with the intended future implementation of Mode S for flights conducted outside of the notified TMA and En Route Mode S Enhanced Surveillance airspace.

1.3 Aircraft equipped with either Mode S Elementary or Enhanced Surveillance functionality must be capable of supporting operations with ground interrogators that are using Surveillance Identifier (SI) Codes.

2 Technical Feasibility

2.1 The assessment of applications for exemptions on grounds of technical feasibility will take into account the estimated annual flying hours of individual aircraft in the

[6] For the purposes of assessing applicability, the maximum cruising true airspeed capability shall be taken from the Performance Section of the Aircraft Flight Manual at MTOM and under Internal Standard Atmosphere conditions. Where this information is not available, the calculation shall be based on the maximum normal operating values of permissible altitude and airspeed (i.e. V_{NO} or V_{MO}/M_{MO} as applicable) quoted in the Limitations section of the Aircraft Flight Manual.

[7] For guidance purposes only, regular access is normally considered as being an average total flying time of in excess of 30 hours annually per airframe spent as IFR flights operating as GAT in the notified European Mode S Enhanced Surveillance airspace.

[8] The applicable airspace will be notified in the UK AIP.

[9] Mode S Enhanced Surveillance includes all the functionality provided by Mode S Elementary Surveillance in addition to the Downlinked Aircraft Parameters (DAPs) that are set out in AIC 88/2001 (Yellow 65) and listed in NPA 20-12a.

relevant airspace. It will also take account of the impact that non-compliance[10] will have on the RF environment and the safety and capacity benefits that Mode S provides.

2.2 Exemptions may be granted to operators of aircraft whose avionics do not support the extraction and transmission of the full set of Downlinked Aircraft Parameters (DAPs) that are listed in NPA 20-12a. This is termed Mode S Enhanced Surveillance Partial Capability. However, the assessment of exemptions for individual DAPs will take into account the estimated annual flying hours of the individual aircraft in the relevant airspace, together with the impact that non-compliance will have on the safety and capacity benefits that Mode S provides. Exemptions for Mode S Enhanced Surveillance Partial Compliance will be also subject to consultation with Air Navigation Service Providers (ANSPs).

2.3 Where appropriate, exemptions for older airframes, which will never be able to comply with the Mode S equipage requirements, will be granted to cover the remaining lifetime of the aircraft. These exemptions will be also subject to consultation with Air Navigation Service Providers (ANSPs).

3 Aircraft Equipped With Legacy Transponders

3.1 During the Transition Period, temporary exemptions from the requirements to provide Mode S functionality may be granted for aircraft that are equipped with serviceable SSR Mode A and C transponders. Nevertheless, when assessing these applications the following factors will be taken into account:

a. The progress of the installation and coverage of Mode S in the ground systems.

b. The level of disruption that an exempted aircraft would cause to ANSPs and Mode S compliant aircraft.

c. The availability of certified Mode S transponders from manufacturers.

d. The impact that exemptions will have, both in isolation and cumulatively, on the early realization of the benefits of Mode S to the aviation industry. This will include assessments on the likely effects that the exemptions would have on competition in the various aviation markets.

3.2 For aircraft equipped with Mode S transponders under the ACAS II equipage requirements, the transponders must be modified to support the use of SI Codes. Exemption applications for Mode S transponders purely on the grounds of a lack of SI Code functionality will not be granted after the end of the Transition Period.

3.3 For aircraft equipped with Mode S transponders that are compliant with ICAO Annex 10 SARPs Amendment 73, Volumes III and IV, a sympathetic approach will be taken during the Transition Period to the award of exemptions from the requirement to comply with Amendment 77.

3.4 Exemptions will not be granted for aircraft equipped with Mode A/C or Mode S transponders that are not ICAO compliant.

[10] An aircraft may be considered Mode S Enhanced Surveillance Compliant if the full list of DAPs, as listed in NPA 20-12a, is available for downloading to the ground. However, aircraft that comply with the GAMMA configuration (Track Angle Rate not available) but which can comply with all other DAPs may also be considered to be Mode S Enhanced Surveillance Compliant.

4 Aircraft Equipped With Dual Transponders

4.1 During the Transition Period, operators of aircraft fitted with dual transponders will only be expected to upgrade one transponder to meet the Mode S equipage requirements. Notwithstanding, operators must be aware that it may not be possible for ANSPs to offer the same level of service to these aircraft if the single Mode S transponder becomes unserviceable in flight. Failures of Mode S transponders before take-off will be managed under similar procedures to those currently detailed in the UK AIP ENR 1.6.2.

4.2 During the Transition Period, the arrangements for aircraft fitted with dual transponders will be reviewed to take account of the factors listed in para 3.1 above. At the end of the Transition Period, the policy for these arrangements may then be updated to require that all transponders provide the appropriate Mode S functionality.

5 Level of ATM Service

5.1 Operators of non-compliant aircraft must be aware that they may not be provided with the same level of ATM service as that being offered to Mode S compliant aircraft. In certain circumstances, ANSPs may refuse to provide a service to non-compliant aircraft where to do so would either compromise safety or result in significant penalties to the operators of compliant aircraft. Alternatively, restrictions on the time during which access to airspace will be granted may have to be applied.

6 Flight Testing and Delivery of Aircraft

6.1 Exemptions will be granted to aircraft operators under existing regulations for flights conducted for the purpose of flight testing, delivery and for transit into and out of maintenance bases.

Section 3: Specific Exemptions

1 Mode S Enhanced Surveillance Requirement

1.1 Exemptions from the requirement for IFR flights operating as GAT to have full Mode S Enhanced Surveillance functionality in notified TMA and En Route Mode S airspace from 31 March 2005 will be assessed in accordance with the processes set out at Sections 7 and 8. In general, aircraft will be exempt from the requirements to fit Mode S Enhanced Surveillance functionality where justification on the following grounds is provided:

a. The incorporation of Mode S Enhanced Surveillance functionality into an aircraft type is **not technically feasible**[11].

b. The aircraft has an **out-of-service date of 31 December 2007 or earlier**.

c. There will be **delays in equipage** of the aircraft because of factors that are **beyond the control** of the operator. However, operators will have to undertake to equip the aircraft as soon as practicable after 31 March 2005. To this end, operators will be expected to provide appropriate documentary evidence that equipment orders and fitment plans have been put in place.

d. The aircraft requires only **occasional**[12] **access** to the airspace.

1.2 When considering requests for exemptions from the requirement to provide full Mode S Enhanced Surveillance, the CAA will assess the capability of the aircraft in the following areas:

a. Whether or not the aircraft could provide at least some of the required DAPs.

b. Whether or not the aircraft is equipped with Mode S Elementary Surveillance or is capable of providing the functionality.

c. Whether or not the aircraft will be fitted with a serviceable Mode A/C transponder during the period of the exemption.

1.3 During the Transition Period, most exemptions will only be valid until 31 March 2007. In special cases, exemptions for longer periods may be granted. Furthermore, following any subsequent reviews of the policy, some exemptions may be extended after the Transition Period has ended.

2 Mode S Elementary Surveillance Requirement

2.1 Exemptions from the requirement for IFR flights operating as GAT to have Mode S Elementary Surveillance functionality in notified TMA and En Route Mode S airspace from 31 March 2005 will be assessed in accordance with the process set out at Section 8. In general, aircraft will be exempt from the requirements to fit Mode S

[11] Aircraft operators will not be expected to upgrade the existing avionics in an aircraft just to provide the required Mode S functionality. Technical feasibility will be judged on the ability to extract the required information to support the DAPs from existing avionics. However, where avionics are upgraded for other reasons, full Mode S functionality will be required.

[12] For guidance purposes only, occasional access is normally considered as being an average total flying time of 30 hours annually or less per airframe spent as IFR flights operating as GAT in the notified European Mode S Enhanced Surveillance airspace.

Elementary Surveillance functionality where justification on the following grounds is provided:

a. The incorporation of Mode S Elementary Surveillance functionality into an aircraft type is **not technically feasible**.

b. The aircraft has an **out-of-service date of 31 December 2007 or earlier**.

c. There will be **delays in equipage** of the aircraft because of factors that are **beyond the control** of the operator. However, operators will have to undertake to equip the aircraft as soon as practicable after 31 March 2005. To this end, operators will be expected to provide appropriate documentary evidence that equipment orders and fitment plans have been put in place.

d. The aircraft requires only **occasional[13] access** to the airspace.

2.2 When considering requests for exemptions from the requirement to provide Mode S Elementary Surveillance, the CAA will assess whether or not the aircraft will be fitted with a serviceable Mode A/C transponder during the period of any exemption.

2.3 During the Transition Period, most exemptions will only be valid until 31 March 2007. In special cases, exemptions for longer periods may be granted. Furthermore, following any subsequent reviews of the policy, some exemptions may be extended after the Transition Period has ended.

[13] For guidance purposes only, occasional access is normally considered as being an average total flying time of 30 hours annually or less per airframe spent as IFR flights operating as GAT in the notified European Mode S Enhanced Surveillance airspace.

Section 4: Applications for Exemptions

1 Assessment of Applicability

1.1 The decision making processes for determining the entitlement to Mode S exemptions for IFR flights operating as GAT in notified TMA and En Route Mode S airspace from 31 March 2005 are at Sections 7 and 8. The CAA will use this process when assessing all applications for exemptions. Aircraft operators should use these flow diagrams in conjunction with Sections 2 and 3 in order to identify whether or not their aircraft may qualify for an exemption from the Mode S equipage requirements.

2 Application Procedure

2.1 The policy contained within this document has been co-ordinated with the regulatory authorities of France and Germany, which are also mandating Mode S Enhanced Surveillance in specified TMA and En Route airspace. In order to administer applications for Mode S exemptions from operators within the 3 States, a Mode S Exemptions Co-ordination Cell (ECC) has been set up within Eurocontrol HQ at Brussels. This cell, although managed by Eurocontrol, will function under the regulatory control of the individual States. The State regulatory authorities have provided the cell with the co-ordinated exemption principles against which all applications will be assessed. Operators of aircraft that are subject to the EHS requirements are required to apply to the ECC

2.2 Aircraft operators who believe that they may be entitled to a Mode S exemption will, in the first instance, need to submit an application to the ECC for an exemption and/or declare that the aircraft is compliant by 30 Jun 05 at the latest. The ECC will then assess the application and issue any exemptions on behalf of the state regulators. A suitable application form has been developed and promulgated. Further information on the ECC and the application process can be found at http://www.eurocontrol.int/mode_s.

Section 5: Compliance Monitoring

1 Overview

1.1 The CAA, with the support of additional resources provided by the National IFF/SSR Committee (NISC) and in conjunction with Eurocontrol, regulatory authorities from other Mode S partner states, the Department for Transport and NATS (En Route) Ltd, will monitor the equipage and operation of Mode S transponders in UK airspace.

2 Airborne Monitoring Projects

2.1 Eurocontrol has set up an Airborne Monitoring Project with which to assess the compliancy and serviceability of Mode S transponders being fitted to aircraft fleets. This enables statistics to be produced on airborne capabilities as reported by Mode S transponders.

2.2 In addition to the Transponder Capability Report function that Mode S provides, monitoring tools are also now available that can be connected in real time to Mode S radars and flight plan systems. These can record and analyse Mode S parameters being received from suitably equipped aircraft automatically. In particular, the following aspects can be monitored:

a. Parameters such as speed, heading, roll and true track angles and aircraft intention.

b. Invalid or duplicated ICAO Mode S 24-bit Aircraft Addresses, absent or invalid Aircraft Identification or erroneous SI Code capability.

2.3 An anomaly reporting process has also been established by Eurocontrol to facilitate the investigation of problems with Mode S transponders. Regular reports are sent directly to the airlines and regulatory authorities concerned in order that equipage can be monitored and corrective action taken.

3 Procedural Monitoring

3.1 Through the Aircraft Register and the allocation of 24-bit Aircraft Addresses, the CAA will monitor the progress and compliancy of Mode S equipage in UK registered aircraft. Furthermore, with the assistance of the Department for Transport, the equipage of foreign registered aircraft can be monitored through the permit system.

3.2 The regulatory authorities and ANSPs of those European States who are implementing Mode S in their airspace are co-operating procedurally and exchanging information on Mode S equipage and monitoring activity in their states.

4 Certification and Inspections

4.1 Through the airworthiness certification process, the initial instalment of Mode S transponders is being monitored closely. In addition, periodic testing of certified Mode S systems will be implemented to ensure that transponders continue to operate correctly. Periodic ramp testing may also be undertaken where a Mode S transponder is suspected of either being non-compliant or unserviceable.

Section 6: Applicability Matrix For IFR GAT Flights

United Kingdom	
Aircraft Applicability	IFR GAT Flights in Notified TMA & ENR Airspace[1]
MTOM[2]>5,700 kg	**Enhanced Surveillance[3] from 31 Mar 05**
Maximum Cruising TAS[4]>250 kts	**Enhanced Surveillance from 31 Mar 05**
MTOM≤5,700 kg **AND** Maximum Cruising TAS≤250 kts[5]	**Elementary Surveillance from 31 Mar 05**

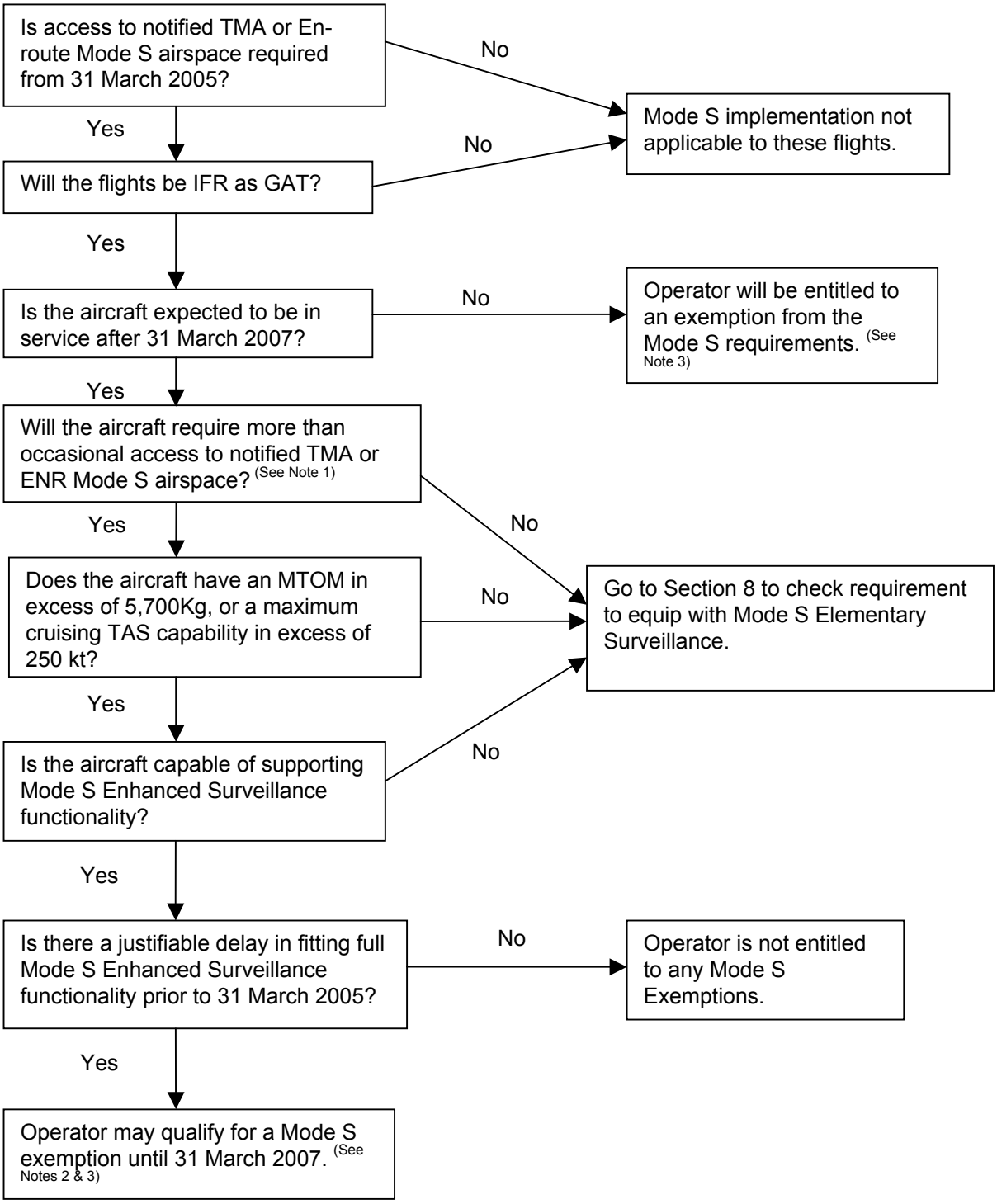
Netherlands, Belgium Luxembourg & Switzerland[6]	
Aircraft Applicability	IFR Flights
New Aircraft	**Elementary Surveillance from 31 Mar 04**
Retrofit of Aircraft	**Elementary Surveillance from 31 Mar 05**

France & Germany		
Aircraft Applicability	IFR Flights	IFR GAT Flights in Specific Notified TMA & ENR Airspace
MTOM>5,700 kg	**Elementary Surveillance from 31 Mar 05[7]**	**Enhanced Surveillance from 31 Mar 05**
Maximum Cruising TAS>250 kts	**Elementary Surveillance from 31 Mar 05**	**Enhanced Surveillance from 31 Mar 05**
MTOM≤5,700 kg **AND** Maximum Cruising TAS ≤250 kts	**Elementary Surveillance from 31 Mar 05**	**Elementary Surveillance from 31 Mar 05**

Notes

1. A 2-year transition period will be applied to the milestones during which exemptions may be sought on a case-by-case-basis.
2. Maximum Take-off Mass.
3. Enhanced Surveillance incorporates all the functionality of Elementary Surveillance and provides additional data from the aircraft avionics.
4. For the purposes of assessing applicability, the maximum cruising true airspeed capability shall be taken from the Performance Section of the Aircraft Flight Manual at MTOM and under Internal Standard Atmosphere conditions. Where this information is not available, the calculation shall be based on the maximum normal operating values of permissible altitude and airspeed (i.e. V_{NO} or V_{MO}/M_{MO} as applicable) quoted in the Limitations section of the Aircraft Flight Manual.
5. Aircraft whose avionics do not support the extraction of Enhanced Surveillance DAPs and those aircraft that only require occasional access to Enhanced Surveillance airspace will also only require Elementary Surveillance.
6. This is the current status of the European plans but other states in addition to the UK, France and Germany may also decide to implement Mode S Enhanced Surveillance in specific notified TMA and En-route airspace.
7. New aircraft must be equipped by 31 Mar 04 for IFR flights.

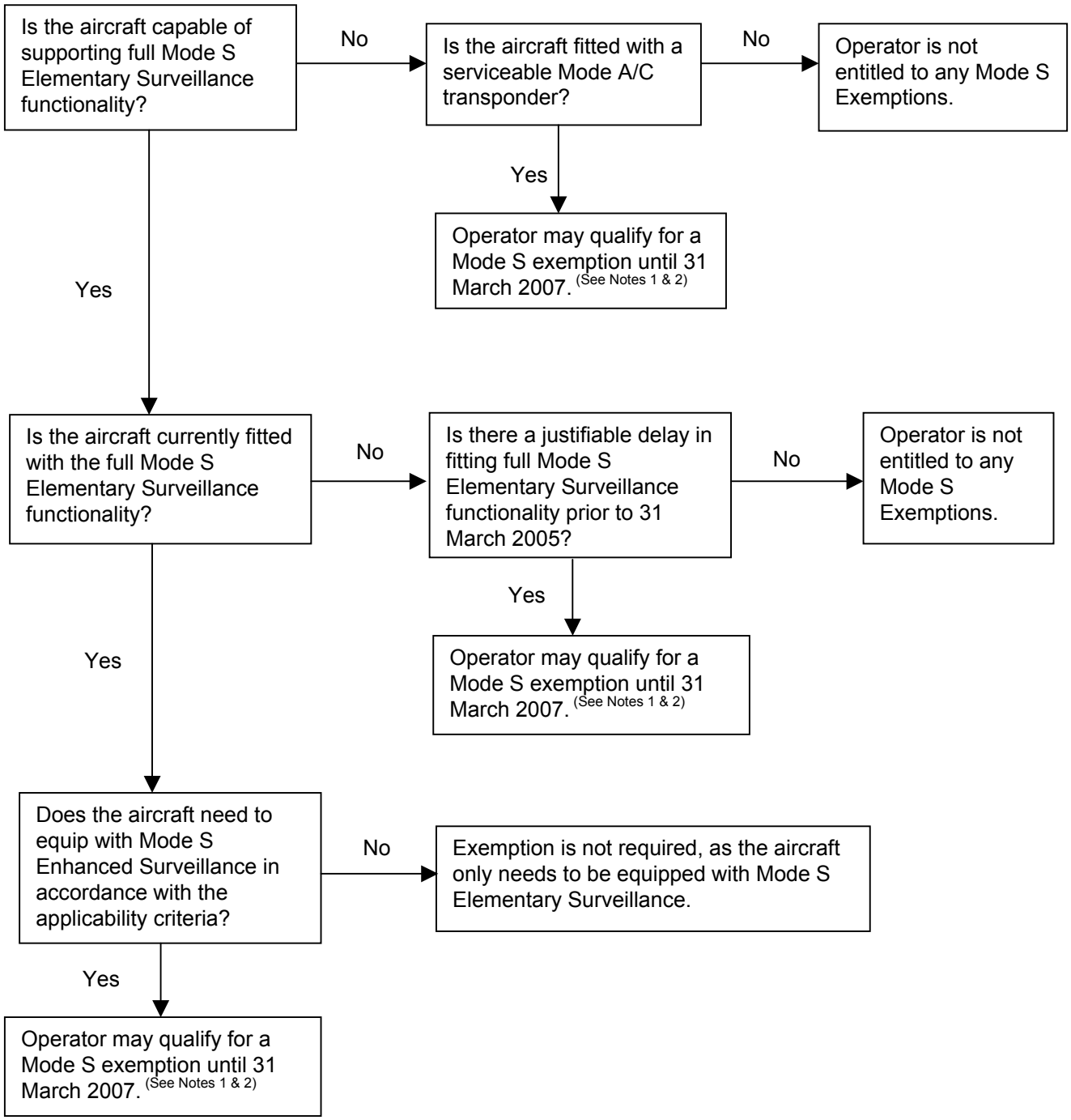
Section 7: Decision Making Process For Enhanced Surveillance Exemptions For Fixed-Wing IFR GAT Flights



Notes

1. For guidance purposes, occasional access is normally considered as being an average total flying time of 30 hours annually per airframe spent as IFR flights operating as GAT in the notified European Mode S Enhanced Surveillance airspace.
2. Operators must undertake to meet the requirements as soon as practicable after 31 March 2005 and provide documentary evidence of equipment orders and fitment plans.
3. Operators of non-compliant aircraft must be aware that they may not be provided with the same level of ATM service as that being offered to compliant aircraft. In certain circumstances, ANSPs may refuse to provide a service to non-compliant aircraft where to do so would either compromise safety or result in significant penalties to the operators of compliant aircraft.

Section 8: Decision Making Process For Elementary Surveillance Exemptions For IFR GAT Flights



Notes

1. Operators must undertake to meet the requirements as soon as practicable after 31 March 2005 and provide documentary evidence of equipment orders and fitment plans.
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Section 9: Glossary of Terms

ACAS	Airborne Collision Avoidance System
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
ANO	Air Navigation Order
ANP	Air Navigation Plan
ANSP	Air Navigation Service Provider
ARLS	Aeronautical Radio Licensing System
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CAA	Civil Aviation Authority
CONOPS	Concept of Operations
DAP	Downlink Aircraft Parameter (Also Directorate of Airspace Policy)
ENR	En Route
FIR	Flight Information Region
FLT ID	Flight Identity
GAT	General Air Traffic
IAS	Indicated Air Speed
IC	Interrogator Code
ICAO	International Civil Aviation Organisation
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
II CODE	Interrogator Identity Code
MECC	Mode S Exemption Co-ordination Cell
MODE S	Mode Select
MTOM	Maximum Take-off Mass
NATS	National Air Traffic Services Ltd
NERL	NATS (En Route) Ltd
NISC	National IFF/SSR Committee
RIA	Regulatory Impact Assessment
RF	Radio Frequency
SARPs	Standards and Recommended Practices
SI CODE	Surveillance Identifier Code
SSR	Secondary Surveillance Radar
SVFR	Special Visual Flight Rules
TAS	True Air Speed
TMA	Terminal Manoeuvring Area
UIR	Upper Information Region
VFR	Visual Flight Rules
VNO/VMO	Maximum Normal Operating Speed Expressed as Indicated Air Speed

Appendix 2

COMPETITION ASSESSMENT

Contents

COMPETITION ASSESSMENT

1 Introduction

1.1 The requirement for Mode S equipment in order to operate within specific commercially important areas of airspace will raise the costs both of those aircraft operators which choose to install the equipment and of those which do not install the equipment and which may therefore face more circuitous routeings. Commercial aircraft operators seem likely to take the first option and there may be an effect on airline competition. Non-commercial operators may choose the second option, which may influence their choice of base airport and hence may affect airport competition.

1.2 The cost of installing Mode S will vary by aircraft type but it is likely that the cost in unit terms will fall heaviest on the operators of smaller aircraft types. This could therefore affect airline competition by altering the market structure (because the impact of asymmetric costs may force some operators to exit and hence may increase industry or market concentration).

1.3 The proposed options are unlikely to affect long-haul markets, where operators use relatively large aircraft. The CAA's Initial Regulatory Impact Assessment (RIA) of 31 October 2002 therefore concentrated on short-haul aviation markets where small and large aircraft might compete. The Initial RIA identified four areas of operation within which competition was at most risk of being affected by the proposed regulatory options:

a. Short-haul passenger services (including routes to/from London City airport and other UK domestic and regional services where small and large aircraft compete).

b. Air cargo services.

c. Air taxi and air ambulance operations.

d. Pilot training schools.

1.4 The CAA now believes that it should add to this list the following areas of operation:

a. Corporate aircraft services.

b. "Aerial" work services.

1.5 In the initial RIA, the CAA invited all interested parties operating in the first four areas to provide feedback on the possible impact on competition. However, at that stage there was little response on this particular issue. Accordingly, in the Partial RIA the CAA included a preliminary analysis of the markets that may be potentially affected in the areas above based on publicly available data. Minimal feedback was, once again, received during the subsequent consultation period.

2 Short-Haul Passenger Markets

2.1 Effect on airline costs

2.1.1 It is estimated that the one-off cost of installing Mode S equipment on jet aircraft with between 100 and 400 seats will be in the order of £28,500 to £60,000 under Option 3, the highest cost option. Of this around a third is the cost of the equipment itself, a half the loss in revenue (less variable cost) from the required additional downtime for fitting the equipment, and the remainder the installation and administration cost. While the revenue loss is likely to be broadly proportional to the size of the aircraft, half the cost is fixed and relatively independent of aircraft size. Thus, the cost for an 18-seat aircraft might be in the order of £30,000 to £45,000. The cost of upgrading existing SSR technology is likely to be higher than the one off costs of installing Mode S equipment; however the differences are unlikely to be significant.

2.1.2 It is unlikely that the Mode S equipment will become technologically obsolete within the foreseeable future and the life span of the equipment is estimated to be 15 to 20 years. Aircraft age is important since the cost of installation depends on the status of the avionics already present in the aircraft. Also, although there may be some residual value in the transponder equipment, the bulk of the cost will be sunk once the aircraft has come to the end of its useful life. However, exemptions to the requirement will apply to those aircraft which have avionics sufficiently old for the installation of Mode S to be untenable or which are reaching the end of their operational lives[14].

2.1.3 The annual maintenance cost is estimated to be small, in the order of £250 a year.

2.1.4 Illustrative unit costs for non-exempt short-haul aircraft are set out in Table 1.

Table 1 - Costs of installing Mode S

Seats per aircraft		18	100
Cost per aircraft		£30,000	£50,000
Sectors per year		2,000	2,000
Assumed interest rate		5%	5%
Maintenance cost per year		£250	£250
Cost per sector seat			
if amortized over			
10	Years	£0.11	£0.03
20	Years	£0.07	£0.02

Source: CAA estimates based on limited industry data

2.1.5 Table 1 suggests that the cost impact per seat of Option 3 is small whether the comparison is between small and large non-exempt aircraft or between exempt and non-exempt aircraft. Any impact under Option 2 would be even less. The CAA recognises that funding the initial investment may be an imposition at a time when the airline industry is suffering from a number of difficulties but it seems doubtful if costs of this magnitude could have a significant long-run competitive impact.

[14] Full details of the Exemption Policy are at Appendix 1.

2.1.6 It is, however, possible that the costs per seat and per passenger may turn out to be somewhat greater than those estimated in Table 1. The following sections therefore analyse the possible relevant markets within the area of short-haul passenger services.

2.2 Effect on passenger markets

2.2.1 The starting point for defining the relevant market as regards the competition for air passengers is usually an Origin and Destination (OD) pair. Passengers will generally want to travel to a specific destination and may not be prepared to substitute another destination when faced with an increase in price. Therefore, every combination of a point of origin and point of destination can be a separate market. OD pairs are usually defined as city pairs. The definition may be narrower or wider than this if distinctions are drawn between different types of passengers such as time-sensitive and time-insensitive passengers or different types of air services such as direct and indirect flights. In some cases passengers (or some types of passenger) may not view the different airports serving a particular city as substitutes so that the relevant market may be narrowed to airport pairs rather than city pairs. On the other hand, leisure passengers, for example, may be less destination-specific than business passengers.

2.2.2 Air routes differ greatly in their density and distance and aircraft types also differ in their size and range capability. There are also economies of aircraft size and, under most circumstances, the unit costs of operation fall as aircraft size increases. Thus, particular aircraft types are generally seen as suitable for particular types of route. Although new technology is changing the picture somewhat, small aircraft are usually seen on short-distance regional routes where the market size does not allow the potentially better economics of larger aircraft to be exploited.

2.2.3 There are thus relatively few examples of scheduled air services where operators of small aircraft compete head-to-head with operators of relatively large aircraft. However, large and small aircraft may compete in the same city-pair markets. The greatest potential for this to occur is perhaps at London City airport where the services may compete with parallel services at Heathrow, Gatwick, Stansted and Luton and where the aircraft size at London City is restricted by operational and environmental restraints.

2.3 Services at London City

2.3.1 In March 2003 there were services from London City to Amsterdam, Belfast City, Berlin, Brussels, Dublin, Edinburgh, Frankfurt, Geneva, Glasgow, Hamburg, Isle of Man, Jersey, Luxembourg, Manchester, Paris CDG, Rotterdam and Zurich which competed with parallel services from other London airports.[15] The London City share of the London markets is normally less than 10% and is only about 3% on the densest markets such as Amsterdam and Paris. The exceptions are Rotterdam (where the London City share was 42% in 2001/2), Isle of Man (26%), and Luxembourg (19%).

[15] In addition there were services to Antwerp, Cardiff, Dundee, Paris Orly, and Swansea, which are only served at London City, and there was a service to Basle that is also served from Heathrow but by the same operator as at London City, Swiss.

2.3.2 Passengers at London City airport were last surveyed by the CAA in 2000. 65% of the passengers who used London City were travelling on business and the vast majority of these passengers travelled to the airport from surface origins in the centre/east of Greater London or from Essex or Kent. In contrast, only 42% of Heathrow's passengers in 2000 were travelling on business and Heathrow's business passengers are drawn from a wider catchment area than that of London City although 48% of UK business passengers and 64% of foreign business passengers had a surface OD in Greater London (the corresponding figures for London City are 79% and 89%).

2.3.3 In terms of passenger throughput, Heathrow with 63m passengers in 2002 is much larger than London City (1.6m passengers in 2002) and in terms of catchment area its coverage is much wider. Also, there is a capacity constraint that limits how much traffic London City can ever take. So, although London City will clearly draw on Heathrow's catchment area, it seems unlikely that prices at London City will affect those at Heathrow. For example, if an airline at Heathrow were to match a fares reduction at London City it would lose revenue on all the traffic from outside London City's catchment area and on that traffic from inside the London City area that either prefers Heathrow or that cannot use the limited capacity at London City.

2.3.4 In the converse situation where fares change at Heathrow it would seem likely London City operators would be influenced by that change although, given London City's distinctive catchment area, it is possible that they may not necessarily be obliged to match the change either exactly or instantly.

2.3.5 To address this issue, the CAA compared the air fares on a sample of routes at London City[16] with those on routes to the same destinations from Heathrow based on the fares in November 2002. The CAA then examined the way in which the fare relativity between Heathrow and London City had changed over time. It should, however, be noted that airfares are volatile and are difficult to compare because of different restrictions and availability so the conclusions can only be tentative.

2.3.6 The analyses of catchment area data and of fare relativities indicate that services at London City compete with those at other London airports but London City's share tends to be small and mainly confined to business passengers travelling from a quite specific catchment area. The bulk of London's business passengers travel through Heathrow, which draws on the London City catchment area. Heathrow is in general regarded as the price leader in the London market but although the prices of services from London City are similar to those from Heathrow they are not necessarily the same and the products are different.

2.3.7 This suggests that operators at London City offer a differentiated product, which allows them some scope for pricing freedom. Even if underestimated, the calculated differences in the cost per passenger resulting from the installation of Mode S is substantially less than the difference in the airport passenger charge at Heathrow and London City and the difference in flexible fares on a number of routes. Mode S equipment will raise the cost of entry but again the impact would seem likely to be small. The conclusion is therefore that the effect of the proposed Mode S options on

[16] The routes in the sample were from Heathrow and London City to Belfast, Brussels, Edinburgh, Paris, and Geneva. All the routes at London City are to destinations within the area covered by the European Single Aviation market in which entry is unrestricted to any EU carrier. It seems likely that the bulk of London City's routes will remain within the single market because of the range limitations of operating small aircraft from London City.

competition between services at London City and those of other London airports is unlikely to be significant.

2.4 Other UK Domestic, Short-haul and Regional Services

2.4.1 CAA Airport Statistics for the year ending March 2003 indicate that, excluding the services at London City; there were about twenty routes in the UK where small aircraft competed directly against larger aircraft. However, there have been changes in the services operated in a number of the routes since March 2003 and in several cases airlines have withdrawn, leaving only one carrier on the route. These routes have not been considered further in this analysis although there may be an issue of the effect of the Mode S proposals on *potential* as opposed to *actual* competition.

2.4.2 The majority of the remaining, competitive, routes have one airline operating aircraft with about 50 seats and the other using aircraft with around 130 seats. Although the differential in aircraft size is marked, the incremental costs of Mode S for 50-seat aircraft are relatively low and seem unlikely to affect competition.

2.4.3 A more significant competitive impact may arise where the smaller of the aircraft types has 30 seats or less. There are only three regional city-pairs where an aircraft of this size competed against a significantly larger aircraft in the year ending March 2003 and where this competition still existed in July 2003: Jersey-Guernsey; Cardiff-Jersey and Cardiff-Dublin.

2.4.4 The Jersey-Guernsey route has special characteristics, most notably because it is only 38km long. Aurigny operates up to 20 round trips a day, mainly with 16-seat Britten-Norman Trislanders but with some services operated by 36-seat Shorts 360s. In July 2003 Flybe had a weekday service Birmingham-Guernsey-Jersey-Birmingham operating under the Air France codes, AF8301/AF8300 and using 146-300 aircraft with 100 seats or more. Although Air France/Flybe offer the service to passengers from Guernsey to Jersey, their frequency is much lower than that of Aurigny, there is no Air France service from Jersey to Guernsey, their market share is low and the operation seems much more attuned to the needs of Birmingham-Jersey and Birmingham-Guernsey passengers. The Mode S proposals seem unlikely therefore to have a competitive impact on this route.

2.4.5 Of the other two routes, the Cardiff-Dublin route is perhaps the most relevant to examine from a competition point of view as its passengers are more likely to be a mix of business and leisure passengers than those on the Cardiff-Jersey route. The latter is likely to be heavily leisure-oriented and the barriers to entry on such routes are generally lower.

2.5 Cardiff-Dublin

2.5.1 Air Wales and Ryanair compete on the Cardiff-Dublin route following the withdrawal in September 2002 of a BA/British Regional operation. Air Wales offers a higher frequency but uses a much smaller aircraft than Ryanair. The CAA examined the shares over time of the two airlines as regards frequency, capacity, and passengers; the current timetables of the two services; the types of aircraft used now and in the past; and the fares that are offered.

2.5.2 In summary, the CAA examination found that Ryanair currently has a high passenger share but its inability to offer day returns may deter some business passengers. Certainly in 2000 Ryanair appeared predominately to carry leisure passengers. Air Wales offers a more attractive flight schedule and may therefore carry a higher proportion of business passengers.[17] Air Wales may therefore be able to create a market niche to offset the diseconomies of operating a much smaller aircraft than Ryanair.

2.5.3 In April 2003 Air Wales introduced a 48-seat ATR 42 to replace the 15-seat Beechcraft and 18-seat Dornier aircraft it had previously used on the route. Had the operations on the route continued along the 2002/3 pattern, the Mode S proposals would have had a much greater financial impact on Air Wales on a per seat basis because it then operated an aircraft some eight times smaller than that of Ryanair. However, the impact is much less if Air Wales continues with an aircraft such as the ATR 42. The issue perhaps is whether the increase in aircraft size by Air Wales in April 2003 (and the withdrawal of the BA/British Regional operation which averaged 29 to 30 seats per aircraft) was recognition of the difficulty that small aircraft face in competing head-to-head with much larger aircraft, with or without the further impact of Mode S. If so, the asymmetric impact of the Mode S options may not affect the balance of competition in the longer term although it might appear to do so in the short term.

3 Air Cargo Services

3.1 Background

3.1.1 In 2001 over two million tonnes of air cargo were carried to and from UK airports. Of the total cargo carried by all transport modes in and out of the UK, air cargo accounts for less than 1% by weight but over 30% by value. Airfreight normally has a high value-to-weight ratio such as computer and telecommunications equipment and parts or is economically or physically perishable or has an unpredictable demand pattern. There are also exceptional loads such as aircraft engines, dangerous goods, or livestock that require specialist handling.

3.1.2 About a third of UK air cargo in 2001 was carried in dedicated freighters (all-cargo aircraft) and the remainder was carried on aircraft primarily intended for passenger service (normally referred to as belly-hold cargo although in the case of combi aircraft, cargo is also carried on part of the main aircraft deck). 80% was carried on scheduled services, 95% was international as opposed to domestic, and 77% was handled at London airports. The available statistics cover only the freight that is transported by air at some stage in its journey. But not all “air” cargo goes by air; trucking is much cheaper where it is feasible. Airline schedules often show short-haul services with a flight number that are operated by trucks rather than by aircraft. In a similar fashion freight may be carried to and from the UK by truck to cargo hubs on the continent where it is loaded onto aircraft.

3.1.3 More generally, the air carriage of cargo is often just part of the overall journey and in some respects the surface distribution systems are more important components. The prime concern of the shipper and consignee of cargo is that the consignment arrives at its destination by the specified time and in good condition. They will not be

[17] No CAA survey data exists for the Air Wales service (the last survey at Cardiff being in 2000).

interested in the routeing or the mode of transport used although they may wish to be aware of its progress.

3.1.4 Connections are not the same deterrent to freight as they are to passengers and, to provide a door-to-door service, integrators such as Fedex and DHL use hub-and-spoke systems (with both main and subsidiary hubs) involving both air and surface transport which are more complex than those used for passengers. Express freight operations are often carried out at night in order that goods dispatched at the end of the working day can be delivered to the recipient at the start of the next working day.

3.1.5 Unless there are obstacles to surface transport, operators of small aircraft face competition from trucks. Because of the nature of their operations, the aircraft utilisation of cargo operators can be relatively low which increases the impact in unit terms of additional investments such as those that would be imposed by the Mode S options.

3.2 Preliminary Findings on the Air Cargo Services Market

3.2.1 As indicated above, the focus of this competition assessment is on situations where small aircraft are in actual or potential competition with large aircraft. In the cargo field, large aircraft tend to be used to provide bulk capacity on trunk routes and to perform specialised services such as the carriage of large or out-of-gauge loads, such as aircraft engines. Small aircraft appear to be used mainly to serve thin markets, to provide feeder services into the hub-and-spoke networks of the express cargo carriers, and to carry out particular one-off tasks, which require the smaller aircraft types.

3.2.2 So, despite the possibility that operators of small all-cargo aircraft could face a relatively high impact on unit costs, the apparently specialised nature of their work would suggest that there may not be a significant impact on competition.

4 Air Taxi And Air Ambulance Operations

4.1 The CAA has little information on the workings of this market and no quantitative information was submitted by the sector during the consultation periods. This would suggest that there may not be a significant impact on competition.

5 Pilot Training Schools

5.1 It is conceivable that the restriction of airspace to aircraft with Mode S equipment could impact on the activities of pilot training schools that are located at airports close to this notified Mode S airspace, favouring those schools and airports more remote from the airspace. This could alter the balance of competition in the market for pilot training but it is not known whether it might have a significant impact and no quantitative information was submitted by the sector during the consultation periods.

6 Corporate Aircraft Services

6.1 Corporate aircraft services will overlap with short-haul passenger services and with air taxi operations. The CAA has little information on the degree of this overlap, the substitutability of the different products, and of competition within the sector. No quantitative information was submitted by the sector during the consultation periods and this would suggest that there may not be a significant impact on competition.

7 Aerial Work Services

7.1 The CAA has little information on the economic workings of this market and no quantitative information was submitted by the sector during the consultation periods. This would suggest that there may not be a significant impact on competition.

Appendix 3

SUMMARY OF THE RESULTS FROM THE FIRST ROUND OF CONSULTATION

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
01	Guild of Air Pilots and Air Navigators	Livery Company	1. Supportive of Enhanced Surveillance Proposals. 2. Some reservations about Elementary Surveillance proposals for 2008 but recognizes that these will be subject to a separate RIA.	1. Noted. 2. The publication of the RIA on proposals to introduce Elementary Surveillance from 2008 will give an opportunity for detailed comment.
02	Monarch	Airline	1. Recognizes need for upgrade to Mode S Enhanced Surveillance. 2. Concern that UK CAA is imposing an earlier requirement date than that required elsewhere.	1. Noted. 2. As a result of cooperation and agreement with France and Germany, a 3 States programme has been agreed with common dates of application. A common exemption policy is also being developed to ensure commonality and a level playing field.
03	Dr J D T Tannock	Private Pilot	1. Whilst recognizing that RIA is in relation to the carriage of Mode S Enhanced Surveillance in 2005, is concerned that it is automatically will lead to changes in 2008. 2. Has serious concerns with cost implications for GA and believes that the regulatory changes will lead to collapse of recreational flying and loss of thousands of jobs.	1. The proposals in this RIA relate purely to the proposed carriage of Mode S Enhanced Surveillance by aircraft in excess of 5700 kg and 250 kts flying IFR/GAT in En Route and major TMA airspace. The proposals for Elementary Surveillance in remaining airspace referred to in the text will be the subject of a separate RIA, which will have to present the rationale separately. 2. The RIA for Enhance Surveillance does not propose a requirement for GA other than that which wishes to fly in the notified En Route and TMA airspace. For these aircraft, a reduced capability of Elementary Surveillance will be required. In addition, the exemption policy will help manage the transition period to minimise impact whilst achieving safety and capacity benefits. As the comments relate primarily to the proposed 2008 transponder carriage RIA, which has yet to be published, they will be addressed at that stage.
04	I Atherton	Private Pilot	1. Insufficient time to properly assess impact on GA.	1. This is the Initial RIA consultation and is aimed at presenting initial views and gathering information. The consultation has followed Government guidelines and subsequent RIA consultations will provide the

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				opportunity for further input.
			2. RIA does not provide full technical detail.	2. It is not appropriate to include full technical detail in an RIA for public consultation. However, full technical information is available in ICAO documentation, which is in the public domain.
			3. RIA does not assess impact on GA community.	3. This RIA is for a proposal for Enhanced Surveillance for aircraft flying IFR/GAT in En Route and TMA airspace that are in excess of 5700 kg and 250 kts. Although there is an impact on GA requiring access to the mandated airspace, exemptions and reduced requirements will take this into account. Any impact on GA outside of this airspace will be addressed in the 2008 transponder carriage RIA to be published in due course.
			4. RIA does not present case for Mode S for GA.	4. The risks outlined in the RIA apply equally to GA, military and commercial traffic that operate as IFR/GAT in En Route and TMA airspace. Any benefits for GA outside of this airspace will be addressed in the 2008 transponder carriage RIA to be published in due course.
05	C T Neville	Unknown	1. Objects to the proposal to introduce Mode S Elementary Surveillance in 2008 for VFR flights.	1. The RIA for increased transponder carriage in 2008 will be published in due course when all relevant issues will be presented.
06	P Draper	Private Pilot	1. Little assessment of impact on Light Aviation throughout RIA.	1. Enhanced Surveillance is not a requirement for light aircraft. Applicability has been designed to ensure that aircraft that cannot fit Enhanced Surveillance would only have to equip with Elementary Surveillance functionality to have access to major TMA and En Route airspace as IFR/GAT. The RIA covering the proposed introduction of Elementary Surveillance and increased transponder carriage in 2008 will cover this aspect.
			2. Fitting of Enhanced Surveillance for current GA fleet would be impossible.	2. Enhanced Surveillance is not a requirement for the majority of the GA fleet. Where an aircraft does fall

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				within the discriminants of weight and speed, it would only be required where it was technically feasible.
			3. Recommends a wait for ADS-B technology.	3. Mode S provides a migratory path towards ADS-B implementation and this has been recognised as a global initial step. The selection of ADS-B technologies and resolution of operational and safety issues are still at an immature stage. The issues needing to be addressed by this RIA cannot wait until ADS-B reaches a mature enough stage to mandate its carriage. Furthermore, cost issues have not been addressed.
			4. Exemption Policy needs to reflect impact of Elementary Surveillance on light aviation.	4. The applicability discriminants and exemption principles take account of the technical feasibility of equipping light aircraft with Enhanced Surveillance. In addition, a realistic transition period would be applied to allow operators the time to equip aircraft while balancing the implementation of Mode S in ground ATC systems. A separate exemption policy will be drafted to support the 2008 Elementary Surveillance and increased transponder carriage RIA.
			5. Existence of Cost Benefit Analysis.	5. A Cost benefit Analysis for Enhanced Surveillance has been developed on a European wide basis. The purpose of the various stages of the RIA is to elicit further information to update this.
			6. Seeks an assurance that LARS will be upgraded to provide a full service throughout the UK	6. The proposed implementation of Mode S Enhanced Surveillance is in En Route and major TMA airspace and so does not affect LARS.
07	M Cowburn	Private Pilot	1. Concerns about technical feasibility of equipping a Piper L-4H with Mode S.	1. The applicability discriminants and exemption principles for major TMA and En Route airspace take account of the technical feasibility of equipping light aircraft with Mode S. Exemptions from increased transponder carriage and Elementary Surveillance in 2008 for aircraft such as this will be addressed within the forthcoming separate RIA.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
08	Director of Air Staff Ministry of Defence	Military	1. Supports proposal for Enhanced Surveillance. 2. Raised issue of legacy systems and compliance.	1. Noted. 2. The issue of legacy systems affects both civil and military operators and is addressed in the exemption policy.
09	E Snook	Private Pilot?	1. RIA takes no account of GA user after 2008. 2. Very concerned at high costs quoted in RIA for Mode S transponders. 3. Supports Option 4.	1. The impact and issues affecting GA after 2008 are to be addressed in the RIA containing proposals for the implementation of increased transponder carriage and Elementary Surveillance in 2008. 2. The Costs quoted in the RIA are indicative of those related to Enhanced Surveillance in commercial aircraft. Costs for small aircraft with reduced functionality are known to be significantly less. However, accurate information on costs for elementary surveillance to enable operators to access Mode S Enhanced Surveillance airspace would be welcomed. 3. The selection of future technologies and resolution of operational and safety issues are still at an immature stage. The issues needing to be addressed by this RIA cannot wait until technology such as ADS-B reaches a mature enough stage to mandate its carriage. Furthermore, cost issues have not been addressed.
10	Scottish Aero Club	Recreational Aviation Organisation	1. Supports introduction of Mode S in airspace classes A and B only. 2. Cost of Elementary Surveillance equipage for a light aircraft assessed as being between £2,000 and £5,000, which is 15-20% of the market value of a typical GA aircraft. Based on this, did not support safety justification of the RIA.	1. The major TMA and En-Route airspace to which this proposal is applicable would mainly be in Classes A and B. However, where significant safety and capacity benefits in some other portions of airspace could be achieved Enhanced Surveillance, the CAA would wish to include them in this proposal. 2. Submission of likely costs welcomed. However, the vast majority of GA aircraft represented by this club will not be affected by this proposal. The safety benefits of equipping with Mode S for those that are affected are well documented in the RIA.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			3. Raises a number of GA concerns and proposals arising from the proposed implementation of increased transponder carriage and Elementary Surveillance in 2008. 4. Implementation should be harmonized across Europe.	3. These issues will all be addressed in the RIA covering the proposed implementation of increased transponder carriage and Elementary Surveillance in 2008. 4. As a result of cooperation and agreement with France and Germany, a 3 States programme has been agreed with common dates of application. A common exemption policy is also being developed to ensure commonality and a level playing field.
11	PPL/IR Europe Group	Aviation Organisation	1. Considers that Mode S delivers minimal operational benefits to light aircraft operating IFR. 2. Concerned that Enhanced Surveillance cannot be adopted in light aviation. 3. Accepts adoption of Elementary Surveillance subject to realistic exemption policy. 4. Concerned that ATC co-operation in accessing designated airspace will still be required. 5. Cost of Elementary Surveillance equipage for a light aircraft assessed as being at least £5,000. 6. Proposes that the criteria for exemptions based on annual hours flown in the airspace be extended to 50 hours.	1. Benefits of Mode S to all IFR/GAT users of major TMA and En Route airspace and ATC service providers are well documented in the RIA. 2. The applicability discriminants and exemption principles for Enhanced Surveillance recognise that Enhanced Surveillance is not required for light aviation. Furthermore, if an aircraft does fall within the criteria, e.g. speed, it would only require Enhanced Surveillance if it was technically feasible. 3. The proposed exemption policy for both Enhanced and Elementary surveillance has been developed from a realistic perspective and is being harmonized from a European perspective. 4. This is recognized. 5. Submission of likely costs welcomed. However, an assessment of the impact of these costs on competition in the various GA markets would also now be welcomed. 6. The figure of 30 hours quoted in the draft exemption policy is for guidance only. Actual exemptions will be judged on a case-by-case basis.
12	B Tempest	General Aviation	1. Against proposals for introduction of Mode S Elementary Surveillance in 2008.	1. The case in support of the 2008 increased transponder carriage and implementation of

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
		Syndicate Pilot		Elementary Surveillance proposals will be subject to a separate RIA.
			2. Against future requirement for carriage of Mode S in Class G airspace on grounds of cost.	2. As above but it should be noted that rules requiring the mandatory carriage of SSR transponders in some Class G airspace already exist.
			3. Considers proposals to be a means of elimination of GA through fiscal policy.	3. The introduction of new surveillance equipment is based on RF environment, safety, capacity and efficient use of airspace issues – not fiscal policy.
13	J Tempest	General Aviation Syndicate Pilot	1. Considers the requirement for Elementary Surveillance from 2008 to be an unjustified measure, which will incur an intolerable financial burden of draconian proportions.	1. The case in support of the 2008 increased transponder carriage and implementation of Elementary Surveillance proposals will be subject to a separate RIA.
14	P Elvidge	Light Aircraft Operator	1. Concerned that light aircraft operator is faced with high expense in return for no benefit.	1. The requirement raised within this RIA only effects those light aviation operators requiring access to the notified airspace as IFR/GAT and is based on a reduced functionality. The benefit would be continued access, interoperability and improved safety at a lower cost than those affected by the Enhanced Surveillance applicability criteria.
			2. Lack of radar cover outside of controlled airspace and Mode S will not affect this.	2. This issue relates to the 2008 increased transponder carriage and Elementary Surveillance proposal and will be addressed in the relevant RIA to be published later.
			3. Would seek financial compensation for upgrade costs.	3. Noted.
			4. Backwards compatibility with Modes 3/A and C must be maintained.	4. Mode S technology on the ground and in the air is wholly backwards compatible with Mode S 3/A and C.
			5. RIA does not contain sufficient evidence to support case and none is referenced.	5. The structure of the RIA is in accordance with Government guidelines and a bibliography for additional reference material was contained on page 9 of the RIA.
			6. Some SSR codes are unallocated in the UK AIP and the use of codes should be rationalized.	6. The use of SSR codes in the UK is audited and rationalized continually. The use of many UK codes is

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				now shared by 4 or 5 ATC agencies because demand outstripped supply many years ago. It is becoming increasingly difficult to extend this code-sharing principle to meet new applications. The vast majority of codes that are currently unallocated have been earmarked for future use on international flights. Some of the emergency services aircraft that operate in the busier airspace Classes A and D require unique codes to enable unambiguous identification. This aids ATC awareness and improves safety.
			7. Controllers could monitor height selections using existing VHF data link technology.	7. VHF data links are not widely fitted, are relatively expensive and do not facilitate all the other benefits that Mode S provides to overcome the risks detailed in the RIA.
15	Helicopter Club of Great Britain	Aviation Organisation	1. Opposes mandatory fitting of Mode S transponders to all UK aircraft on grounds of cost effectiveness and practical operating considerations.	1. The issues raised are all relevant to the proposal for increased transponder carriage and Elementary Surveillance in 2008 and will be addressed within the relevant RIA to be published later.
16	Cliff Barber	Microlight Pilot	1. Raises issues that are directly concerned with the proposals for increased transponder carriage and the implementation of Elementary Surveillance in 2008.	1. The issues raised are all relevant to the proposal for increased transponder carriage and Elementary Surveillance in 2008 and will be addressed within the relevant RIA to be published later.
17	National Air Traffic Services En-Route Ltd	Air Navigation Service Provider	1. Supports implementation of Enhanced Surveillance 2005 and expansion of Elementary Surveillance in 2008.	1. Noted.
			2. Stresses need for common European implementation.	2. As a result of cooperation and agreement with France and Germany, a 3 States programme for Enhanced Surveillance has been agreed with common dates of application. The proposed exemption policy for both Enhanced and Elementary surveillance has been developed from a realistic perspective and is being harmonized from a European perspective.
			3. Already working to identify and implement	3. Noted.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			effective early measures to achieve benefits of Enhanced Surveillance in South East England and the London TMA. 4. Already committed to the replacement of En Route radar sites with Enhanced Surveillance capable radars. 5. Stresses that any benefits would be negatively affected by the number of non-Mode S aircraft within busy airspace and so the exemption policy must be robustly managed. 6. All parties must have a common understanding of ICAO SARPs to maximize the benefits.	4. Noted. 5. Exemptions will be managed to ensure that airborne equipage matches the deployment of Mode S functionality in the ground ATC systems. The aim will be to maximize the benefits of Mode S as soon as possible but in an equitable fashion for all operators. 6. Any amendment to the airborne carriage requirements in the ANO 2000 will make reference to the relevant ICAO Annex 10 SARPs and JAA Technical Standard Orders. Airworthiness Directives will be issued to ensure compliancy with technical standards.
18	Aircraft Owners and Pilots Association	Aviation Organisation	1. Seeks assurance that GA IFR flights will still be able to access the UK IFR system in 2005 and beyond without Enhanced Surveillance. 2. Opposes the requirement for aircraft of less than	1. The applicability and exemption criteria are set out clearly in the draft exemption policy. To gain access to the notified Mode S portions of the UK IFR system beyond 2005, GA aircraft of less that 5,700 kg and 250 kts will only need to equip with Elementary Surveillance. In order to ensure that the risks outlined in the RIA can be overcome as soon possible, airborne equipage will need to match the deployment and use of Mode S on the ground. Therefore, no assurance can be given that non-compliant IFR/GAT flights from any aviation sector would be granted perpetual access to major TMA and En Route airspace after 2005. This would be inequitable to those operators that had equipped to the standard needed to both overcome the risks and realize the benefits to all users in the airspace. 2. In order to realize the benefits of Mode S and

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			5,700 kg to install Elementary Surveillance by 2005 to gain access to major TMA and En Route airspace.	overcome the current risks, all aircraft requiring access to major TMA and En Route airspace as IFR/GAT will need to equip eventually. The applicability and exemption principles have been designed to take account of aircraft size and technical capability. Furthermore, a transition period would apply from 2005 to allow time for operators with genuine difficulties to meet the equipage requirements.
			3. Contends that all GA operations, which currently require only Modes 3/A and C, to be able to continue to do so until there are low cost lightweight or ADS-B solutions available.	3. There will be no suitable ADS-B or low cost and lightweight solutions available in the near future that would alleviate the risks or maximize the benefits outlined in the RIA. Aircraft equipped with legacy Modes 3/A and C transponders would be granted exemptions on a case-by-case basis in accordance with the exemption policy.
			4. Requires additional information on the terminology of notified airspace and details of what UK airspace will not be notified.	4. The airspace would be notified as and when the ATC service providers require to use Mode S information to alleviate the risks and maximize the benefits outlined in the RIA. As NATS (En Route) plc has stated, plans are being implemented to initially use Enhanced and Elementary Surveillance in the South East of England and London TMA from 2005. Other major TMAs and routes will only then be promulgated as and when the deployment of Mode S widens on the ground. Class G airspace would not be subject to the Enhanced Surveillance requirement.
			5. Supports Option 4 for all airspace users.	5. Option 4 would not alleviate the risks and maximize the benefits outlined in the RIA in the short to medium term. A new technology needs to be implemented in 2005. Implementing Mode S has been almost globally accepted as the way of migrating towards the future implementation of ADS-B.
			6. Requests the date beyond which Modes 3/A and C transponders would no longer be able to be used.	6. This proposal does not affect the existing rules for the use of Mode 3/A and C transponders outside of the notified TMA and En Route airspace. Depending

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				on the progress made in deploying Mode S on the ground, it is currently envisaged that aircraft equipped with Modes 3/A and C transponders would, in all but exceptional cases, be denied access to major TMA and En Route Mode S airspace as IFR/GAT flights from the end of the initial 2-year transition period. However, exemptions will continue to be applied pragmatically on a case-by-case basis after 2007.
			7. Requests delay in Mode S implementation until possible problems with the 24-bit aircraft addressing system have been scoped and an operational risk assessment report produced by the JAA CNS/ATM steering group.	7. The issue of duplicate 24-bit aircraft addresses has been well understood and monitored globally for several years. A reporting mechanism for incorrect addressing is in place and occurrences of duplicate addresses are now rare.
			8. Contends that IATA do not want GA to equip with Mode S.	8. IATA has accepted that Mode S extended squitter would provide a suitable migratory path to future use of ADS-B. Furthermore, commercial operators would not wish to see the alleviation of risks or the attainment of the benefits of Mode S not being realized because of the granting of access to non-compliant GA flights to the major TMA and En Route Mode S airspace as IFR/GAT.
			9. Not satisfied that the RIA meets Cabinet Office requirements and requests an external review of the RIA.	9. The approval of the DfT Better Policy Unit and the Cabinet Office Regulatory Impact Unit on the content and format of the RIA was sought prior to its publication. All advice received from these departments was followed. As an Initial RIA, it was issued to seek the early views of the industry and to gather quantitative information to support these views. It would be useful to receive details of where the respondent considered the RIA to fall short of the Cabinet Office requirements.
19	Stapleford Flight Centre	Pilot Training School and Flying Club	1. States that cost of equipage with Elementary Surveillance for a small aircraft (Piper PA-34) will be $20,000 (approx £11,500), which represents 17% of [illegible]	1. The CAA is grateful for the submission of costs. However, from other consultation the CAA believes that replacement Elementary Surveillance [illegible]

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			the value of the aircraft. (Total cost for the business will be $40,000 (approx £23,000) to meet the requirements of this proposal.) 2. States that the total cost for the business to meet the 2008 increased transponder and Elementary Surveillance proposal will be $280,000 (£190,000), which is 1/3 the value of the aircraft and would put the PPL training business at risk.	transponders for the PA-34 aircraft would be in the region of £5,000 to £6,000 fully fitted. The estimated total cost for the business should be £12,000 for the 2 aircraft to meet the requirements of this proposal. 2. The issues and costs raised are all relevant to the proposal for increased transponder carriage and Elementary Surveillance in 2008 and will be addressed within the relevant RIA to be published later.
20	General Aviation Manufacturers and Traders Association	Aviation Organisation	1. Commends the strategy of going straight to Enhanced Surveillance and aligning the implementation dates with the ACAS II Phase II equipage requirements. 2. Agrees that SSR frequency congestion will need to be reduced to support the wider carriage and efficient operation of ACAS II. 3. Seeks assurance that Enhanced Surveillance would not be superseded by ADS-B before 2012. 4. Seeks assurance that ADS-B would utilize the Mode S equipment without further conversion costs being required. 5. Seeks a free and open discussion on the practicality of ADS-B as an alternative solution before the legislation is changed to implement Mode S.	1. Noted. 2. Noted. 3. The CAA has not seen any evidence that ADS-B would be realistically available for use in the high-density airspace of the UK or core Europe prior to 2015. Furthermore, the CAA has not received any information that ATC service providers would be prepared to invest in an ADS-B ground infrastructure to support operations in major TMA and En Route airspace prior to 2015. 4. Mode S extended squitter has been almost globally accepted as the preferred migratory path towards ADS-B operations for commercial air traffic. This view has been supported recently by the FAA, IATA and within Europe. 5. Mindful of the above answers, the CAA believes that ADS-B is not a practical solution to alleviate the current risks set out in the RIA from 2005. However, the CAA would welcome the submission of any quantitative information in support of the

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				implementation of ADS-B in major TMA and En Route airspace from 2005.
21	British Microlight Aircraft Association	Aviation Organisation	1. No comment on this proposal but raised advanced discussion issues on the 2008 increased transponder carriage and Elementary Surveillance proposal.	1. Noted.
22	Acro Engines and Airframes Ltd	Small Business?	1. Raises issues that are directly concerned with the proposals for increased transponder carriage and the implementation of Elementary Surveillance in 2008.	1. The issues raised are all relevant to the proposal for increased transponder carriage and Elementary Surveillance in 2008 and will be addressed within the relevant RIA to be published later.
23	Popular Flying Association	Aviation Organisation	1. No objection in principle to this proposal but disagrees strongly with the 2008 increased transponder carriage and Elementary Surveillance proposal.	1. Noted.
24	British Airways	Airline	1. Supports the move to Mode S in principle. 2. States that the implementation deadlines are unrealistic and will dramatically increase costs to airlines because special 'downtime' periods will be required if they are to be met. 3. Considers that total adherence to the end dates for all aircraft is hard to justify. 4. Considers that the lack of a guarantee that ATC service providers will deliver the benefits on time and in full is a major weakness of the proposal and that the CAA should take appropriate enforcement	1. Noted. 2. The CAA would not expect operators to arrange 'Special Inputs' to meet the equipage requirements as long as documentary evidence is provided that embodiment plans have been made to equip aircraft as early as possible during routine 'downtime' periods. This would be managed and monitored through the exemption process. 3. It is recognized that a staged implementation would be required for the implementation of Mode S. This is why an initial 2-year transition period would be applied to facilitate realistic equipage of aircraft without dramatically increasing costs to operators over and above that which is required for the actual embodiment process. 4. The CAA has already received high level written assurances from NATS (En Route) Plc that benefits from Mode S equipage will be realized from 2005, commencing with the London TMA. This will be

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			action.	monitored through the NATS Licence Management Co-ordination Committee. Any unavoidable delays in the deployment of Mode S on the ground would be matched with realistic and sympathetic application of exemptions to aircraft operators experiencing similar difficulties in equipping aircraft to meet the implementation timescales.
			5. Requires clarification of the exemption principle for SI Code equipage requirement.	5. This has been clarified in the latest draft of the proposed exemption policy. Exemption applications for Mode S transponders purely on the grounds of a lack of SI Code functionality would not be granted after the end of the promulgated transition period.
			6. Stresses the need for the equipage requirements and exemption rules to be applied equally to all UK and overseas aircraft operators.	6. As a result of cooperation and agreement with France and Germany, a 3 States programme for Enhanced Surveillance has been agreed with common dates of application. The proposed exemption policy for both Enhanced and Elementary surveillance has been developed from a realistic perspective and is being harmonized from a European perspective to the maximum extent possible. To this end, a Mode S Exemption Co-ordination Cell (MECC) will be set up within Eurocontrol from January 2004.
			7. The impact of the recent Amendment 77 to ICAO SARPs and any other impending changes should be considered carefully and taken into account to ensure that operators are not unfairly affected.	7. The draft exemption policy has been amended to cover this issue. For aircraft equipped with Mode S transponders that are compliant with ICAO Annex 10 SARPs Amendment 73, Volumes III and IV, a sympathetic approach will be taken during the transition period to the award of exemptions from the requirement to comply with Amendment 77.
			8. Submits that crew training, maintenance staff training, manual updates and logistics during the embodiment programme are other costs that need to be considered.	8. This input is most welcome and the Partial RIA now includes these issues. However, the CAA would welcome the submission of any quantitative information relating to these other costs.
25	HQ United States	Military	1. Supportive of the initiative to implement new	1. Noted.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
	Air Forces Europe		Mode S technology and reports that 40% of the USAF aircraft already equipped with some Mode S functionality. 2. Unable to meet proposed timescales for full Mode S equipage and concerned that some older legacy aircraft will never be able to be equipped. 3. Believes that majority of aircraft would need case-by-case exemptions on grounds of technical feasibility or only occasional requirement for access to the airspace.	2. All UK and overseas military aircraft alleviations would be assessed on a case-by-case basis against the common European exemption principles. Applications will be judged against the effect that exemptions would have on the realization of the benefits of Mode S. 3. Exemption principles on the grounds of technical feasibility and only occasional use of the airspace are included in the proposed exemption policy.
26	Guild of Air Traffic Control Officers	Air Traffic Controller User Group	1. Fully supportive of the proposal to implement Enhanced Surveillance in a single step and agrees with the benefits set out in the RIA. 2. Supports the 2008 increased transponder carriage and Elementary Surveillance proposal. 3. Considers the draft exemption policy for Enhanced Surveillance to be a highly sensible approach.	1. Noted. 2. Noted. 3. Noted.
27	CHC Scotia Ltd	Offshore Helicopter Operator	1. Requests clarification of whether or not the Enhanced Surveillance proposal would apply to offshore helicopter operations. 2. Estimates cost of equipage for the fleet of 32 helicopters to be £1.13M, not including any increased maintenance costs, or purchase of additional test equipment. 3. Estimates loss of revenue for the business due to	1. The Enhanced Surveillance proposal would not apply to offshore helicopter operations. Only helicopters requiring access to the notified major TMA and En Route structure as IFR GAT would require equipage with Elementary Surveillance. 2. Helicopters would only be required to equip with Elementary Surveillance in order to meet the requirements of this proposal. In this regard, the costs quoted seem high when compared to £5,000 to £6,000 for a light aircraft Elementary Surveillance transponder. 3. The CAA is grateful for the submission of this data

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			the downtime required for aircraft equipage to be up to 128 days.	and would welcome a further input from the company on what this downtime would equate to in monetary terms. Notwithstanding, the CAA is of the opinion that this proposal would not affect this company but that it would fall under the proposed requirements for the 2008 increased transponder carriage and Elementary Surveillance proposal.
			4. Considers that the alternative technology of ADS-B is now well advanced and should be given equal consideration to that of Mode S.	4. The CAA has not seen any evidence that ADS-B would be realistically available for use in the high-density airspace of the UK or core Europe prior to 2015. Furthermore, the CAA has not received any information that ATC service providers would be prepared to invest in an ADS-B ground infrastructure to support operations in major TMA and En Route airspace prior to 2015. Therefore, the CAA believes that ADS-B is not a practical solution to alleviate the current risks in major TMA and En Route airspace as set out in the RIA from 2005. However, the CAA would welcome the submission of any quantitative information in support of the implementation of ADS-B in major TMA and En Route airspace from 2005.
28	Julian Scarfe	Private Pilot	1. Considers the Eurocontrol CBA to be flawed and outdated.	1. Noted. However, the CBA in respect of Enhanced Surveillance was conducted under the guidance of the Enhanced Surveillance Downlinked Aircraft Parameters (ESDAP) Steering Group. Membership of this Group comprised Eurocontrol, Air Traffic Service providers, military authorities, airlines and their respective organizations. The work was only completed in February 2001.
			2. Considers that the CBA does not make the case for Mode S equipage in the GA community. Compliance by GA is unnecessary for the benefits of Enhanced Surveillance to be delivered.	2. The CBA is based on Enhanced Surveillance equipage within specific volumes of airspace and takes account of technical feasibility in aircraft types. The safety and capacity benefits would only be achieved in that airspace if equipage was maximized irrespective of whether the aircraft using the airspace

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				were military, commercial or GA. Indeed, between 1997 and 2001, pilots of aircraft with an MTOM of less than 5,700 kg made approximately 9% of all 'Level Busts' in the UK.
			3. Supports Option 4 and seeks a deferment of the implementation to permit time for a re-evaluation of the CBA in light of the recent world events that have affected traffic levels.	3. Traffic levels continue to recover and 2003 saw the busiest day on record for flights within Europe. By 2005 to 2006, it is anticipated the traffic levels and forecast growth will have returned to those predicted prior to 11 September 2001. The CAA has not seen any evidence that ADS-B would be realistically available for use in the high-density airspace of the UK or core Europe prior to 2015. Furthermore, the CAA has not received any information that ATC service providers would be prepared to invest in an ADS-B ground infrastructure to support operations in major TMA and En Route airspace prior to 2015. Therefore, the CAA believes that ADS-B is not a practical solution to alleviate the current risks in major TMA and En Route airspace as set out in the RIA from 2005. However, the CAA would welcome the submission of any quantitative information in support of the implementation of ADS-B in major TMA and En Route airspace from 2005.
			4. Considers that only those operators that will reap the benefits of Mode S should bear the cost of equipage.	4. All operators, irrespective of whether they are military, commercial or GA, using the notified airspace as IFR/GAT would reap the benefits in terms of improved safety, more efficient handling and ultimately reduced delays.

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Appendix 4

SUMMARY OF THE RESULTS FROM THE SECOND ROUND OF CONSULTATION

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
01	Director of Air Staff Ministry of Defence	UK Military	1. Funding has been set aside to equip MOD airfields with Mode S Elementary Surveillance between 2006 and 2011.	1. Noted.
			2. Requests exemptions be granted to MOD for fleets rather than on a case-by-case basis for individual aircraft.	2. Single applications for exemptions for particular fleets will be acceptable but details of all the airframes within each fleet will need to be attached to the applications.
			3. Requests clarity on how the Mode S equipage requirements for OAT will be determined.	3. Military aircraft operating under OAT rules are not affected by the proposals in this RIA. The future Mode S equipage proposals that would affect OAT flights will all be addressed in a future RIA consultation process covering the proposed implementation of increased transponder carriage and Mode S Elementary Surveillance in 2008.
			4. Requests assurance that permanent exemptions will be available for non-Mode S capable aircraft after the end of the initial 2-year Transition Period.	4. Section 1, paragraph 2.2, and Section 2, paragraph 2.3, of the UK Mode S Exemption Policy make provisions to allow for the granting of exemptions with a validity period beyond the initial Transition Period.
			5. Requests clarification that military aircraft operating as OAT, which are not Mode S equipped, will still be allowed unfettered access to Mode S airspace. Similarly, requests clarification that civil service providers will non-compliant aircraft to enter the notified airspace.	5. Compliant and non-compliant military aircraft on operational priority missions will be allowed access to Mode S airspace. However, for routine peacetime training and deployment, military aircraft requiring access to the notified TMA and En Route airspace, as GAT under IFR, will be expected to be equipped with Mode S. This will ensure that civil handling of military aircraft does not compromise safety in the Mode S airspace and that the benefits of Mode S to commercial traffic are not compromised. Military aircraft operating under OAT rules that wish to cross the notified Mode S controlled airspace will be subject to the existing rules and procedures

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				that are currently applied.
			6. Military equipage costs need to be captured.	6. The CAA does not have access to this information and no costs were provided in the MOD response to the consultation.
			7. Requests assurance that airfields will install the required ground infrastructure, especially those beneath the notified Mode S airspace.	7. Only those Air Navigation Service Providers operating aircraft as IFR GAT in the notified airspace will need to install the required ground infrastructure. During the initial implementation stages of Mode S Enhanced Surveillance within the London TMA, this will only affect NATS (En Route) plc. Consequently, NATS has already begun to install Mode S interrogators and has invested in new controller display tools that will be installed in the London Terminal Control Centre in 2005. The notified airspace will only be expanded to other areas in the UK where the service providers are investing to make use of the Mode S Enhanced Surveillance data within other major TMA and En Route airspace. A separate RIA consultation process will cover the proposed use of Mode S Elementary Surveillance in all other airspace from 31 March 2008.
			8. Requests clarification of who will decide whether or not it is technically feasible to equip an aircraft with Mode S Enhanced Surveillance.	8. It is accepted that combat aircraft will only be able to provide Mode S Elementary Surveillance. However, the larger and more modern military transport type airframes should be able to support the Mode S Enhanced Surveillance requirements. Paragraph 3.4 of the RIA provides further guidance on this issue. Negotiations are ongoing with European partners and the Eurocontrol Military Business Division to agree some suitable principles that can be applied realistically to State aircraft.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
02	PPL/IR Europe Group	Aviation Organisation	1. Recognises that the proposal for the carriage of Mode S transponders is a contribution to air safety. 2. Notes that there was no inclusion of the compliance costs for private operators, which are likely to be higher than those for other operators. Therefore, the response contends that the RIA falls a long way short of the Cabinet Office 'Guide to Regulatory Impact Assessment' and regrets the CAA's failure to follow the guide. The response further contends that the RIA should now be revised.	1. Noted. 2. This is not accepted. Prior to the promulgation of the Initial RIA and the Partial RIA for the relevant consultation periods, each RIA was submitted to the DfT and Cabinet Office Better Policy units for scrutiny and feedback. On both occasions, authority to distribute the RIAs for consultation was sought and approved. The CAA does not have access to readily available information on the compliance costs or hours flown by private operators in the London TMA or major En Route airspace structure. Therefore, it was hoped that small General Aviation businesses and private individuals would submit this information during the RIA consultation process. Unfortunately, the General Aviation community has provided very little quantitative information during the 2 rounds of consultation. We also note that none is provided in this submission. It has therefore not been possible to break out the overall compliance costs to the General Aviation sector with any degree of certainty. However, it is considered that only a very small proportion of private operators fly within the London TMA and major En Route airspace as GAT under IFR. Therefore, although compliance costs for those individuals whose aircraft require equipage with Mode S Enhanced Surveillance will be proportionately higher than those for commercial operators, the impact of this proposal on the overall General Aviation sector is not thought to be significant. This may also explain why there have been so few responses from private individuals with

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				quantitative data. Notwithstanding, it is accepted that the impact on the members of this particular General Aviation user group is likely to be higher than that for other groups. Moreover, the CAA has been grateful for the recent feedback and dialogue received from PPL/IR Europe on this policy proposal.
			3. Submits costs for equipping a light aircraft with a Mode S Elementary Surveillance transponder to be £5,500 to £6,000.	3. Noted. These are in-line with the CAA's estimated costs stated in paragraph 5.2.1 of the RIA.
			4. Requests that the Transition Period be extended to 3 years so that the end coincides with the start of the implementation of Mode S Elementary Surveillance in March 2008. This would enable more time for manufacturers to progress alternative transponder units, thereby increasing competition and lowering costs. It would also give time for the Light Aviation SSR Transponder unit to be finalised and make the fitting of a basic Mode S unit by those not requiring regular access to the notified airspace a more economic proposition.	4. The transition arrangements for the implementation of Mode S Enhanced Surveillance will be reviewed prior to March 2007. The exemption arrangements will then be assessed against progress being made with equipage in aircraft and in ground systems. The impact that non-compliant aircraft are having on the realization of the benefits of Mode S will be discussed with operators and Air Navigation Service Providers. A revised policy will then be developed and promulgated for the period after March 2007.
			5. Disagrees with the use of True Airspeed, as defined in the Mode S Exemption Policy, for one of the discriminants for assessing whether aircraft require Mode S Enhanced Surveillance compliance and antenna diversity. Argues that the proposed definition of 'Maximum Cruising True Airspeed' based on V_{no} is not based on the practical performance of the aircraft, is anti-competitive for turboprop operators and brings many additional General Aviation aircraft into the Enhanced Surveillance criteria. The response also contends that the definition in the Exemption Policy is more stringent than has been specified in the draft ANO amendment. In the vast majority of cases, the response	5. The requirements for antenna diversity and Mode S Enhanced Surveillance are essentially separate technical issues and subject to different exemption arrangements. Antenna diversity is required primarily to ensure efficient interaction with collision avoidance systems. However, for clarity, common applicability criteria for both requirements were sought when the Enhanced Surveillance proposal was being developed. The intention of the speed and weight applicability criteria for Mode S is that as many light aircraft as possible, which cannot be equipped with Mode S Enhanced Surveillance

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			argues that this equipage would not be technically feasible without significant expense being required to replace the avionics. The response provides 5 options for revising and clarifying the speed criteria. Furthermore, the response requests that aircraft exempted from Mode S Enhanced Surveillance should also be exempted from the antenna diversity requirements.	but which require access to the airspace, should fall below the Enhanced Surveillance criteria. This reduces the burden on the Exemption Co-ordination Cell and reduces the costs and burden on light aircraft operators to the maximum possible extent. The point on the Mode S Enhanced Surveillance speed criteria has been well made by the PPL/IR Europe group and GASCo and the CAA recognizes the issue. Therefore, the speed criteria has been re-examined and a new proposal, which is in-line with one of the suggestions of the 2 groups, has now been submitted to the other European regulators and the certification authorities for consideration.
			6. Requests that the guideline for classifying infrequent use of airspace be increased to 50 hours per year for each aircraft.	6. This is not accepted. The more hours that a non-compliant aircraft operates within the airspace and the more aircraft that are granted alleviations by relaxing the guidelines, the greater the adverse impact that these aircraft will have on the safety and capacity benefits of Mode S Enhanced Surveillance. Safety Cases and Business Cases will therefore be unduly compromised. Notwithstanding, within the exemption process, the number of hours flown is only a guideline and all exemptions will be assessed on a case-by-case basis.
			7. States that there will be a need for the exemption mechanisms to be in place by mid 2004 to allow operators to make the necessary equipage arrangements. This necessary to ensure continued access to the airspace from 31 March 2005.	7. The Eurocontrol Mode S Exemption Co-ordination Cell is now established and operating. Full details are available at http://www.eurocontrol.int/mode_s.
			8. Decided not to comment on Option 2 because a Eurocontrol information notice stated that the UK had already decided to implement Mode S Enhanced	8. This is regrettable. Eurocontrol has no regulatory authority in the UK. All negotiations and decisions in the Eurocontrol forum are

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			Surveillance.	subject to the appropriate regulatory provisions being made in the States concerned. In the UK, all proposed changes to the ANO 2000 must go through the RIA consultation process. Therefore, any UK intentions expressed in Eurocontrol documentation, which would affect the ANO 2000, merely indicate a recommendation that the CAA will place in front of UK industry for proper consultation. However, the CAA would not make these recommendations if it were not convinced that the proposals were in the best interest of the aviation industry.
			9. Contends that the sole beneficiaries of Option 3 will be the airlines and, therefore, expresses surprise that the RIA does not set out financing options for equipping the GA fleet.	9. As stated in the RIA, Option 3 would provide mitigation for all of the risks that are set out in Paragraph 2.2 of the document. The identified safety risks affect all users of the notified airspace, irrespective of which industry sector they originate from. Therefore, the small proportion of the GA fleet that requires access to the notified airspace as IFR/GAT will receive the same safety benefits as the airlines. Furthermore, equipping with Mode S will ensure that the GA fleet remains interoperable with commercial traffic in the busy controlled airspace to which this proposal relates. Overcoming the risks of maintaining capacity against the background of increased traffic growth will benefit the UK economy in general. All aviation sectors will benefit from this, whether or not they require access to the airspace.
			10. Contends that the CAA has taken a decision to procure new Mode S radars with the Traffic Information Service (TIS) facility removed. This is against the interests of GA as the automatic facility to pass details of	10. It is for the Air Navigation Service Providers to make the commercial decision on which radars to procure, not the CAA. Furthermore, this RIA proposal only relates to the busy TMA

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			conflicting traffic would have been a major safety benefit.	and En Route Controlled Airspace, within which the separation of aircraft is the responsibility and function of Air Traffic Control. The provision of TIS, therefore, would be of limited value in this environment. However, the issue surrounding the use of TIS by GA will be considered in the next RIA consultation process on the proposal to increase Mode S Elementary Surveillance transponder carriage from 2008.
			11. Argues that the wording of the proposed amendments to Schedule 5 of the ANO is confusing, contains redundant information and should be revised.	11. Noted. The wording will be reviewed by the CAA Legal Department in light of these comments.
03	National Air Traffic Services (En-Route) Ltd	Air Navigation Service Provider	1. Still firmly supportive of the implementation of Option 3 and recognizes the need to overcome RF congestion and alleviate 'Level Busts'.	1. Noted.
			2. NATS has committed £100M to replace its existing radars with Mode S systems.	2. Noted.
			3. Does not feel able to comment on the Eurocontrol CBA figures as the situation has changed since it was written. However, a NATS' internal Business Case has shown that Mode S is needed in order to address recognized capacity restricting problems within the short term.	3. Noted.
04	Aircraft Owners and Pilots Association	User Group	1. Does not believe that the CAA has done enough to explain why its preferred technology is Mode S.	1. The RIA has set out all the risks associated with the current SSR system, which need to be overcome in the short term. Mode S is the only available technology that is mature enough to provide this mitigation. It also provides a migratory path to other emerging technologies, such as ADS-B, which the CAA does not believe will be suitable for the busy core European airspace until at least 2015.
			2. Believes that the CAA's surveillance strategy does not meet the needs of all airspace users in that it exists	2. As stated in the RIA, Option 3 would provide mitigation for all of the risks that are set out in

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			only to support airline operations. States that the economic value of Mode S to commercial air traffic is enormous but that the strategy has not taken into account the wide and varied fleet that operates IFR. In addition, the response requests clarification of the safety benefits of installing Mode S on GA aircraft.	Paragraph 2.2 of the document. The identified safety risks affect all users of the notified airspace, irrespective of which industry sector they originate from. Therefore, the small proportion of the GA fleet that requires access to the notified airspace as IFR/GAT will receive the same safety benefits as the airlines. Realization of the safety benefits is particularly important and can only be achieved if all the aircraft equip to be interoperable. Equipping with Mode S will ensure that the GA fleet remains interoperable with commercial traffic in the busy controlled airspace to which this proposal relates. Overcoming the risks of maintaining capacity against the background of increased traffic growth will benefit the UK economy in general. All aviation sectors will benefit from this, whether or not they require access to the airspace.
			3. GA operators will require a 10-15 year usage window from the Mode S equipment to get an adequate return on their investment. This will, therefore, mean that the GA sector's preferred use of emerging technologies, such as ADS-B, will not be realised for a considerable time.	3. Mode S provides a migratory path towards ADS-B implementation and this has been recognised as a global initial step. The selection of ADS-B technologies and the resolution of operational and safety issues associated with these technologies is still at a relatively immature stage. The issues needing to be addressed by this RIA cannot wait until ADS-B reaches a mature enough stage to mandate its carriage. Furthermore, cost issues have not been addressed. The CAA has not seen any evidence that ADS-B would be realistically available for use in the high-density airspace of the UK or core Europe prior to 2015. Furthermore, the CAA has not received any information that ATC service providers would be prepared to invest in an ADS-B ground infrastructure to support

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				operations in major TMA and en route airspace prior to 2015. Therefore, the GA community will be able to realise at least a 10-year use of the Mode S equipment before ADS-B will be realistically available.
			4. There is a need to clarify and justify the speed, weight and infrequent airspace use criteria that have been devised for the Mode S Enhanced Surveillance mandate.	4. The intention of the applicability criteria for Mode S is that as many light aircraft as possible, which cannot be equipped with Mode S Enhanced Surveillance but which require access to the airspace, should fall below the Enhanced Surveillance criteria. This reduces the burden on the Exemption Co-ordination Cell and the costs and burden on light aircraft operators to the maximum possible extent. However, as a result of the feedback from the 2nd round of consultation, the speed criteria has been re-examined and a new proposal has now been submitted to the other European regulators and the certification authorities for consideration. Infrequent users of the airspace can apply for an exemption from the Enhanced Surveillance equipage requirements because, typically, an aircraft that spends less than 30 hours per year in the airspace would not have a significant impact on the realisation of the benefits of Mode S.
			5. Raises several issues regarding potential integration difficulties and costs for equipping the whole GA fleet for Mode S.	5. Only those GA aircraft that operate as General Air Traffic under IFR in the major terminal and en route Air Traffic Service route structure are affected by this proposal. The CAA believes that this is only a very small proportion of the total GA fleet.
			6. Requests clarification of whether or not 'IFR' includes night flying in all airspace and what airspace will be affected.	6. The RIA and Exemption Policy clearly state that only those aircraft that operate as General Air Traffic under IFR in the major terminal and en

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				route Air Traffic Service route structure are affected by this proposal. Therefore, this RIA does not affect IFR operations that are not conducted as General Air Traffic within the controlled airspace route structure. Mode S Enhanced Surveillance will only be implemented in the busier TMAs and en route structure, where safety and capacity benefits can be realized and where ground implementation of Mode S is appropriate. Initially, this will just be the London TMA and the airspace will only be expanded to other Controlled Airspace in the UK where the service providers are investing to make use of the Mode S Enhanced Surveillance data within other major TMA and en route airspace.
			7. Contends that GA non-commercial operations could continue with standard Mode A/C equipage to support ATC and collision avoidance until emerging technologies such as ADS-B through UAT or VDL Mode 4 can be introduced. Therefore, AOPA UK does not support the need for non-commercial operations to install Mode S for IFR or VFR flights.	7. The risks associated with continuing to use the current SSR technology in the short term are well documented in the RIA. Furthermore, ADS-B through UAT and VDL Mode 4 is not interoperable with the current collision avoidance systems. Aircraft operating as VFR flights are not required to equip with Mode S under this proposal.
05	General Aviation Manufacturers and Traders Association	User Group	1. Acknowledged and accepted the CAA responses to GAMTA submission for the 1st round of consultation. 2. Supports the implementation of Option 3. 3. Welcomes the proposals in the draft Exemption Policy and believes that these will alleviate some of the perceived problems of installing equipment in aircraft by 31 March 2005.	1. Noted. 2. Noted. 3. Noted
06	British Microlight Aircraft Association	User Group	1. Has no comment to make about this RIA consultation, as the BMAA will not be affected by this proposal. 2. Has concerns about the proposal to increase	1. Noted. 2. The concerns will be addressed in a future

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			transponder carriage from 31 March 2008.	RIA covering the proposed implementation of increased transponder carriage and Mode S Elementary Surveillance in 2008.
07	British Airways	UK Airline	1. Highlights disappointment that the ground and air implementation is not fully harmonised and concern that this will lead to a slower than expected delivery of the benefits. In particular, the response contends that most European States currently have only limited plans to use the downlinked Aircraft Identification within the ATC data processing systems. Therefore the benefits of no longer having to use SSR codes will not be realized as quickly as previously envisaged. The response states that pressure should be placed on the Air Navigation Service Providers to ensure that Mode S is integrated in the ground systems as soon as possible.	1. Noted. NATS (En Route) plc is already deploying Mode S radars and has invested in new controller display tools that will be installed in the London Terminal Control Centre in 2005. Therefore, Mode S data will be used to improve safety and some traffic handling procedures with effect from 2005. Changes to UK legacy data processing systems to use Mode S Aircraft Identification will be prohibitively expensive. Consequently, the use of Aircraft Identification in the UK will probably not be possible until NATS replaces these systems from 2008 onwards. The NATS Licence Management Committee will monitor closely the progress of the delivery of all services and benefits developed from the available Mode S Enhanced Surveillance data. The aircraft exemption arrangements will be managed to match airborne equipage with the integration and use of Mode S in the ground systems. The CAA also looks to the airlines, of which some are part owners of NATS (En Route) plc, to apply pressure on the service providers to ensure that the benefits of Mode S are realised as soon as possible.
			2. Contends that gaps in the deployed upper and lower airspace coverage of Mode S Enhanced Surveillance across Europe will limit both the safety and the operational benefits that can be delivered.	2. The main benefits from Mode S Enhanced Surveillance implementation will be realized in the busy TMAs and major air routes and, therefore, contiguous international coverage of Enhanced Surveillance is not a significant requirement. However, France, Germany and the UK published a 3-States Master Plan Document in 2002 setting out plans for Mode S

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				Enhanced Surveillance coverage from 2005. Since then, Switzerland has stated a similar intention and it is likely that coverage will also be extended into the Maastricht UAC. Other States are also expected to announce decisions to implement Mode S Enhanced Surveillance in due course.
			3. Urges Air Navigation Service Providers to initiate plans to use the Mode S Extended Squitter functionality, which can be provided by most Mode S Enhanced Surveillance equipped aircraft, as soon as possible.	3. Noted. At the 11th ICAO Air Navigation Conference, Mode S 1090 Extended Squitter was accepted as the global solution for the initial introduction of ADS-B enabled services.
			4. Requests alleviation from the equipage requirements beyond 2007 for a small percentage of aircraft to prevent the need to bring the aircraft in for specific downtime. If specific downtime was mandated, the costs of Mode S embodiment would increase dramatically.	4. Requests of this nature are recognized and will be co-ordinated by the implementing States through the Mode S Exemption Co-ordination Cell. Nevertheless, requests for exemptions such as these will need to be measured against the impact that non-compliant aircraft will have on the expeditious realization of the benefits of Mode S for the ATC providers and operators of compliant aircraft.
			5. Endorses the planned alleviation from the requirement for aircraft to be SI Code compliant by 31 March 2005 and contends that a small proportion of non-SI Code compliant aircraft after 2007 would not have an operational impact on Mode S radars.	5. Noted. Use of SI Codes will be required as soon as possible after 2005. Although Mode S radars can be configured to manage a small number of non-SI Code compliant aircraft, there is a resultant penalty on the loading of the SSR radio frequencies. This would, therefore, reduce one of the major safety benefits of Mode S. Therefore, any decision to grant exemptions from the SI Code requirement after 2007 would need to be considered carefully.
			6. Requests clarification of whether exemptions for aircraft equipped with Mode S to the ICAO Annex 10 Amendment 73 standards will be granted after 2007.	6. The safety benefit of Amendment 77 equipped aircraft providing the barometric pressure setting on which the 'Selected Altitude' parameter is based is well recognized. Therefore, continued exemptions for non-

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				Amendment 77 compliant aircraft after 2007 will have to be considered in close consultation with the Air Navigation Service Providers and the safety regulators.
			7. Requests clarification of the policy for Minimum Equipment List (MEL) relief and proposes a Category D (120 day) MEL relief for failure to broadcast individual parameters or Aircraft Identification. In addition, the response states that it is not practical to individually request approval from states to operate in the event of missing parameters and, therefore, no such requirement should be specified in ICAO Doc 7030 or State AIP	7. Noted. Discussions on MEL relief are ongoing within the Joint Aviation Authority and CAA SRG.
08	US Department of Defense	Overseas Military	1. Understands and supports the initiative to introduce Mode S to maintain current levels of safety and capacity as traffic levels continue to grow but supports Option 2 for DoD aircraft.	1. Noted.
			2. Due to significant concerns, technical feasibility in legacy aircraft and the small impact of military aircraft to traffic volume, the response contends that all military aircraft should be exempt from the Mode S Enhanced Surveillance requirement. However, the response indicates that as many US DoD legacy aircraft as possible are planned to be equipped with Mode S Elementary Surveillance. Where older airframes are replaced, Enhanced Surveillance equipage is anticipated.	2. Noted. It is accepted that combat aircraft will only be able to provide Mode S Elementary Surveillance. However, the larger and more modern military transport type airframes should be able to support the Mode S Enhanced Surveillance requirements. Paragraph 3.4 of the RIA provides further guidance on this issue. Negotiations are ongoing with European partners and the Eurocontrol Military Business Division to agree some suitable principles that can be applied realistically to State aircraft. Therefore, the CAA believes that these principles will address the majority of the DoD's concerns in this area.
			3. Concerns expressed about broadcasting aircraft intention information.	3. Noted. The CAA is willing to discuss these concerns with operators of military aircraft and, if necessary, take this into account when assessing requests for exemptions.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			4. Concerns expressed about the possible future expansion of Mode S Enhanced Surveillance within the En Route system, as this would severely hamper the DoD's global mission. 5. Due to a longer budget cycle than civil operators, a larger and older fleet and extended production/installation cycles, many aircraft will not be able to be equipped with Mode S Elementary Surveillance by the UK deadlines. Moreover, it will not be possible to regionalize the varied DoD fleets.	4. Mode S Enhanced Surveillance will only be implemented in the busier TMAs and en route structure, where safety and capacity benefits can be realized and where ground implementation of Mode S is appropriate. The agreed exemption principles will also apply in any further expansion of the Enhanced Surveillance implementation. 5. Noted. This is recognized throughout Europe and suitable exemption principles are being negotiated between the European States that are implementing Mode S, which will take account of these specific issues relating to State aircraft.
09	Guild of Air Traffic Control Officers	Air Traffic Controller User Group	1. Supports the implementation of Option 3 and the safety enhancements that should ensue from its introduction, particularly from the point of view of reducing 'Level Busts' through the provision of 'Selected Altitude'. 2. Considers the RIA to be well written and comprehensive. 3. States that the new controller display tools that can be implemented using Mode S are very intuitive and should enhance 'stack management' techniques considerably, thereby reducing workload for the controllers concerned.	1. Noted. 2. Noted. 3. Noted
10	General Aviation Safety Council	User Group	1. Decided not to comment on Option 2 because a Eurocontrol information notice stated that the UK had already decided to implement Mode S Enhanced Surveillance.	1. This is regrettable. Eurocontrol has no regulatory authority in the UK. All negotiations and decisions in the Eurocontrol forum are subject to the appropriate regulatory provisions being made in the States concerned. In the UK, all proposed changes to the ANO 2000 must go through the RIA consultation process. Therefore, any UK intentions expressed in Eurocontrol documentation, which would affect

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				the ANO 2000, merely indicate a recommendation that the CAA will place in front of industry for proper consultation. However, the CAA would not make these recommendations if it were not convinced that the proposals were in the best interest of the aviation industry.
			2. Accepts that stage one of the programme to implement Option 3 will provide substantial benefits to the airline industry from increased ATC capacity and reduced delays whilst maintaining or improving safety levels. However, the response expresses serious reservations about certain aspects of the programme when applied to General Aviation.	2. As stated in the RIA, Option 3 would provide mitigation for all of the risks that are set out in Paragraph 2.2 of the document. The identified safety risks affect all users of the notified airspace, irrespective of which industry sector they originate from. Therefore, the small proportion of the GA fleet that requires access to the notified airspace as IFR/GAT will receive the same safety benefits as the airlines. Furthermore, equipping with Mode S will ensure that the GA fleet remains interoperable with commercial traffic in the busy controlled airspace to which this proposal relates. Overcoming the risks of maintaining capacity against the background of increased traffic growth will benefit the UK economy in general. All aviation sectors will benefit from this, whether or not they require access to the airspace.
			3. Opposes the future proposal to increase transponder carriage in the rest of the UK airspace from 31 March 2008.	3. Noted. The issues submitted will all be addressed in a future RIA covering the proposed implementation of increased transponder carriage and Mode S Elementary Surveillance in 2008.
			4. Argues that the CAA, as the regulator for NATS, should reverse the decision to permit NATS to install a new SSR system that is unable to provide Traffic Information Service (TIS) data. This system would provide a significant safety benefits to small airliners not equipped with collision avoidance systems, and to GA at	4. It is for the Air Navigation Service Providers to make the commercial decision on which radars to procure, not the CAA. Furthermore, this RIA proposal only relates to the busy TMA and En Route Controlled Airspace, within which the separation of aircraft is the responsibility and

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			minimal cost.	function of Air Traffic Control. Furthermore, the vast majority of aircraft operating in this environment will be equipped with ACAS II. The provision of TIS, therefore, would be of limited value in this environment. However, the issue surrounding the use of TIS by GA will be considered in the next RIA consultation process on the proposal to increase Mode S Elementary Surveillance transponder carriage from 2008.
			5. Argues that the wording of clause 2.1.2 in the RIA does not limit stage one to controlled airspace. It should not be used by the CAA to take powers to mandate the carriage of Mode S outside controlled airspace in stage one without proper consultation with the GA industry.	5. Mode S Enhanced Surveillance functionality will only be introduced in the busy Controlled Airspace around major airports and within the major airways and air routes. This is where the safety and capacity benefits of Mode S Enhanced Surveillance need be realised. Initially, this implementation will be in the London TMA and the notified airspace will only be expanded to other TMAs and airways/air routes in the UK where the service providers are investing to make use of the Mode S Enhanced Surveillance data.
			6. Supports the decision to reject Option 1 and accepts that there is insufficient time to adopt Option 4 but regrets that the significant safety benefit for non-ACAS equipped aircraft will not be realised.	6. Noted.
			7. Argues that the wording of the proposed amendments to Schedule 5 of the ANO is confusing, contains redundant information and should be revised. The ANO changes should be drafted to enable an operator to ascertain applicability without reference to the Exemption Policy document. Also, the section on applicability in the Exemption Policy document appears to impose more stringent conditions than the ANO and should be deleted.	7. Noted. The wording will be reviewed by the CAA Legal Department in light of these comments.
			8. Argues that the CAA has not demonstrated that there	8. In order to maximize the benefits of Mode S

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			is a need to mandate the fitting of Enhanced Mode S to any aircraft with a Maximum Take-Off Mass of less than 5,700kg by 31st March 2005. The present proposal for determining a maximum cruising true airspeed is also confusing, inconsistent, and discriminates unfairly against certain aircraft, solely because they are more robustly constructed than competitive aircraft. Unless the CAA can produce evidence of the need, the references to a maximum cruising true airspeed of 250kts should be deleted.	Enhanced Surveillance in the busy terminal and en structure, all aircraft that operate in the airspace need to be equipped with Enhanced Surveillance functionality. However, the CAA recognises that smaller or older aircraft will not be able to support this new technology. Therefore, the applicability and exemption criteria were developed with the aim that as many light aircraft as possible, which cannot be equipped with Mode S Enhanced Surveillance but which require access to the airspace, should fall beneath the Enhanced Surveillance criteria. This reduces the burden on the Exemption Co-ordination Cell and the costs and burden on light aircraft operators to the maximum possible extent. The point on the Mode S Enhanced Surveillance speed criteria has been well made by the PPL/IR Europe group and GASCo and the CAA recognizes the issue. Therefore, the speed criteria has been re-examined and a new proposal, which is in-line with one of the suggestions of the 2 groups, has now been submitted to the other European regulators and the certification authorities for consideration.
			9. Contends that CAA should produce a full RIA for these important proposals in stage one strictly in accordance with Government policy as set out in the Cabinet Office document *Better Policy Making: A Guide to Regulatory Impact Assessments.* Notes that there was no inclusion of the compliance costs for GA industry sector.	9. Prior to the promulgation of the Initial RIA and the Partial RIA for the relevant consultation periods, each RIA was submitted to the DfT and Cabinet Office Better Policy units for scrutiny and feedback. On both occasions, authority to distribute the RIAs for consultation was sought and approved. The CAA does not have access to readily available information on the compliance costs or hours flown by private operators in the London TMA or major En Route airspace structure. Therefore, it was hoped that

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				small General Aviation businesses and private individuals would submit this information during the RIA consultation process. Unfortunately, the General Aviation community has provided very little quantitative information during the 2 rounds of consultation. We also note that none is provided in this submission. It has therefore not been possible to break out the overall compliance costs to the General Aviation sector with any degree of certainty. However, it is considered that only a very small proportion of private operators fly within the London TMA and major En Route airspace as GAT under IFR. Although compliance costs for those individuals whose aircraft require equipage with Mode S Enhanced Surveillance will be proportionately higher than those for commercial operators, the impact of this proposal on the overall General Aviation sector is not thought to be significant. This may also explain why there have been so few responses from private individuals with quantitative data. Notwithstanding, it is accepted that the impact on the members of this particular General Aviation user group is likely to be higher than that for other groups.
			10. The response notes surprise at the limited responses to the first letter of consultation from the airline industry and NATS.	10. Noted. However, consultation on this proposal, through the various CAA consultation fora, has been ongoing for several years. NATS and the UK airline industry has expressed support of Option 3 on many occasions within these fora. The CAA had hoped to see a greater response to the formal RIA process from small businesses with quantitative information. Regrettably this has not occurred but it may be an indication that this proposal should not have a

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
				significant impact on operators of small aircraft.
11	Kuwait Airways	Overseas Airline	1. States that the airline will not be able to equip with Mode S Enhanced Surveillance by 31 March 2005 and requests that exemptions be granted during the 2-year transition period.	1. Noted. Potential equipage difficulties are being reported by all airlines and we are monitoring the situation closely The Eurocontrol Mode S Exemptions Co-ordination Cell will process all requests for exemptions on a case-by-case basis. The Cell will apply the criteria set out in the UK Mode S Exemption Policy on behalf of the CAA during the transition period. This policy has been co-ordinated with the other European states that are also implementing Mode S Enhanced Surveillance.
12	Loganair Ltd	UK Airline	1. Notes that the Enhanced Surveillance parameters listed in Appendix 5 of the Partial RIA differ from the ones contained in the draft ANO amendment at Appendix 8.	1. Since the Eurocontrol CBA was published, there has been another amendment to the ICAO Mode S Standards and Recommended Practices. This changed some of the Mode S registers slightly and the Downlinked Aircraft Parameters shown in the draft ANO amendment reflects these changes. However, only the terminology for 'Selected Altitude' differs. Under ICAO Annex 10 Amendment 77, Selected Vertical Intent includes the 'Selected Altitude' functionality.
			2. Notes that the costs for upgrading avionics to provide transponders with the necessary Mode S Enhanced Surveillance information has not been included in the Competition Assessment. Therefore, the overall costs have been greatly underestimated. Clarification of 'technically infeasible' is also required.	2. Where the existing avionics of an aircraft do not support the provision of Mode S Enhanced Surveillance parameters, an exemption would be granted on the grounds of 'technical feasibility'. The operator would then only be expected to equip the aircraft with Elementary Surveillance functionality. Therefore, the costs for upgrading avionics have not been included in the RIA. The Eurocontrol Mode S Exemption Co-ordination Cell is able to advise operators about aircraft capabilities to support Enhanced Surveillance.

SER NO	RESPONDENT	SECTOR	SUMMARY OF COMMENT	CAA RESPONSE
			3. Requests confirmation of when Mode S will be implemented in the Scottish and Irish FIRs.	3. Mode S Enhanced Surveillance functionality will only be introduced in the busy Terminal Manoeuvring Areas around major airports and within the major airways and air routes. This is where the safety and capacity benefits of Mode S Enhanced Surveillance need to be realised. Initially, this implementation will be the London TMA and the notified airspace will only be expanded to other Controlled Airspace in the UK where the service providers are investing to make use of the Mode S Enhanced Surveillance data. Notwithstanding, the CAA will be publishing another RIA to propose the introduction of Mode S Elementary Surveillance in all other airspace, which is not included in the Enhanced Surveillance mandates, with effect from 31 March 2008.
			4. Comments of the cumulative high costs associated with many other recent equipage mandates and on the reducing opportunities for organisations to submit modifications for 'out of production' aircraft without design organisation approval. Therefore, for even the smallest modification, costs are increased significantly.	4. Noted.
13	British Gliding Association	User Group	1. Submitted a paper dated 8 May 2002 with detailed comments about the future CAA proposal to increase transponder carriage from 31 March 2008.	1. The submission was not relevant to this RIA consultation, as gliders will not be affected. The issues submitted will all be addressed in a future RIA covering the proposed implementation of increased transponder carriage and Mode S Elementary Surveillance in 2008. The CAA hopes to receive a more up-to-date response from this organisation during the consultation process for that future RIA.
14	UK Airprox Board	Air Incident Investigation	1. Supports the implementation of Option 3 because of the air safety benefits that will be gained.	1. Noted.

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Appendix 5

METHODOLOGY AND ASSUMPTIONS OF THE EUROCONTROL REVISED CASE FOR ENHANCED SURVEILLANCE IN EUROPE

1 Background

1.1 The original Mode S Cost Benefit Analysis (CBA) was completed in July 1998 and showed a substantial return on investment for both Mode S Elementary Surveillance and Enhanced Surveillance. However, while the case for Elementary Surveillance was accepted by the aviation community, it was felt that the case for Enhanced Surveillance required further work to substantiate the value of the operational benefits produced by Downlinked Aircraft Parameters (DAPs).

1.2 The further work on Enhanced Surveillance was conducted under the guidance of the Enhanced Surveillance – Downlinked Aircraft Parameters (ESDAP) Steering Group. Membership of the Group comprised Eurocontrol, Air Traffic Service providers, military authorities, airlines and their respective organizations. The ESDAP Report was published in 2000 and it identified 8 Mode S Enhanced Surveillance DAPs that could achieve major benefits.

1.3 The Eurocontrol Revised Case for Enhanced Surveillance in Europe is built on work conducted since 1994 in the development of the Mode S Enhanced Surveillance Concept and the work conducted under supervision of the ESDAP Steering Group. The CBA Centre of Expertise of the Programme Portfolio Management Unit of Eurocontrol produced the Revised CBA that accompanied the Case.

3 Methodology

2.1 The Revised Case incorporated the use of the following 8 DAPs that were recommended by the ESDAP Steering Group:

a. Magnetic Heading.

b. Indicated Air Speed and Mach Number.

c. Selected Altitude.

d. Track Angle Rate.

e. Vertical Rate.

f. Roll Angle.

g. Ground Speed.

h. True Track Angle.

2.2 Eurocontrol and DFS undertook Fast Time Simulations of the first 3 DAPs listed above. Magnetic Heading and Indicated Air Speed were initially taken together and then Selected Altitude was added to compare the results. The results for 3 DAPs showed a significant increase in benefits over just two and so the benefits of the 3 DAPs are used in the Revised CBA.

2.3 The selection of the 3 DAPs was based on DAPs that can reduce controller workload and, therefore, enhance capacity and safety. The simulations were based on the Karlsruhe Upper Airspace Control Centre sectors. This was chosen as being

representative of busy airspace showing signs of capacity restraint. The results showed a capacity increase of 5-7% in high traffic density En Route airspace. However, the results achieved were considered to be conservative because Karlsruhe airspace is not as complex as London TMA. The benefits of Mode S Enhanced Surveillance will increase as the airspace complexity increases.

2.4 The benefits included in the Revised Case that are specifically associated with Mode S Enhanced Surveillance were a reduction of R/T workload and radar tasks, which lead to an increase in capacity. The benefits of Mode S Enhanced Surveillance DAPs on Short Term Conflict Alert systems were not included in the Revised Case.

2.5 The evaluation of benefits was based on the statistical derivation of relationships between delay and traffic levels for each of the centres in the core European airspace. This included centres in Belgium, Maastricht, France, Germany, Italy, UK, Netherlands and Switzerland. This modelling was based on historical figures for the increase in delays that resulted from increases in traffic levels.

2.6 Airborne equipage costs were based on the following reports:

a. A British Airways report on the Airborne Impact of Enhanced Surveillance and Downlinked Aircraft Parameters, published on 24 November 1999.

b. A Europe Air Design study into the Airborne Mode S Enhanced Surveillance Implementation Costs, published on 29 December 2000.

2.7 Costs and benefits were assessed for period to 2017.

3 Assumptions

3.1 A baseline equipage rate of 70% in the air was assumed. Furthermore, it was assumed that Mode S Enhanced Surveillance would only be fitted to aircraft in which it was technically feasible to do so. In effect, this means aircraft with digital or partly digital avionics. It was also assumed that aircraft with digital avionics would make up 90% of the affected flights by 2017.

3.2 It was assumed that Airline equipage would be completed with 50% of the aircraft being modified through Service Bulletins and 50% through Supplemental Type Certificates. In addition, it was assumed that retrofit of aircraft with Mode S Elementary Surveillance to meet the Enhanced Surveillance requirements would be done during routine downtime periods with no specifically attributable downtime costs.

3.3 A two-step implementation of Mode S was assumed. Firstly, it was assumed that Mode S Elementary Surveillance would be implemented in the Core Area of Europe first and that this would be the basis of surveillance services for 15-20 years in Europe. It was further assumed that Enhanced Surveillance would be implemented on top of Elementary Surveillance in high density En Route airspace and TMAs in 2005.

3.4 It was assumed that there would be a 31.9% capacity increase between 2001-2005 in London through airspace optimisation and productivity improvements before Mode S Enhanced Surveillance was implemented. It was then assumed that there would be a further 3% growth each year thereafter without Enhanced Surveillance.

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Appendix 6

ASSUMPTIONS AND ESTIMATED COSTS FOR THE EQUIPAGE OF THE UK COMMERCIAL AIR TRANSPORT FLEET WITH MODE S FUNCTIONALITY.

Transport Passenger and Cargo Aircraft		**Option 2 (Low)** (See Note 1)	**Option 2 (High)** (See Note 2)	**Option 3 (Low)** (See Note 3)	**Option 3 (High)** (See Note 4)
Total from A-REG					
ELS (25%)	223	N/A	N/A	£445,500	£7,128,000
EHS (75%)	668	N/A	N/A	£8,019,000	£40,095,000
Total	**891**	**£1,782,000**	**£28,512,000**	**£8,464,500**	**£47,223,000**
Medium Sized Airline					
All EHS Capable	**40**	**£80,000**	**£1,280,000**	**£480,000**	**£2,400,000**
Small Airline					
ELS Capable	8	N/A	N/A	£16,000	£256,000
EHS Capable	12	N/A	N/A	£144,000	£720,000
Total	**20**	**£40,000**	**£640,000**	**£160,000**	**£976,000**
Medium Sized Airline					
ELS Capable	18	N/A	N/A	£36,000	£576,000
EHS Capable	22	N/A	N/A	£264,000	£1,320,000
Total	**40**	**£80,000**	**£1,280,000**	**£300,000**	**£1,896,000**
Very Small Airline					
All EHS Capable	**10**	**£20,000**	**£320,000**	**£120,000**	**£600,000**
Large Airline					
All EHS Capable	**70**	**£140,000**	**£2,240,000**	**£840,000**	**£4,200,000**
Very Large Airline					
All EHS Capable	**230**	**£460,000**	**£7,360,000**	**£2,760,000**	**£13,800,000**

Note 1: This option makes the assumption that all the aircraft are already equipped with a Mode S transponder through the ACAS II requirements and so this equipment will only need minimal modification to meet the Mode S ELS functionality. The lowest estimated cost of this modification is £2,000 per airframe if the aircraft do not have to be brought in for special maintenance inputs. This calculation is the 'best-case' scenario for Option 2 but is highly unlikely to occur in reality.

Note 2: This option assumes that all the aircraft need to be equipped with completely new Mode S transponders to meet the Mode S ELS functionality. The highest estimated cost of this modification is £32,000 per airframe if the aircraft do not have to be brought in for special maintenance inputs. This calculation represents the 'worst-case' scenario for Option 2 even though aircraft can be modified during routine maintenance periods. The CAA considers that the actual costs will be less than this calculation and hopes to avoid a requirement for 'Special Inputs' as this would significantly increase the costs to airlines.

Note 3: This option makes the assumption that all the aircraft are already equipped with a Mode S transponder through the ACAS II requirements and so this equipment will only need modification and integration with existing avionics to meet the Mode S EHS functionality. The lowest estimated cost of this modification is £12,000 per airframe if the aircraft do not have to be brought in for special maintenance inputs. This calculation is the 'best-case' scenario for Option 3 but is highly unlikely to occur in reality.

Note 4: This option assumes that all the aircraft need to be equipped with completely new Mode S transponders to meet the Mode S EHS functionality. The highest estimated cost of this modification is £60,000 per airframe if the aircraft do not have to be brought in for special maintenance inputs. This calculation represents the 'worst-case' scenario for Option 3 even though aircraft can be modified

during routine maintenance periods. The CAA considers that the actual costs will be less than this calculation and hopes to avoid a requirement for 'Special Inputs' as this would significantly increase the costs to airlines.

Note 5: There are many variables that could affect what actual costs between the high and low assumptions an airline will have to meet. The age of the fleet will be an important factor and also any special inputs will result in higher than necessary costs. As most airlines have a mixture of old and modern aircraft, it is likely that the actual costs for will fall somewhere in between the 2 assumptions. Furthermore, virtually all airline aircraft affected will already have a Mode S Transponder, which may or may not need to be replaced with new equipment. In addition, many of the aircraft affected by this UK proposal will need to equip with Mode S in order to fly in the airspace of other European States from 31 March 2005, irrespective of whether or not the proposal is implemented in the UK. Therefore, the total costs that are directly attributable to this UK proposal are highly likely to be much less than the worst-case calculations shown in the table.

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Appendix 7

ASSUMPTIONS AND ESTIMATED COSTS FOR THE EQUIPAGE OF THE UK GENERAL AVIATION FLEET WITH MODE S FUNCTIONALITY.

General Aviation Aircraft	**Totals from A-REG**	**(See Note 1)**	Percentage of fleet requiring access to the notified airspace **(See Note 2)**			
			70%	80%	85%	90%
>5700kg (75% EHS Capable)	124	**(See Note 3)**	87	99	105	112
			Percentage of fleet requiring access to the notified airspace **(See Note 4)**			
			5%	10%	15%	20%
>2730kg <=5700kg (25% EHS Capable)	281	**(See Note 5)**	14	28	42	56
<=2730kg (ELS Capable Only)	6091	**(See Note 6)**	305	609	914	1218
Total ELS Capable	6333	**(See Note 7)**	337	655	972	1288
Total EHS Capable	163	**(See Note 8)**	69	81	90	98
Total Aircraft	6496		405	736	1061	1386
Option 2 (Low)	**(See Note 9)**		£1,054,040	£1,914,640	£2,759,120	£3,603,600
Option 2 (High)	**(See Note 10)**		£2,432,400	£4,418,400	£6,367,200	£8,316,000
Option 3 (Low)	**(See Note 11)**		£2,590,960	£3,738,560	£4,765,880	£5,793,200
Option 3 (High)	**(See Note 12)**		£4,799,531	£7,227,563	£9,457,969	£11,688,375

Note 1: Although the figures are based on the General Aviation aircraft listed on the CAA's Aircraft Register, there are many aircraft owned by UK operators that are registered with overseas authorities but based in the UK. In particular, the 'N Register' in the USA is particularly popular. Unfortunately, the CAA does not have access to reliable data on the numbers of aircraft like this that are owned and operated in the UK. However, the CAA estimates that there could be as many as 50% additional GA 'N Registered' aircraft affected by this proposal and so the overall costs could be as much as 50% higher for each of the options.

Note 2: These figures set out the assumptions of how much of the overall fleet of aircraft in this weight category will require access to the notified Mode S airspace. As these aircraft are fairly large and capable, it has been assumed that a high proportion will require access. However, in reality it is thought likely that the proposal will affect a much smaller proportion of the overall fleet.

Note 3: The Aircraft Register currently lists 1015 aircraft in this weight category but, from other sources, it has been estimated that 891 of these aircraft fly within the Commercial Aviation sector. The remaining figure of 124 has been assumed to comprise of small General Aviation businesses and private individuals. A further assumption has been made that only 75% of the remaining number of aircraft will be capable of supporting Mode S EHS functionality.

Note 4: These figures set out broad assumptions of how much of the overall fleet of aircraft in these lower weight categories will require access to the notified Mode S airspace. As these aircraft are relatively light, it has been assumed that only a small proportion will require access. In reality, it is thought likely that the proposal will affect aircraft in the lower end of the assumptions.

Note 5: It has been assumed that only 25% of aircraft in this weight category will be capable of supporting Mode S EHS functionality. Mindful of the proposed exemption criteria, it is thought likely that this figure will be lower in reality.

Note 6: It has been assumed that no aircraft in this category will be required or able to support Mode S EHS functionality.

Note 7: This figure has been estimated from the assumption that 25% of aircraft >5700kg, 75% of aircraft >2370kg and <=5700kg, and all aircraft <2370kg will only require to be equipped with Mode S ELS functionality.

Note 8: This figure has been estimated from the assumption that 75% of aircraft >5700kg, 25% of aircraft >2370kg and <=5700kg, and no aircraft <2370kg will require to be equipped with Mode S ELS functionality. In reality, this is likely to be lower due to the proposed exemption criteria.

Note 9: This option assumes that all the aircraft requiring access to the notified Mode S airspace will purchase and equip with the Filser small Mode S ELS equipment or that the price of Mode S transponders will reduce with market forces. The current cost of Filser Mode S transponder can be as little as £2,600 and is the minimum cost that the CAA can envisage would have to be met.

Note 10: This option assumes that all aircraft requiring access to the notified Mode S airspace will need to be equipped with a standard Mode S ELS transponder at the currently quoted prices. The current maximum cost is believed to in the order of £6000. This would be the 'worst-case' cost scenario that the CAA can envisage for Option 2.

Note 11: This option assumes that all the aircraft requiring access to the notified Mode S airspace and only needing to equip with a Mode S ELS capability will equip in accordance with the 'Low' assumption for Option 2. It has been further assumed that the cost of equipping those aircraft requiring Mode S EHS functionality will be £25,000, which is the estimated cost for equipping a light turboprop aircraft. These totals represent the minimum cost that the CAA can envisage would have to be met by the GA sector for Option 3 between 2005 and 2017.

Note 12: This option assumes that all the aircraft requiring access to the notified Mode S airspace and only needing to equip with a Mode S ELS capability will equip in accordance with the 'High' assumption for Option 2. It has been further assumed that the cost of equipping those aircraft requiring Mode S EHS functionality will be £40,500, which is the estimated cost for equipping a small business jet. This would be the 'worst-case' cost scenario that the CAA can envisage for Option 3.

Note 13: Accurate data on the General Aviation industry sector is extremely difficult to source and so the assumptions are particularly broad. In reality, the required access and cost of equipage could be a permutation of any of the assumptions. However, due to the exemption and applicability criteria, the CAA believes that it is highly unlikely that the total equipage costs would be greater than the 'high' options calculated. Furthermore, many of the aircraft affected by this UK proposal will need to equip with Mode S in order to fly in the airspace of other European States from 31 March 2005, irrespective of whether or not the proposal is implemented in the UK. Therefore, the total costs that are directly attributable to this UK proposal are highly likely to be much less than the worst-case calculations shown in the table.

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Appendix 8

PROPOSED REGULATORY AMENDMENTS

Proposed Regulatory Amendments

AIR NAVIGATION ORDER 2000 SCHEDULE 5 Article 15

Radio and radio navigation equipment to be carried in aircraft

2 Table

Aircraft and Circumstances of Fflight	*Scale of Equipment Required*								
	A	B	C	D	E	F	G	H	J
(1) All aircraft (other than gliders) within the United Kingdom:									
(a) when flying under Instrument Flight Rules within controlled airspace	A*				E1 *	F*#			
(b) when flying within controlled airspace	A*								
(c) when making an approach to landing at an aerodrome notified for the purpose of this sub-paragraph							G*		
(d) when flying for the purpose of public transport on and after 1st January 2004					E1 *				
(2) All aircraft within the United Kingdom:									
(a) when flying at or above flight level 245	A*								
(b) when flying within airspace notified for the purposes of this sub- paragraph	A*								
(3) All aircraft (other than gliders) within the United Kingdom:									
(a) when flying at or above flight level 245					E1 *	F*			
(b) when flying within airspace notified for the purposes of this sub- paragraph					E1 *				
(c) when flying at or above flight level 100					E1 *				
(3A)(a) All aeroplanes having a maximum take-off weight authorised not exceeding 5,700kg and a maximum cruising true airspeed capability not exceeding 250 knots when flying under Instrument Flight Rules within airspace notified for the purposes of this sub- paragraph					E2 *				
(b) All rotorcraft when flying under Instrument Flight Rules within airspace notified for the purposes of this sub-paragraph					E2				
(c) All aeroplanes having either a maximum take-off weight authorised of more than 5,700kg or a maximum cruising true airspeed capability of more than 250 knots when flying under Instrument Flight Rules within airspace notified for the purposes of this sub- paragraph					E3*				
(d) All aircraft required to carry Scale E2 or E3					EE				
(4) All aircraft registered in the United Kingdom, wherever they may be:									
(a) when flying for the purpose of public transport under Instrument Flight Rules:									

Aircraft and Circumstances of Fflight	*Scale of Equipment Required*								
(i) while making an approach to landing	A		C	D				H	
(ii) on all other occasions	A		C					H	
(b) when flying for the purpose of public transport on and after 1st January 2004					E1				
(c) subject to sub-paragraph (e), multi-engined aircraft when flying for the purpose of public transport under Visual Flight Rules	A							H	
(d) subject to sub-paragraph (e), single-engined aircraft when flying for the purpose of public transport under Visual Flight Rules:									
(i) over a route on which navigation is effected solely by visual reference to landmarks (ii) on all other occasions	A A	B							
(d) when flying under Instrument Flight Rules within controlled airspace and not required to comply with paragraph (4)(a) above	A*								
(5) All aeroplanes registered in the United Kingdom, wherever they may be, and all aeroplanes wherever registered when flying in the United Kingdom, powered by one or more turbine jets or turbine propeller engines and either having a maximum take-off weight exceeding 15,000 kg or which in accordance with the certificate of airworthiness in force in respect thereof may carry more than 30 passengers									J

*Unless the appropriate air traffic control unit otherwise permits in relation to the particular flight and provided that the aircraft complies with any instructions which the air traffic control unit may give in the particular case.
#Provided that non-public transport aircraft flying in Class D and E airspace shall not be required to be provided with distance measuring equipment.

3 The scales of radio and radio navigation equipment indicated in the foregoing Table shall be as follows:

Scale E1

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and is capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale E2

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and has the capability and functionality prescribed for Mode S Elementary Surveillance and is capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale E3

Secondary surveillance radar equipment which includes a pressure altitude reporting transponder capable of operating in Mode A and Mode C and has the capability and functionality prescribed for Mode S Enhanced Surveillance and is

capable of being operated in accordance with such instructions as may be given to the aircraft by the air traffic control unit.

Scale EE

The aircraft shall, in the circumstances specifed in paragraph 2.1.5.3 of Volume IV of Annex 10 (Z Edition) to the Chicago Convention, comply with the requirements for antenna diversity set out in that paragraph.

AIR NAVIGATION (GENERAL REGULATIONS) 1993

Mode S Transponder

18B (1)(a) For the purposes of paragraph 2(3A) of Schedule 5 to the Air Navigation Order 2000, the capability and functionality prescribed for Mode S Elementary Surveillance shall be that specified for a level 2 transponder in Volumes III and IV of Annex 10 (Z Edition) to the Chicago Convention together with the additional functionality specified in sub-paragraph (b).

(b) This is the additional functionality referred to in sub-paragraph (a):

(iv) Capability to support the Interrogator Identifier (II) Code and Surveillance Identifier (SI) Code functionality;
(v) Extended Squitter functionality; and
(vi) ACAS Active Resolution Advisory.

(2)(a) For the purposes of paragraph 2(3A) of Schedule 5 to the Air Navigation Order 2000, the capability and functionality prescribed for Mode S Enhanced Surveillance shall be that specified for a level 2 transponder in Volumes III and IV of Annex 10 (Z Edition) to the Chicago Convention together with the additional functionality specified in sub-paragraph (b) and the additional downlinked parameters specified in sub-paragraph (c).

(b) This is the additional functionality referred to in sub-paragraph (a):

(iv) Capability to support the Interrogator Identifier (II) Code and Surveillance Identifier (SI) Code functionality.
(v) Extended Squitter functionality.
(vi) ACAS Active Resolution Advisory.

(c) These are the additional downlinked parameters referred to in sub-paragraph (a):

(x) Reporting of the Magnetic Heading Downlinked Aircraft Parameter.
(xi) Reporting of the Indicated Airspeed Downlinked Aircraft Parameter.
(xii) Reporting of the Mach Number Downlinked Aircraft Parameter.
(xiii) Reporting of the Vertical Rate Downlinked Aircraft Parameter.
(xiv) Reporting of the Roll Angle Downlinked Aircraft Parameter.
(xv) Reporting of the Track Angle Rate Downlinked Aircraft Parameter.
(xvi) Reporting of the True Track Angle Downlinked Aircraft Parameter.
(xvii) Reporting of the Ground Speed Downlinked Aircraft Parameter.
(xviii) Reporting of the Selected Vertical Intent Downlinked Aircraft Parameter (including Barometric Pressure Setting).

Appendix 9

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19. JAA Administrative and Guidance Material, Section 1: General, Part 3: Temporary Guidance Leaflets, Leaflet No 18: Certification of Transponder Systems for Enhanced Surveillance.

20. JAA Administrative and Guidance Material, Section 1: General, Part 3: Temporary Guidance Leaflets, Leaflet No 13 Revision 1: Certification of Transponder Systems for Elementary Surveillance.

21. JAA TSO 2C112a, Minimum Operational Performance Specification for SSR Mode S Transponders. (Adopts EUROCAE ED-73A)

22. EUR Regional Supplementary Procedures, ICAO Doc 7030/4.

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