

## European Air Traffic Management Programme



### 8.33 kHz STEERING COMMITTEE/CONTACT PERSONS

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### 8.33 kHz above FL195 – Close Out Report

#### EXECUTIVE SUMMARY

The ICAO EANPG 44 meeting, held in Paris on 2-5 December 2002, concluded on the need to expand 8.33 kHz operations below the then existing mandatory carriage level at FL245. Subsequently, EUROCONTROL developed an Implementation Plan for 8.33 kHz above FL195. The 8.33 kHz above FL195 implementation is now drawing to a close. This Close-Out Report considers to what extent the original planning and assumptions have been satisfied by the execution of the above FL195 phase.

#### Recommendations

The 8.33 kHz working arrangements and affected stakeholders are recommended to take into account the results of this Close-Out report, in particular when developing the Implementation Plan for 8.33 kHz below FL195. The following recommendations are highlighted:

- a) From the outset, to ensure a coherent approach between the development of the EUROCONTROL Implementation Plan and the revision to the European Commission Regulation 1265/2007. This will facilitate a coherent approach and a consensus amongst all affected stakeholders.
- b) Plan on the assumption that the main frequency planning benefits will start to emerge once a significant number of 25 to 8.33 kHz conversions have been coordinated in the ICAO COM2 table. For the above FL195 phase, frequency planning benefits have emerged in the period 6 to 18 months after the mandatory carriage date.
- c) To provide as much advanced notice as possible for implementing the airborne element, and to provide the affected stakeholders (aircraft operators, airframe manufacturers, modification centres, and avionics suppliers) with carriage dates that are credible and will be respected. In particular, advanced notice in the form of AICs and complimentary awareness material is essential. In the case of State aircraft, it is essential to anticipate transition periods that take into account procurement and technical constraints applicable to the military.
- d) To plan on the basis that a Pan-European approach should eventually prevail. The above FL195 phase has demonstrated that final goal of a harmonised Pan-European approach will provide the greatest frequency planning benefits, whilst maintaining safety levels and minimising any negative operational impact.
- e) With regards to any remaining activities on the above FL195 phase, the EUROCONTROL ESSIP/LSSIP process should be used to monitor progress.

## 1. INTRODUCTION

The ICAO EANPG44 meeting – held December 2002 in Paris – concluded on the need to implement 8.33 kHz below FL245 in order to address VHF congestion in the aeronautical VHF COM band 118 - 137 MHz. Subsequently, EUROCONTROL developed an Implementation Plan for 8.33 kHz above FL195.

The Implementation Plan set out the scope of work needed to implement 8.33 kHz above FL195 in the ICAO EUR Region, in order to realise frequency planning benefits from mid-2007 onwards. The 8.33 kHz above FL195 implementation is now drawing to a close. This Close-Out Report considers to what extent the original planning and assumptions have been satisfied by the actual execution of the above FL195 phase. The report discusses the lessons learned, with equal emphasis given to successes and failures.

The report has been prepared by the 8.33 kHz Programme Support Office in liaison with the main 8.33 kHz working arrangements, namely the Steering Committee and the 8.33 kHz Contact Persons.

## 2. ORIGINAL PLANNING & ASSUMPTIONS

For the above FL195 phase, the basic approach was to enforce mandatory carriage in the airspace above FL195 and ensure a near 100% equipage of 8.33 kHz radios amongst the affected aircraft fleet. In this way, the necessary pre-requisites would be satisfied for proceeding with 25 to 8.33 kHz ground-radio conversions in the airspace, thus enabling frequency planning benefits.

The original planning and assumptions for the above FL195 phase are documented in the *Implementation Plan for 8.33 kHz above FL195 in the ICAO EUR Region (Edition 1.0, dated 14/10/05)* – hereinafter referred to as the Implementation Plan.

The Implementation Plan described the original planning for the above FL195 phase, and gave particular emphasis to the following key milestones.

- The application of mandatory carriage above FL195;
- The completion of 25 to 8.33 kHz conversions.

The Implementation Plan contained important assumptions with regards to:

- The enforcement of mandatory carriage above FL195;
- 25 to 8.33 kHz conversions;
- Frequency planning benefits;
- Airspace user impact;
- State aircraft policy;
- Safety; and
- Costs.

The extent to which the original planning and assumptions have been satisfied in the actual execution is now assessed.

### **3. REVIEW OF ABOVE FL195 EXECUTION**

The original planning and the main assumptions are now reviewed in turn. For each item, a short description of the original assumptions and the actual execution is provided, together with some conclusions.

#### **3.1. Planning**

##### *Background*

The ICAO EANPG 44 meeting, held in Paris on 2-5 December 2002, concluded on the need to expand 8.33 kHz operations below the then existing mandatory carriage level at FL245.

Subsequently, the ACG22 meeting, held in Brussels in February 2004, endorsed the development of an Implementation Plan for 8.33 kHz above FL195 in the ICAO EUR Region. EUROCONTROL Permanent Commission Recommendation 05/6 was issued on April 2005, urging Member States to support the implementation of 8.33 kHz above FL195 in the ICAO EUR Region with a carriage date of 15 March 2007.

##### *Original Assumptions*

A high-level schedule for 8.33 kHz above FL195 is shown at Figure 1. The figure shows the main milestones and indicates both the original planned date (white diamonds) and the actual date (black diamond). In particular, the Implementation Plan identified the following key milestones and target dates:

- 15 March 2007: mandatory carriage applied above FL195 in the ICAO EUR Region;
- 31 December 2007: planned 25 to 8.33 kHz conversions completed in France and the UK.

##### *Execution*

From the Gantt, it can be seen that a period of 26 months elapsed between the ICAO EANPG 44/40 Conclusions and the publication of the EUROCONTROL Permanent Commission Recommendation 05/6. That it took so long can partly be explained by:

- the time required to set up the programme within the Agency during a period of reorganisation; and
- difficulties experienced in reaching a consensus with just a few of the large number of affected stakeholders.

Those items on the critical path – namely the introduction of the IFPS flight plan checking on the 26<sup>th</sup> October 2006, and the enforcement of mandatory carriage on 15<sup>th</sup> March 2007 – were achieved on time. In practice, 30 ICAO EUR Region States enforced mandatory carriage on the 15 March 2007, with a further 5 EU States enforcing on 15<sup>th</sup> March 2008; the latter in accordance with European Commission Regulation 1265/2007

The Implementation Plan identified a milestone to complete 25 to 8.33 kHz conversions in France and the UK by 31 December 2007. The requirement to complete 25 to 8.33 kHz conversions was specified in the EC Regulation 1265/2007 with a date of 3 July 2008 set for the implementation of the conversions. In practice, the majority of the planned conversions have been coordinated in the ICAO COM-2 table by end 2008.

In June 2005, the European Commission (EC) issued EUROCONTROL with a mandate to develop an Implementing Rule (IR) for air-ground voice channel-spacing. In December 2005, a Regulatory Approach was published, defining the development of a regulation that initially addressed 8.33 kHz above FL195. EC Regulation 1265/2007 was published in the EC Journal on 27th October 2007. From the Agency perspective, the IR was seen as an opportunity for binding European regulation which could compel stakeholders to meet their obligations on the 8.33 kHz Programme.

#### *Conclusions on Planning*

The original planning has been largely respected during the execution of the above FL195 phase. In particular, those milestones on the critical path – such as the enforcement of mandatory carriage on the 15 March 2007 – have been implemented on time.

For the above FL195 phase, the EUROCONTROL Permanent Commission Recommendation 05/6 had already been published, before work had begun on developing the European Commission Implementing Rule. As a consequence, some difficulties were experienced in getting consensus and a coherent approach amongst all stakeholders. For the below FL195 phase, a coherent approach should be planned from the onset.

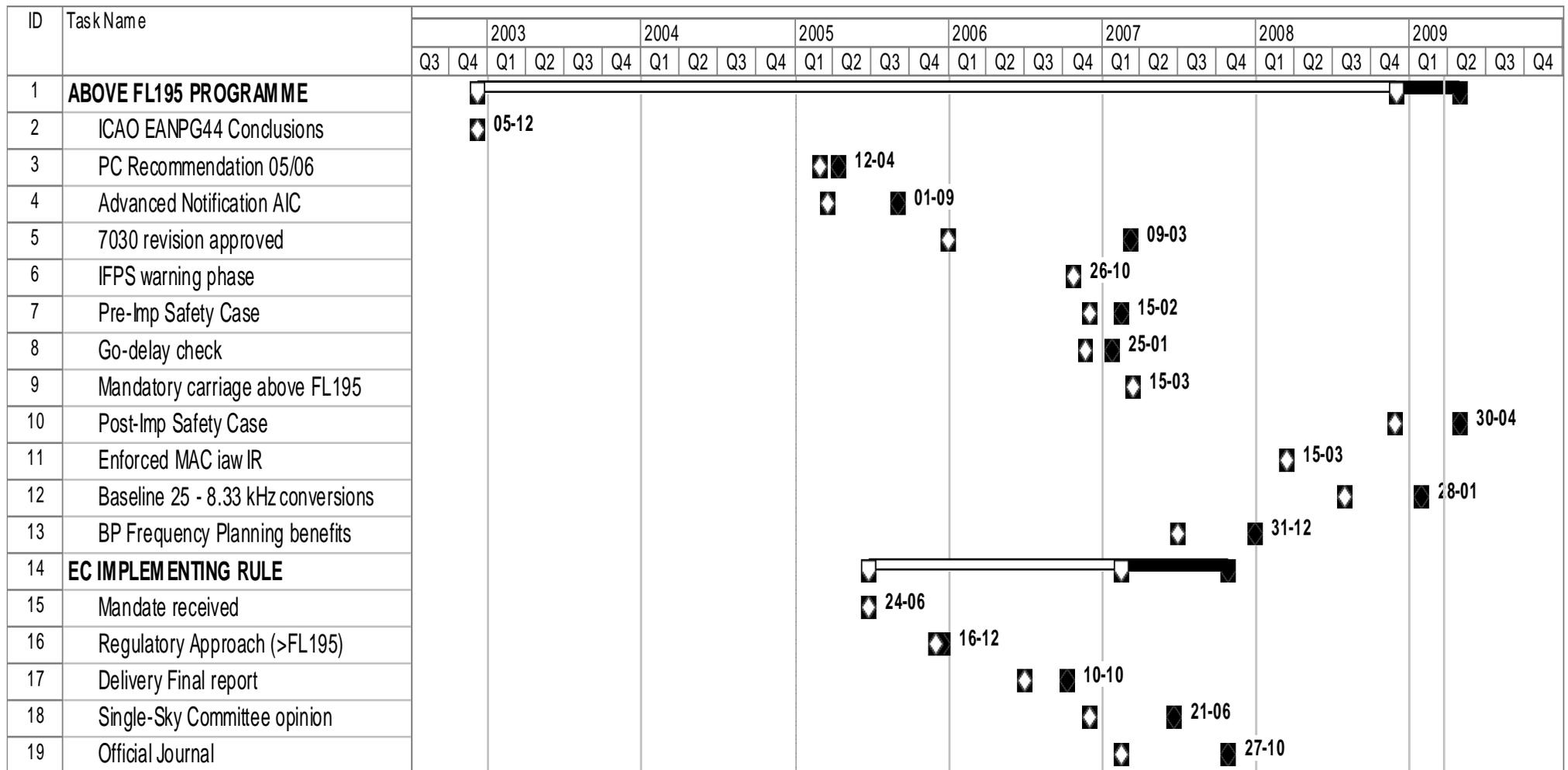


Figure 1: 8.33 kHz Above FL195 schedule showing key milestones

### **3.2. Enforcement of Mandatory Carriage**

#### *Background*

The enforcement of mandatory carriage, and achieving a near 100% equipage of 8.33 kHz radios in the affected aircraft fleet, are basic prerequisites for proceeding with the operation of 25 to 8.33 kHz radio conversions in a selected airspace.

#### *Original Assumptions*

The Implementation Plan recommended that the mandatory carriage of 8.33 kHz channel-spacing capable radio equipment be applicable above FL195 across the whole of the ICAO EUR Region, and that it be enforced, as a minimum, in those States that already enforced 8.33 kHz above FL245.

The recommendation to enforce mandatory carriage above FL195 was based on the following considerations:

- The Preliminary System Safety Assessment (PSSA) identified the enforcement of mandatory carriage as a mitigation against a number of safety hazards;
- To minimise the additional controller workload and complicated flight planning arrangements that could result from enforcing at FL195 and FL245 in different States;
- To enable States to introduce 8.33 kHz channels principally based on ATC operational and frequency management considerations, without the need for additional coordination to enforce mandatory carriage on an individual State basis.

#### *Execution*

In accordance with PC Recommendation 06/5, the carriage and operation of 8.33 kHz radio equipment above FL195 in the ICAO EUR Region became effective on 15 March 2007 and was enforced in 30 States.

For a period of 1 year, Spain and Portugal continued to enforce above FL245. As a consequence, transition arrangements were established in the Letters of Agreement between France and Spain. In accordance with EC Regulation 1265/2007, a further 5 EU States, including Spain and Portugal, enforced mandatory carriage above FL195 from 15 March 2008.

#### *Conclusions on the Enforcement of Mandatory Carriage*

The recommendation to enforce mandatory carriage at above FL195, as a minimum, in all those States that originally enforced above FL245, has been achieved. For a period of 1 year, between 15 March 2007 and 15 March 2008, Spain and Portugal continued to enforce mandatory carriage above FL245, thus requiring transition arrangements for a 1-year period.

In the end, a Pan-European approach has prevailed, and the creation of a homogeneous area of enforced mandatory carriage above FL195 has provided the necessary prerequisite for proceeding with 25 to 8.33 kHz conversions.

### **3.3. Aircraft impact**

#### *Background*

As mentioned earlier, it is a basic pre-requisite that a near 100% equipage of the 8.33 kHz radios in the affected fleet be achieved, before proceeding with 25 to 8.33 kHz conversions in a particular airspace. Non-8.33 kHz equipped State aircraft flying above FL195 have to be accommodated, provided that this is within ATM capacity limits and safety levels are maintained.

This section assesses: aircraft 8.33 kHz equipage rates; the handling of State aircraft; and the total number of aircraft impacted by 8.33 kHz above FL195.

#### **3.3.1. Aircraft 8.33 kHz equipage rates**

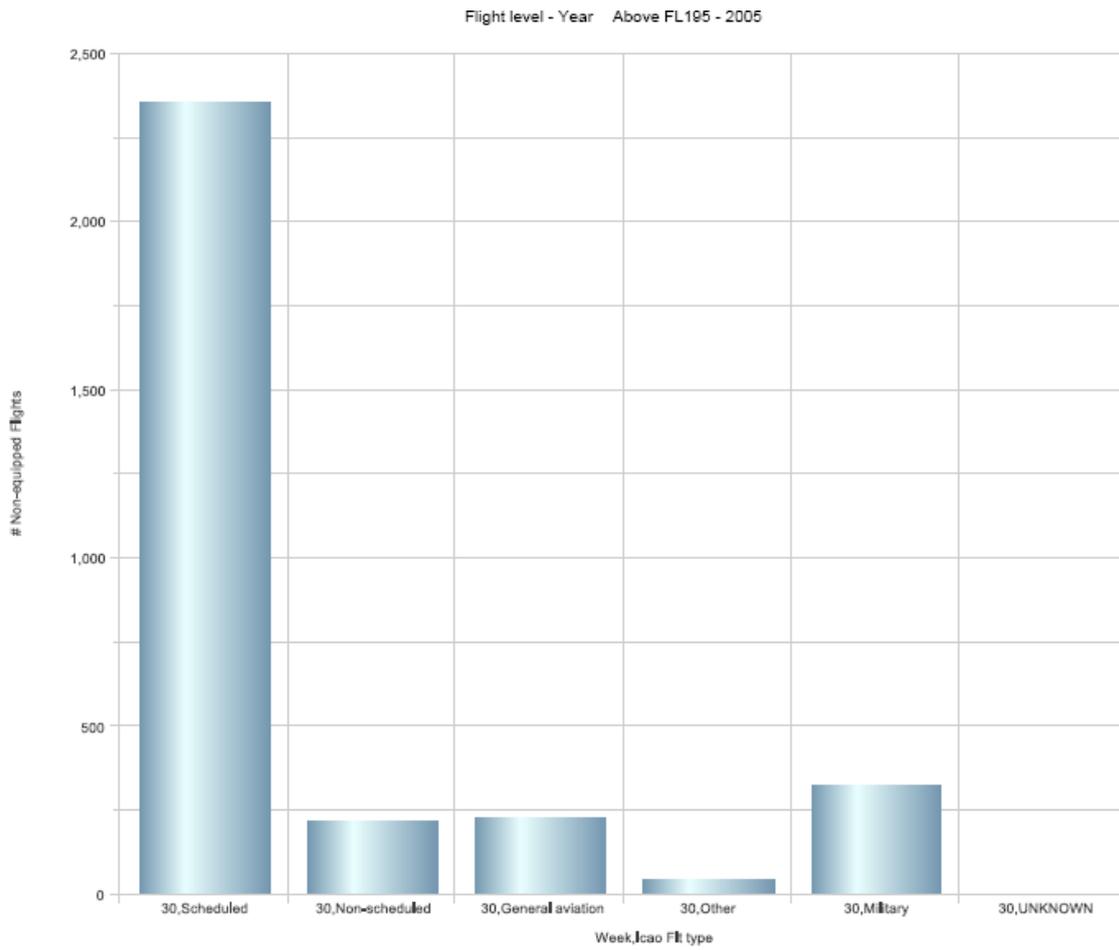
This section contains a number of diagrams generated using the EUROCONTROL PRISME data warehousing tool. The PRISME tool uses enriched tactical ATFM data from the Enhanced Tactical Flow Management System (ETFMS) at the Central Flow Management Unit (CFMU).

The 8.33 kHz equipage status is determined by assessing whether a “Y” is included in the equipment field of the flight plan data. It is important to bear in mind that this process is subject to some uncertainties, for example:

- Equipment field data not always available;
- Aircraft operators with 8.33 kHz equipped aircraft may have omitted to file a “Y” if the requested flight level was below the mandatory carriage level.

#### *Original Assumptions*

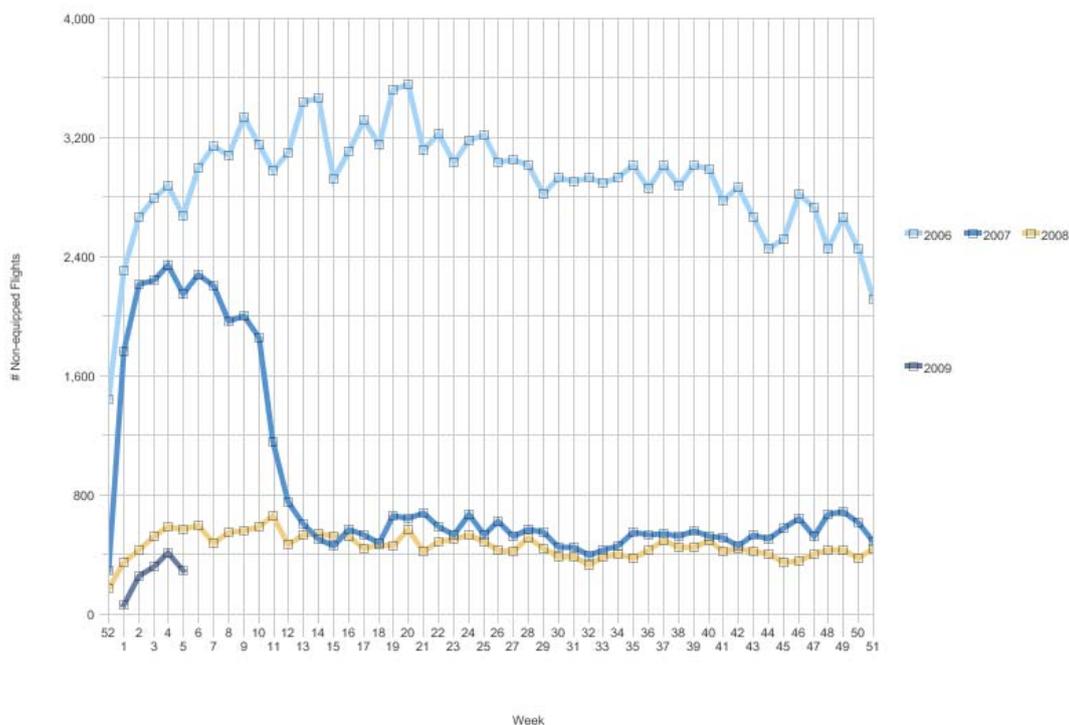
Figure 2 shows the non-8.33 kHz equipped flights for a busy week from 25/07/2005 until 31/07/2005. It can be seen that scheduled flights comprised the largest category of non-8.33 kHz equipped flights, many of which corresponded to turbo-props flown by European regional aircraft operators.



**Figure 2: Non-8.33 kHz equipped flights between 25/07/2005 and 31/07/2005**

### *Execution*

Figure 3 shows the evolution of non-8.33 kHz equipped flights above FL195 in the 8.33 kHz area, on a per weekly basis, from 1 January 2005 until 31 January 2009. The figure shows a steady decrease in the number of non-8.33 kHz equipped flights in the second half of 2006, with a steep decrease just before the introduction of mandatory carriage on 15 March 2007. This pattern is consistent with the feedback received from operators, with respect to both aircraft equipage plans and the correct filing of a “Y” in the flight-plan.



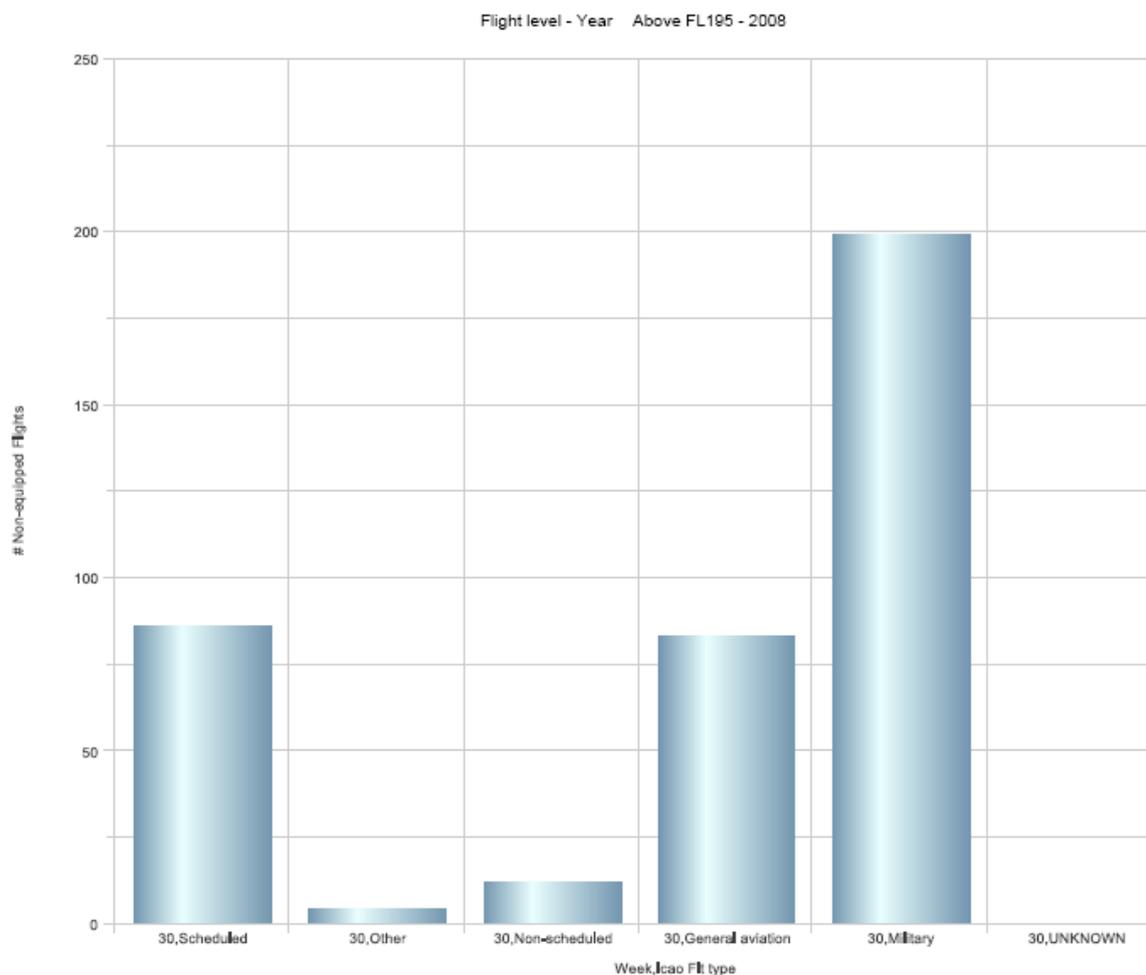
**Figure 3: Non-8.33 kHz equipped flights above FL195 in 8.33 Area (~35 States) per week since January 2005**

Figure 4 gives an indication of the number of non-8.33 kHz flights above FL195 in the 8.33 kHz area in 2008. It shows the non-8.33 kHz equipped flights for a busy week from 21/07/2008 until 27/07/2005. It should be compared to the situation in July 2005 – as shown at Figure 2.

Overall, the number of non-8.33 kHz equipped flights has decreased significantly when compared to 2005. For the sample chosen, whereas scheduled flights were the largest category of non-8.33 kHz equipped flights in 2005, military flights are now the largest category of non-8.33 kHz equipped flights in 2008, but nevertheless compared to 2005 (figure 2) the number decreased by more than 30%.

In 2005, it was already reported that some aircraft operators would prefer to fly below FL195, rather than invest in 8.33 kHz radio equipment. Such aircraft operators typically explained that their aircraft rarely flew above FL195. Moreover, some operators have stated that they will await a decision on below FL195 before investing in 8.33 kHz radios.

The enriched flight data confirms that some aircraft operators may have elected to fly below FL195. Neither flight plan data nor feedback from ATC indicates any increase in the traffic below FL195 due to this approach.



**Figure 4: non-8.33 kHz equipped flights between 21 July 2008 and 27 July 2008**

### *Conclusions on aircraft equipage rates*

Compared to the situation in 2005, the 8.33 kHz aircraft equipage above FL195 has continued to increase, with today's equipage rate in the region of 99.75%. There remains a need to be vigilant about the potential safety implications of some non-8.33 kHz equipped aircraft flying above FL195.

### **3.3.2. State aircraft**

#### *Background*

For the above FL245 implementation, a guideline had evolved which foresaw that non-8.33 kHz equipped State aircraft could enter the mandatory carriage area, provided that they were infrequent users (less than 30 hours per year in the airspace) and UHF equipped. In practice, this guideline had led to additional workload when handling non-8.33 kHz equipped State aircraft, which could impact on safety.

#### *Original Assumptions*

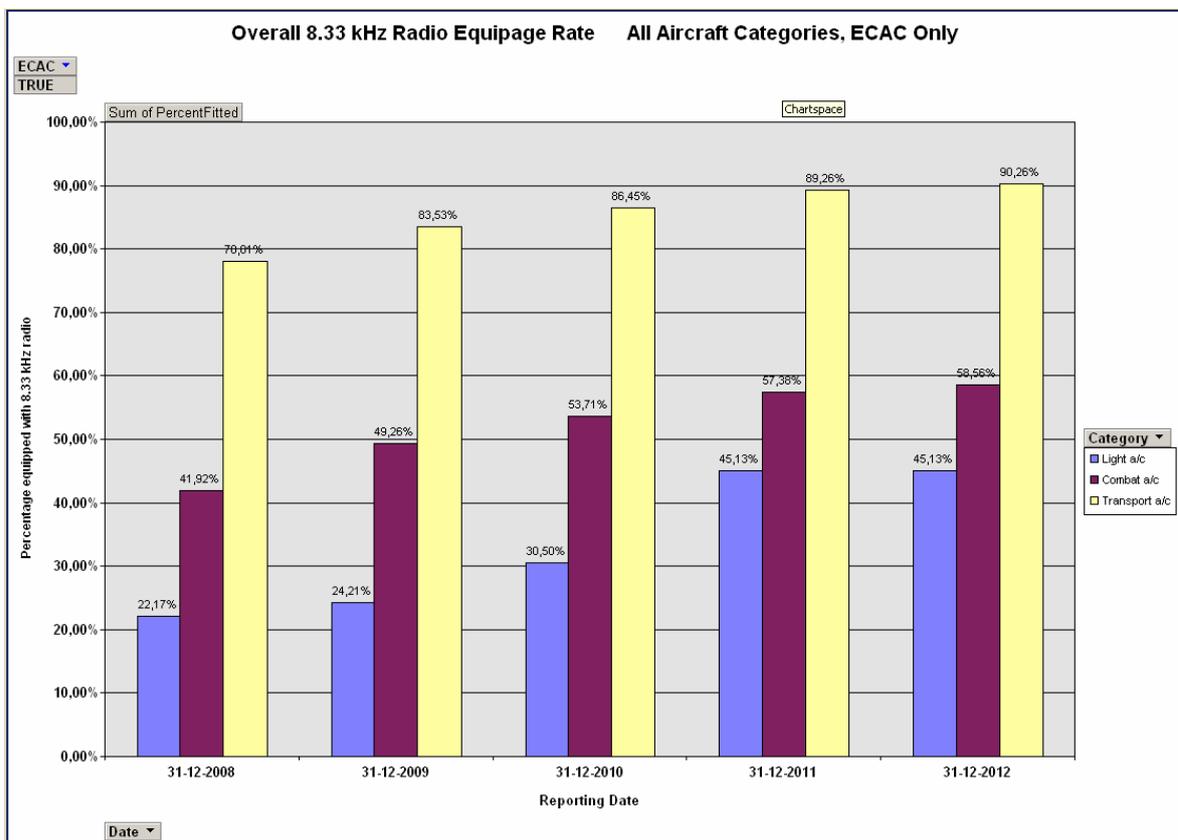
For the above FL195 implementation, the 8.33 kHz Contact Persons meeting (21-22 April 2004, Brussels) recommended that a revised policy for handling State aircraft be developed. The aim of the policy would be to maximise the 8.33 kHz equipage of State aircraft, in particular for Transport-type aircraft, whilst ensuring that ANSPs handled the remaining non-8.33 kHz equipped State aircraft.

## Execution

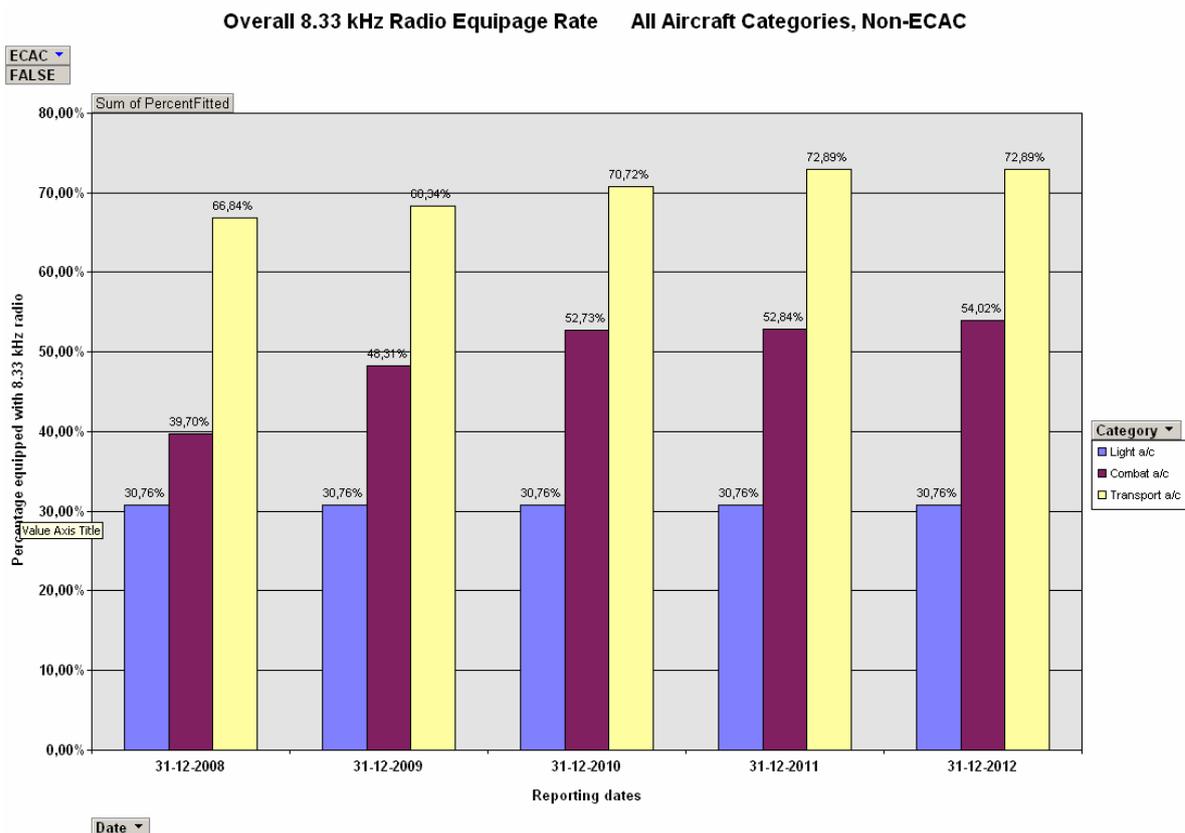
Work started on the revised 8.33 kHz policy for State aircraft in late 2004, and a draft policy was reviewed at the CMIC (Civil Military Interface Standing Committee) 25 meeting, held March 2006. The CMIC supported the need for a policy, but requested that a coherent approach with the relevant articles of the Implementing Rule on Air-ground Voice Channel Spacing. Subsequently, the Agency policy has been superseded by article 5 of the European Commission Regulation 1265/2007, which was published in the EC Journal on 27<sup>th</sup> October 2007.

Within the Agency, the Directorate Civil-Military ATM Coordination (DCMAC) has been monitoring progress on State aircraft equipage based on reports provided via Civil-Military Interface Standing Committee (CMIC) members and observers.

Figure 5 and Figure 6 indicate the 8.33 kHz State aircraft equipage plans for both ECAC and non-ECAC States – this information is subject to further review by DCMAC. It can be seen that there is a high equipage rate for transport-type aircraft – which are the most frequent users of the airspace – and that the equipage rate for light and combat aircraft also continues to increase.



**Figure 5 : Planned 8.33 kHz State aircraft equipage (ECAC States).**



**Figure 6 : Planned 8.33 kHz State aircraft equipage (NON-ECAC)**

### *Conclusions on State aircraft*

Based on the equipage plans, it can be seen that the rate of 8.33 kHz equipage for State aircraft is steadily increasing. There will, however, be a continuing need to handle some non-8.33 kHz equipped State aircraft, in particular combat type aircraft. It is apparent that, due to the particular procurement and technical constraints faced by the military, the retrofit of State aircraft takes place over a much longer period than for civil aircraft.

### **3.3.3. Impacted Aircraft numbers**

#### *Original assumptions*

The Implementation Plan estimated that between 950 and 1600 aircraft could be impacted by an above FL195 implementation. The main category of aircraft impacted by the above FL195 would be civil turbo-props mainly flown by European regional operators. For State aircraft, it was recognised that efforts should be focussed on equipping transport-type aircraft.

It was noted that some aircraft operators had aircraft which rarely, if ever, flew above FL195. In such cases, the aircraft operator might not elect to equip their aircraft with 8.33 kHz radios.

In early 2005, it was understood that the necessary radio equipment, service bulletins and supplementary type certificates, would be available in time for a carriage requirement on 15 March 2007.

#### *Execution*

Flight data for the period January 2005 until January 2009, for flights between FL195 and FL245, has been analysed to make an estimate of the number of aircraft that are equipped with 8.33 kHz radios.

In practice, it is difficult to assess historical flight data to assess the number of aircraft that are equipped with 8.33 kHz radios directly as a consequence of the above FL195 phase. For example, a number of new aircraft are capable of flying above FL245 and need to be equipped with 8.33 kHz radios anyway.

Based on the sources of data, it is estimated that around 1600 aircraft have been equipped with 8.33 kHz radios as a consequence of the above FL195 phase. Of these aircraft, 420 correspond to commercial transport, 200 to Business & General Aviation, and around 1000 correspond to State aircraft (corresponding to transport-type, combat and light aircraft).

Table 1 compares the original estimate of the numbers of aircraft required to equip with 8.33 kHz radios – derived from the Implementation Plan in 2005 – compared to an estimate made in 2009 of the actual numbers equipped – based on an analysis of flight data.

Category	2005 estimate	2009 estimate	Delta
<b>Commercial Air Transport</b>	450	420	30
<b>Business &amp; General Aviation</b>	400	200	200
<b>State aircraft</b>	500	1000	-500
<b>Total</b>	<b>1350</b>	<b>1620</b>	<b>-270</b>

**Table 1: estimated aircraft impact due to 8.33 kHz above FL195**

The table shows that the 2009 estimate of the actual numbers of commercial air transport aircraft equipped with 8.33 kHz radios, due to above FL195, is of a similar order of magnitude to the original estimate made in 2006. The 2009 estimate of the actual number of Business & General Aviation aircraft impacted by above FL195 appears lower than the 2005 estimate. It is important to note, however, that the 8.33 kHz equipage of GA aircraft flying below FL195 continues to increase.

It is noted that some airframe manufactures reported relatively late orders for 8.33 kHz retrofit. This was notably the case for SAAB 340 aircraft needing a solution for Bendix-King equipped aircraft, and Fokker 50s requiring a Wulfsberg radio solution. As a consequence, some difficulties in the development of Service Bulletins and installation on board certain aircraft were experienced. Such examples highlight the need for as much advanced notice as possible for the airborne elements, and the need to give affected stakeholders (aircraft operators, airframe manufacturers, and modification centres and avionics suppliers) confidence that dates are credible and will be respected.

Today, Airframe manufacturers indicate that there is a steady demand from aircraft operators to equip their aircraft with 8.33 kHz radios. Hence, the numbers of 8.33 kHz equipped aircraft flying above FL195 is expected to increase.

The 2009 estimate of the actual number of State aircraft planned for equipage with 8.33 kHz radios is far higher than the original 2005 estimate. This can be explained by the fact that the original 2005 estimate focussed on transport-type aircraft, as well as by the fact that the legal obligation to equip State aircraft flying above FL 195 with 8.33 kHz radios, was imposed by the AGVCS IR being published in October 2007. In practice, a very large number of combat-type and even light aircraft have also equipped. Equipage plans

handled by DCMAC indicate that the equipage plans for State aircraft should continue to increase until 2012.

#### *Conclusions on aircraft equipage*

In the area of enforced mandatory carriage above FL195, the 8.33 kHz equipage rate for the affected flights is in the order of 99.75%. Based on equipage plans submitted to DCMAC, it can be identified that the equipage rate of State aircraft – including transport-type, combat and light aircraft – continues to increase steadily

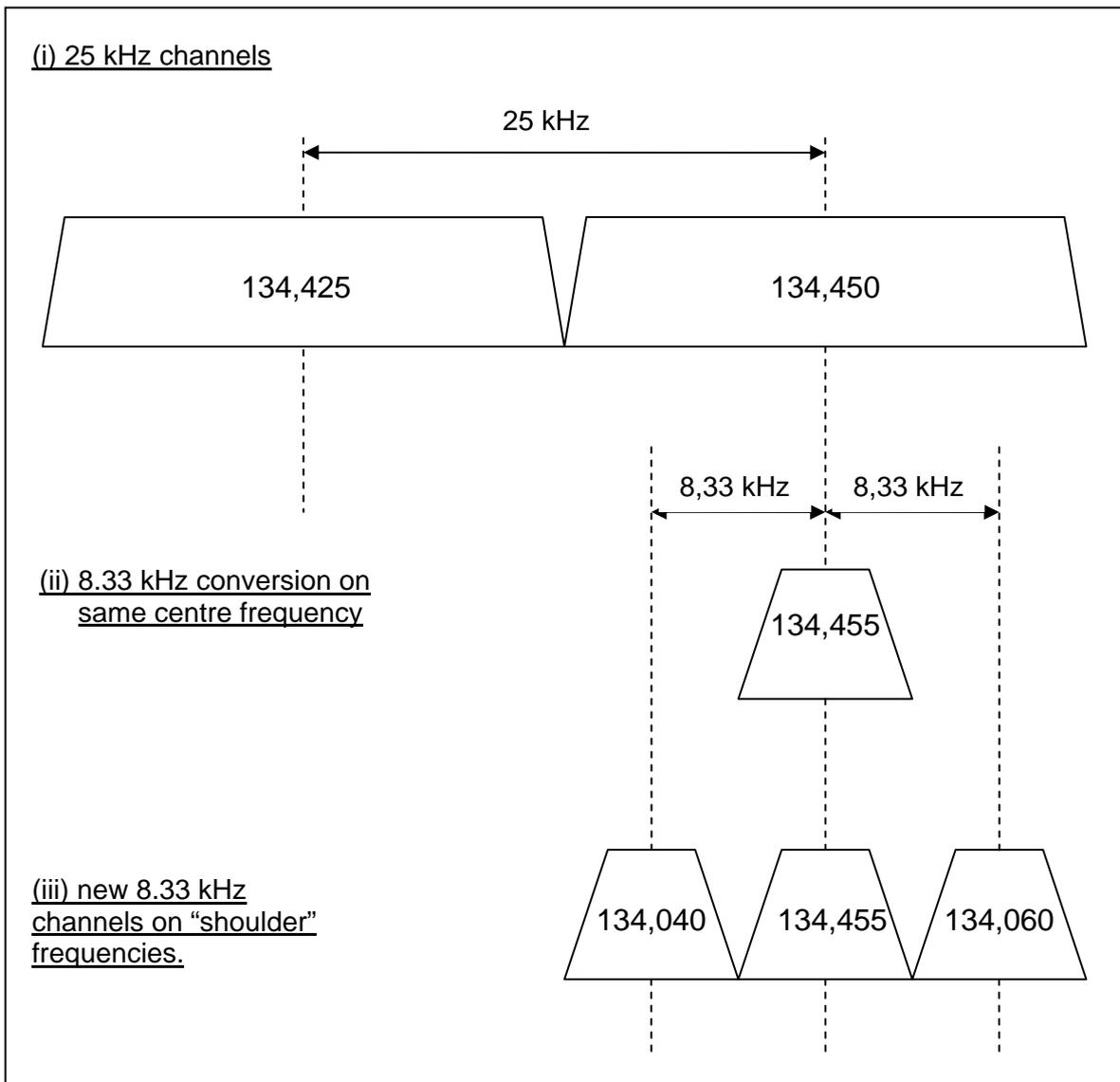
The requirement for an enforced area of mandatory carriage above FL195, with a near 100% equipage rate of 8.33 kHz radios in the affected aircraft fleet, has been satisfied.

### **3.4. 25 to 8.33 kHz conversions**

#### *Background*

An 8.33 kHz channel uses a smaller bandwidth and has a better stability compared to a 25 kHz channel. Figure 7 illustrates the conversion process from 25 to 8.33 kHz channels.

The conversion from 25 to 8.33 kHz takes place in stages. First of all, the ground-radio equipment needs to be capable of operating in 8.33 kHz channel spacing mode. The actual operational conversion is initially operated for a trial period – typically 3 months – during which time any potential problems, such as interference, can be assessed. Subject to the successful outcome of the trial period, the conversion can be coordinated in the ICAO COM-2 table, the repository of VHF COM assignments in Europe. It is only at this final stage that the “old” 25 kHz assignment can be deleted, thus allowing new 8.33 kHz channels on the shoulder assignments to be freed up.



**Figure 7: 25 to 8.33 kHz conversion process**

### *Original Assumptions*

The frequency planning benefits arising from 8.33 kHz are driven by the number of 25 to 8.33 kHz conversions that can be achieved. At the onset of the above FL195 phase, the number of conversions was limited by:

- Sectors having a lower-limit below FL195;
- Sectors making use of the climax (offset-carrier) system. The system uses more than one transmitter for coverage and/or availability reasons, and was not compatible with 8.33 kHz operations at the time of preparing the Implementation Plan<sup>1</sup>.

<sup>1</sup> The Communications section at EUROCONTROL is assessing the use of 8.33 kHz climax based on 2 legs and an offset of +/- 2.5 kHz. A EUROCAE 8.33 kHz Task Force has prepared ED23C to address 8.33 kHz climax

In April 2005, France and the UK proposed to make 39 conversions from 25 to 8.33 kHz, but there were no firm intentions from other States.

### *Execution*

At the time of writing, 25 to 8.33 kHz conversions above FL195 have now been implemented in Bulgaria, France, Greece, Hungary, Ireland, Italy, Portugal, Romania, Spain, Sweden and the UK. Moreover, conversions are also planned at a later date in Albania and Belarus.

The current status of the 25 to 8.33 kHz conversions – based on information available in the ICAO COM-2 table on 28 January 2009 - is indicated in summary form at Table 2.

<b>State (EU States In shading)</b>	<b>Potential Conversions</b>	<b>Conversions in progress</b>	<b>Coordinated COM2 Table</b>	<b>Old 25 kHz deleted COM2 Table</b>
<b>Albania</b>	<b>3</b>	<b>Due 2009</b>		
<b>Belarus*</b>	<b>11</b>	<b>Regional approach recommended</b>		
<b>Bulgaria</b>	<b>7</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>France</b>	<b>27</b>	<b>24</b>	<b>24</b>	<b>24</b>
<b>Greece</b>	<b>7</b>	<b>7</b>	<b>4</b>	<b>4</b>
<b>Hungary</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>Ireland</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>
<b>Italy</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Portugal</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Romania</b>	<b>9</b>	<b>8</b>	<b>8</b>	<b>8</b>
<b>Spain</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>
<b>Sweden</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>5</b>
<b>UK</b>	<b>9</b>	<b>8</b>	<b>6</b>	<b>6</b>
<b>Totals</b>	<b>98</b>	<b>75</b>	<b>70</b>	<b>69</b>

**Table 2: Status 25 to 8.33 kHz conversions above FL195 (28 Jan 2009)**

The column labelled “Potential Conversions” shows the number of planned 25 to 8.33 kHz conversions based on information provided in the State Action reports received by the 8.33 kHz Programme Support Office (PSO).

The column labelled “Conversions in Progress” shows the 25 to 8.33 kHz conversions that are actually operational. As mentioned earlier, the converted 8.33 kHz channel is typically operated for a trial period.

The column labelled “Coordinated ICAO COM2 Table” shows the conversions that have been coordinated in the ICAO COM2 table.

And finally, the column labelled “Old 25 kHz deleted COM2 table” shows the “old” 25 kHz assignments that have been deleted from the ICAO COM2 table.

From the table, it can be seen that – as of 28 January 2009 – there were 75 conversions from 25 to 8.33 kHz in actual operation, of which 70 had been coordinated in the ICAO COM2 table. It can be seen that the majority of the planned conversions in the European

Union States – which are covered by the scope of EC regulation 1265/2007 – have been completed.

Further to a regional meeting held in Minsk in June 2008, the conversions in Belarus are likely to take place as part of a coordinated regional approach at a later date. In this regard, it is noted that Poland now plans to introduce 8.33 kHz channels in 2012, coincident with the introduction of the new ATM System PEGASUS 21.

#### *Conclusions on 25 to 8.33 kHz conversions*

The number of 25 to 8.33 kHz conversions arising from the above FL195 has largely exceeded the original estimate in the Implementation Plan. Moreover, a much larger number of States than originally foreseen have implemented conversions.

As can be seen from the Gantt at Figure 1, however, the ground conversions have taken place over a longer period than originally foreseen.

### **3.5. Frequency Planning benefits**

#### *Background*

National frequency managers address the demand for new frequencies using either the ad-hoc or block planning processes. The ad-hoc process works on a local basis, with the national frequency manager identifying a potential frequency, and then coordinating with other frequency managers using the SAFIRE (Spectrum & Frequency Information Resource) tool to confirm that the frequency can be assigned and registered.

At a European level, most of the time there is a need to shift existing assignments in order to satisfy the demand for new frequencies. In order to facilitate this co-ordination, a bi-annual block-planning meeting is held under the auspices of the ICAO FMG; specific frequency planning tools are used to propose the best allocation of frequencies. The proposed solutions are then coordinated and registered using the SAFIRE tool.

#### *Original Assumptions*

The Implementation Plan made an estimate of the frequency planning benefits arising from the planned 25 to 8.33 kHz conversions in the above FL195 phase. The simulation tried to estimate the impact on the block planning and ad-hoc processes. The frequency planning benefits were calculated by:

- Estimating the future demand for VHF assignments;
- Estimating the number of 25 to 8.33 kHz conversions above FL195;
- Performing a simulation using the SENSI tool, in order to assess how the planned conversions could impact the estimated demand.

The simulation results indicated that 47 additional demands for VHF assignments could be satisfied, including:

- 11 demands for Core Area services with an upper-limit higher than FL 280;
- 17 demands for Core Area services with an upper-limit between FL95 and FL280;
- 19 demands for services adjacent to the Core Area with an upper-limit higher than FL280.

The frequency simulation results indicated that the impact of an above FL195 implementation would be very limited after 2009, especially in the Core Area.

In terms of operational impact, the Implementation Plan stated that any failure to satisfy the demand for VHF assignments could put operational improvements, such as airspace resectorisation, at risk.

### *Execution*

The full frequency planning benefits of the above FL195 phase can only be assessed, once all of the 25 to 8.33 kHz conversions have been coordinated in the ICAO COM2 table, and sufficient time has elapsed to really assess the impact on the block-planning and ad-hoc processes. A large number of conversions have already been coordinated, however, and so it is now possible to make an initial assessment of the frequency planning benefits emerging from the above FL195 phase.

### Block-Planning Trends

The demand/satisfaction rates of the six-monthly Block Planning meetings are an important indicator of VHF congestion in the ICAO EUR Region.

Figure 8 and Figure 9 indicate the BP meeting demand/satisfaction rates from April 1997 until December 2008 for the “Initial 8.33 States”<sup>2</sup> and the “Other 8.33 States”<sup>3</sup> respectively. The curves indicate the percentage of proposed frequency solutions (in black) and coordinated frequencies (in pink), compared to the demand.

The three main mandatory carriage dates for 8.33 kHz – namely October 1999 and October 2002 for above FL245, and March 2007 for above FL195 – are indicated in vertical dotted lines.

For the above FL245 phases, the diagrams indicate that:

- the initial above FL245 implementation from October 1999 had a large positive effect on the satisfaction rate for both Initial States and the Other States;
- the above FL245 implementation from October 2002 (Horizontal Expansion) had a large positive effect on the Other States, but a limited impact on the Initial 8.33 States.

For the above FL195 phase, the diagrams indicate that the demand/satisfaction rate, for both the Initial 8.33 States and the Other 8.33 States, increases steadily from the June 2007 to December 2008 BP meetings. This corresponds to the period in which many 25 to 8.33 kHz conversions were being implemented, and conversions were being coordinated in the ICAO COM2 table.

From Figure 8 and Figure 9 it can be seen that a 100% success rate was achieved for proposed coordinations at the BP26 meeting held in December 2008; this corresponds to 26 proposed solutions. The extent to which the proposed solutions are satisfied in practice will depend on the outcome of the coordination process.

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<sup>2</sup> Initial 8.33 State = the 7 States that originally introduced 8.33 kHz above FL245 in October 1999.

<sup>3</sup> Other States = the remaining States that have subsequently enforced 8.33 kHz carriage in their airspace.

The outcome of the future BP meetings planned for June and December 2009, will be important indicators on the frequency planning benefits arising from the above FL195 phase. The recent simulations performed by the EUROCONTROL Spectrum & Frequency Management (SFM) Unit, in support of the Below FL195 Business Case, estimate that the main benefits from 8.33 kHz above FL195 will be realised in the period until 2010-2011.

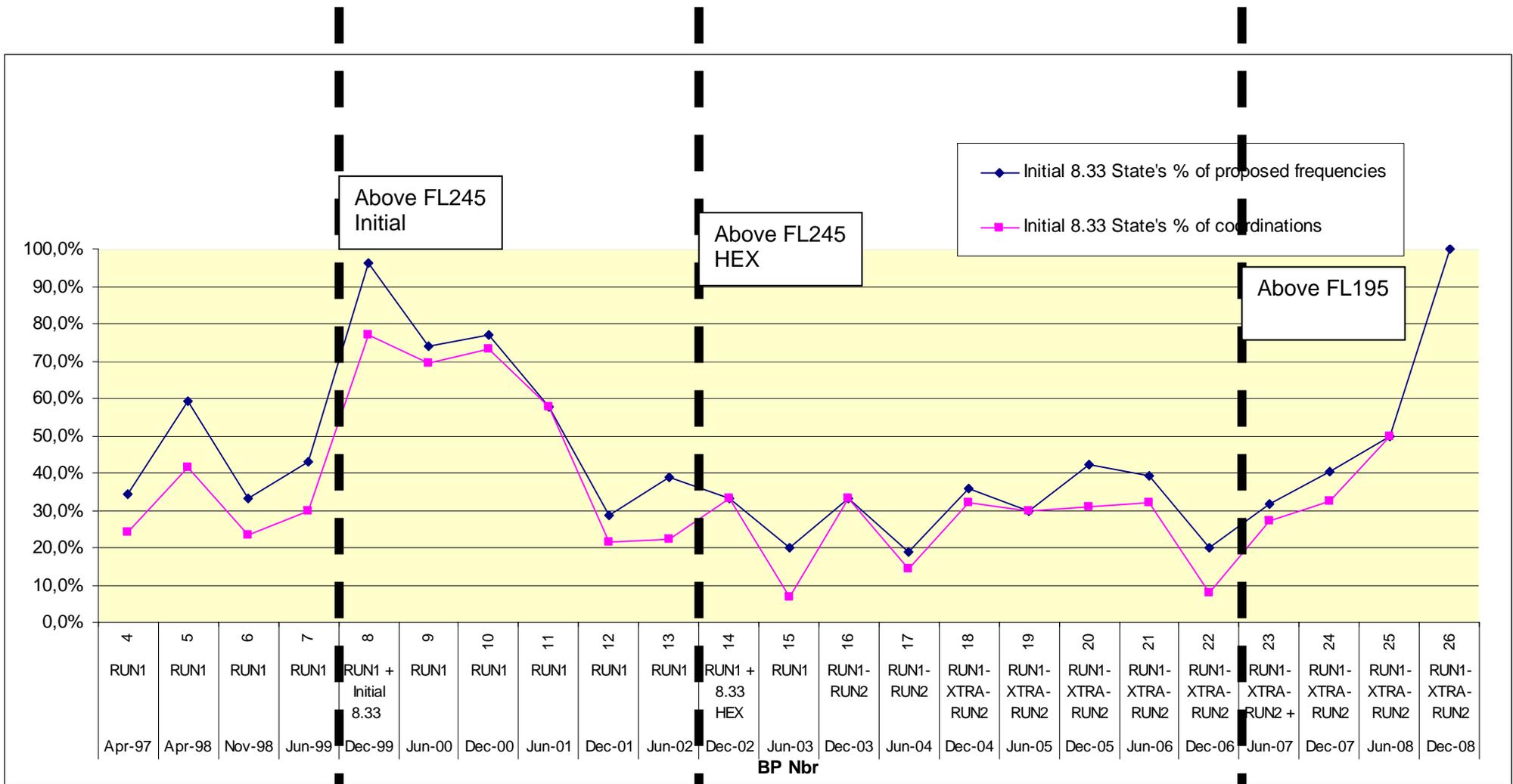


Figure 8 : Block-Planning Trends in the Initial 8.33 States

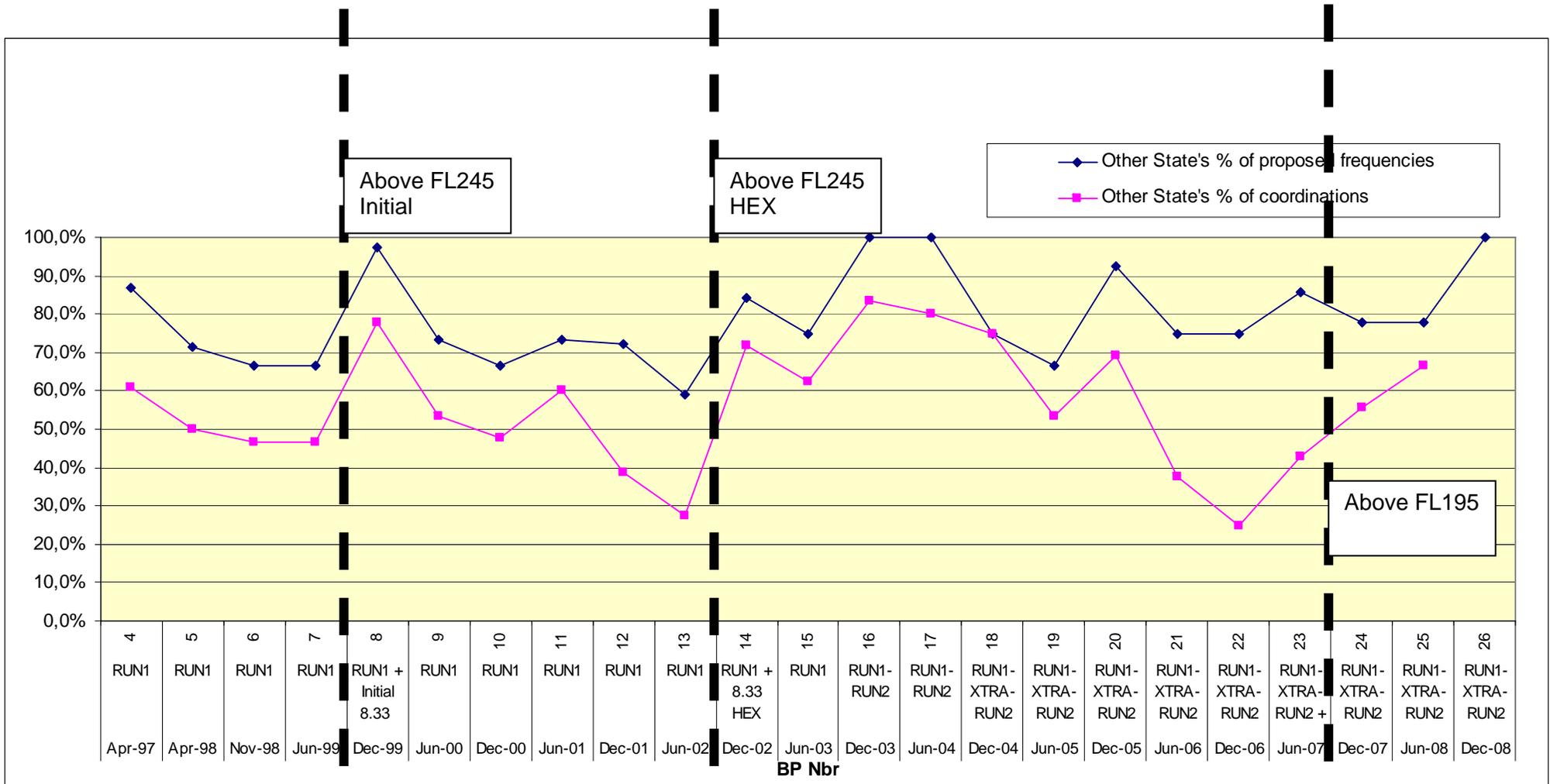


Figure 9: Block-Planning Trends in the Other States

Overall Impact (including Ad-hoc process)

The ad-hoc process is used in those cases where the national frequency manager is able to find a new VHF assignment without recall to the Block-Planning meetings. The frequency manager needs to coordinate with neighbouring States in order to ensure that there are no interference problems.

Table 1 shows the evolution of 8.33 kHz assignments for Area Control Centre (ACC) services for the three main phases of the programme, namely the Initial 8.33 and Horizontal Expansion Phase above FL245, and the above FL195 Phase.

For each phase, the mandatory carriage date is indicated, along with a date at which the impact of the accompanying 25 to 8.33 kHz conversions is assessed. With regards to the 8.33 kHz assignments, a distinction is made between the conversions - corresponding to the conversion of an old 25 kHz assignment to a new 8.33 kHz assignment operating on the same frequency – and new 8.33 kHz assignments – corresponding to the actual gain.

The number of 8.33 kHz ACC assignments has increased steadily with each new phase, including the above FL195 phase. As the number of 8.33 kHz conversions has increased, then this has increased the frequency planning flexibility, providing more opportunities for 8.33 kHz channels to be used on the freed up “shoulder” frequencies.

As of 28 January 2009, the ICAO COM2 table contained 411 assignments in 8.33 kHz for ACC services, comprising 207 conversions and 204 new channels. It is important to bear in mind, as illustrated at Figure 10, that these ACC assignments have very large frequency protection volumes, and so are very significant from a spectrum viewpoint.

Phase	Initial 8,33>FL245	Hex>FL245	Above FL195	Total
MAC date	Oct 99	Oct 2002	March 2007	
COM2 version	Dec 2001	Dec 2004	Jan 2009	
Total 8,33 ACC in ICAO COM2	108	213 (+105)	411 (+198)	411
Conversions	74	58	75 (70 in COM2)	207
New 8,33 channels	34	47	123	204

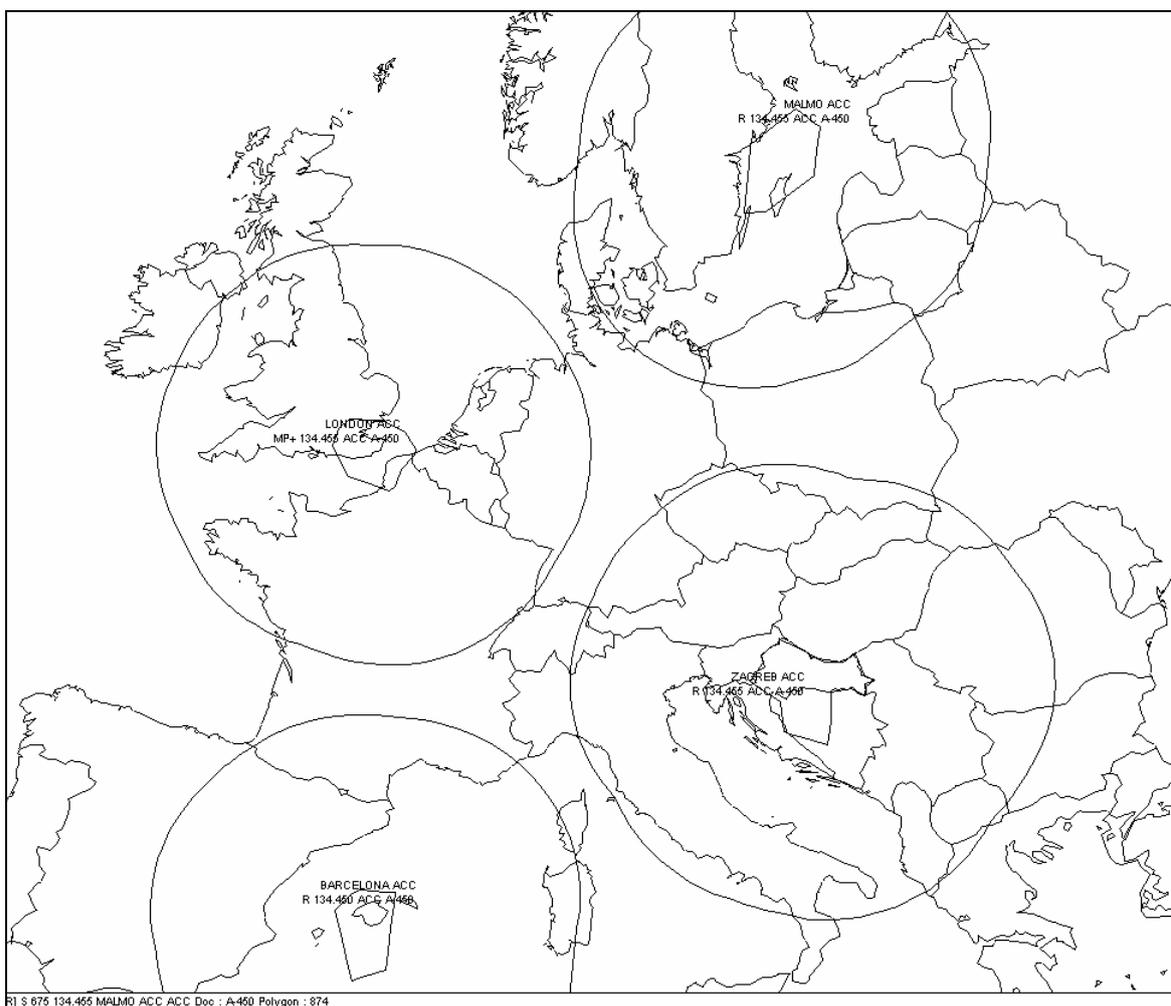
**Table 3: Evolution of 8.33 kHz ACC assignments (28 January 2009)**

The total number of 8.33 kHz assignments in the ICAO COM2 table, for all services, is shown at Table 4. The corresponding number of 25 kHz assignments for each service is also shown.

From the table, it can be seen that the bulk of the 8.33 kHz assignments (411) correspond to ACC services, representing about 25% of all ACC services in the ICAO COM-2 table. In addition, there are 102 OPC (Operational Control – company frequencies) in 8.33 kHz, as well as a handful of A/G (Air-Ground) and AS (Aerodrome services).

Count of ASGNBR	TYPE		
SERVICE	8	25	Total
A/G	7	1837	1844
ACC	411	1243	1654
AS	5	785	790
OPC	102	1837	1939
Grand Total	525	5702	6227

**Table 4: Total 8.33 kHz assignments in ICAO COM-2 table (28 January 2009)**



**Figure 10 : Frequency protection volumes for 134,455 (8.33 kHz) at London, Malmo & Zagreb ACCs, and 134,450 (25 kHz) Barcelona ACC.**

#### *Conclusions on frequency planning benefits*

Based on the results of both the ICAO FMG Block-Planning meetings and the ad-hoc processes, frequency planning benefits are emerging from the above FL195 phase. The anticipated 100% demand-satisfaction rate from the BP26 meeting, held December 2008, is higher than originally foreseen. The overall number of 8.33 kHz channels for ACC assignments in the ICAO COM-2 table continues to increase.

More will be known about the extent to which the above FL195 phase can satisfy future frequency demand, when the results of the June 2009 and December 2009 Block Planning meetings are known. These results will provide an important indication of whether above FL195 benefits can go beyond 2010 – 2011, as foreseen in the simulations used to develop the Below FL195 Business Case.

From a planning perspective, it can be seen that the frequency planning benefits only emerge some time after the 25 to 8.33 kHz conversions have been coordinated in the ICAO COM-2 table. In the case of the above FL195 phase, significant benefits only really started to emerge from December 2007 culminating in a very successful BP meeting in December 2008. In effect, the main frequency planning benefits have been realised, in the period 6 – 18 months after the mandatory carriage date.

### **3.6. Safety**

#### *Original Assumptions*

This section discusses how safety work has been conducted on the above FL195 phase. Specific details on safety issues are provided in the actual safety documents, including the Post-Implementation Safety Case.

The Implementation Plan defined a number of safety related activities that needed to be fulfilled in order to ensure that safety levels were maintained on the above FL195 phase. A number of key safety deliverables were required, including:

- Safety policy and plan;
- Functional Hazard Assessment (FHA) and Preliminary System Safety Assessment (PSSA);
- System Safety Assessment (SSA)
- Pre-Implementation Safety Case;
- Post-Implementation Safety Case;
- Guidance material for ANSPs, e.g. templates for National Safety Plan and State Action reports.

It was planned to submit the Safety Cases to the EUROCONTROL Safety Regulation Commission (SRC) via the Agency Safety Regulation Unit (SRU).

#### *Execution*

In practice, it became apparent that the required contents of the Safety Policy and Safety Plan were very similar. Hence, it was decided to prepare a unique Safety Plan – containing all of the relevant elements of the policy and plan – and this was issued in March 2006.

A Safety Assessment Report – containing the results of the FHA and PSSA – was also published in March 2006. The results of the SSA were incorporated in the Pre-Implementation Safety Case (PISC) which was published in February 2007.

As can be seen from the Gantt at Figure 1, the PISC was issued about 4 months later than originally planned. This delay can be explained by a knock-on effect resulting from delays in the approval of ICAO Doc. 7030. The Post-Implementation Safety Case is planned to be issued in April 2009, a few months later than the originally planned date in November 2008.

Whilst the PISC was signed-off at the level of Director within the EATM part of the EUROCONTROL Agency and forwarded to the Agency SRU, no formal review was performed by the SRC. In early 2007, the SRU advised that the SRC and the Agency were defining a new process for the assessment of safety deliverables related to EATM and was, at the time, unable to review the 8.33 kHz Safety Case.

A Post-Implementation Safety Case (POSC) has been prepared to take into account the first 18 months of operation after the 15 March 2007. The POSC has been reviewed by the EATM Safety Management Service (SMS), and feedback is currently awaited from the Safety Regulation Unit (SRU) concerning the SRC Review Process concerning the coordination of NSA views on the Safety of ATM Programmes.

### *Summary*

The main safety deliverables have been prepared in accordance with the original assumptions in the Implementation Plan. The Post-Implementation Safety Case is due to be completed by April 2009.

## **3.7. Costs**

### *Original assumptions*

The Implementation Plan included an estimate of the potential costs of an above FL195 implementation. The estimate covered the following main elements:

- Aircraft retrofit covering:
  - Commercial air transport.
  - Business and General Aviation ;
  - State aircraft.
- ANSP costs covering: Air-ground radio conversions;
  - Support costs for enforcing mandatory carriage, e.g. training, project; management support, AICs etc.
- CFMU modifications;
- EUROCONTROL EATM Programme management, safety assessment etc.

Given the uncertainty concerning costs and numbers of impacted aircraft, the Implementation Plan contained a range of estimates, ranging from low to medium to high. The estimated total cost ranged from 34 to 64 M€.

### *Execution*

Table 5 makes a comparison of the original medium estimate made in 2005, with a revised estimate made in 2009. It can be seen that the 2009 estimate is considerably higher than the 2005 estimate. Most of the difference can be explained by:

- An increased number of equipped State aircraft, which also includes equipped combat and light aircraft that were not taken into account in the 2005 estimate;
- A higher number of 25 to 8.33 kHz ground radio conversions.

<b>STAKEHOLDERS COSTS (k€)</b>	<b>2005 estimate</b>	<b>2009 estimate</b>
<b>Commercial Air Transport</b>		
numbers of aircraft	450	420
cost per aircraft	23	47
total CAT costs	10350	19740
<b>Business &amp; General Aviation</b>		
numbers of aircraft	400	200
cost per aircraft	23	23
total BA & GA costs	9200	4600
<b>State Aircraft</b>		
numbers of aircraft	500	1000
cost per aircraft	70	70
total SA costs	35000	70000
<b>ANSP costs</b>		
Number of conversions	39	75
Avg. cost per conversion	25	86
Total Conversion costs	975	6.450
No. States enforcing MAC	35	35
Avg cost per State	40	50
Cost enforcing MAC	1400	1750
total ANSP costs	2375	8200
<b>CFMU</b>		
Flight plan handling modifications	150	180
<b>EATM costs</b>		
Project management, safety, awareness, procedures etc costs	1800	1800
<b>Total costs (k€)</b>	<b>58875</b>	<b>104520</b>

**Table 5 : Estimated costs of the Above FL195 Implementation**

*Conclusions on the overall costs*

The overall estimated costs are higher than originally estimated. The main difference arises from a higher number of equipped State aircraft than originally foreseen.

#### **4. LESSONS LEARNT**

A Lessons Learnt exercise was held during the 8.33 kHz Contact Persons 16 meeting, held on 25<sup>th</sup> April 2007.

The attendees were requested to rate the activities on the above FL195 phase in terms of importance and performance. The activities that scored the highest were:

- 8.33 Programme Support Office (responding to email, telephone calls, general support);
- 8.33 main working arrangements (contact persons meeting, drafting groups etc);
- 8.33 documentation (user guide, programme management plan, AIC and AIP templates).

The attendees were requested to respond to a number of questions, as follows:

*What has been the most frustrating aspect of the 8.33 kHz above FL195 phase?*

A number of responses are concerned with difficulties in getting consensus amongst the different stakeholders, and the slowness of the overall process.

*What has been the most satisfying aspect of the 8.33 kHz above FL195 phase?*

A number of responses indicate satisfaction with stakeholder involvement, support from the 8.33 PSO, and the fact that the enforcement of mandatory carriage above FL195 went relatively smoothly.

The results of the lessons learnt exercise are consistent with many of the findings related to the execution of the above FL195 phase described in this paper.

#### **5. SUMMARY OF SUCCESSES & FAILURES**

This section summarises the main successes and failures of the above FL195 phase, based on a review at the 8.33 kHz Contact Person 20 meeting, held September 2008. It is intended to be transparent about what has gone well and what could have been done better on the above FL195 phase.

##### **5.1. Successes**

From a Programme management viewpoint, the execution of the above FL195 phase can be considered to be a success:

- i) The original timescales in the Implementation Plan were, in the main, respected. In particular, the mandatory carriage of 8.33 kHz radio equipment above FL195 was enforced in 30 ICAO EUR Region States from the 15 March 2007, and a further 5 EU States from the 15 March 2008.
- ii) The 8.33 kHz aircraft equipage rate is extremely high above FL195 which, together with the enforcement of mandatory carriage, is an important prerequisite for introducing 25 to 8.33 kHz conversions. Moreover, the 8.33 kHz equipage of State aircraft is far higher than originally foreseen, which was strongly influenced by the relevant articles of European Commission regulation 05/1265.
- iii) The number of actual 25 to 8.33 kHz conversions will be far higher than originally envisaged. The original estimate was for 39 conversions in France and UK. At the

time of writing, 75 conversions are operational with 70 coordinated in the ICAO COM2 table.

- iv) Based on feedback from the June 2007 to December 2008 ICAO FMG Block Planning meetings, the frequency planning benefits from the above FL195 phase are starting to be realised. In particular the ~ 100 % success/demand rate from the December 2008 BP 26 meeting is very encouraging.
- v) There is now a coherent approach between the ICAO EANPG 40 conclusions and DOC. 730, the EUROCONTROL PC Recommendation 06/05, and the EC Regulation 1265/2007.
- vi) The 8.33 kHz above FL195 phase represents a major, complex European ATM Programme, involving significant airborne and ground elements. From a Programme Management viewpoint, the original planning and assumptions have been largely satisfied in the actual execution.

## **5.2. Failures**

Whereas, from an overall programme management viewpoint, the above FL195 phase can be considered to be a success, there have nevertheless been difficulties. The following issues were highlighted in feedback from the 8.33 kHz working arrangements:

- vii) As can clearly be seen from the Gantt at Figure 1, it has been extremely difficult and taken an extremely long time to get coherent decisions within the ICAO, EUROCONTROL and European Commission working arrangements. It is noted that, on occasions, delays can be attributed to a failure in reaching a consensus with one or two stakeholders.
- viii) The lack of clarity on below FL195 has had a negative impact on the above FL195 phase. For example, some aircraft operators are awaiting clarification on below FL195 before making investment decisions on retrofitting with 8.33 kHz radios. In general, the momentum that has been built up on the above FL195 phase is now lost, and it will be necessary to restart a number of activities to tackle below FL195.

## **6. NEXT STEPS**

The above FL195 phase is now nearing completion. The remaining activities are concerned with:

- Publishing this Close-Out report;
- Formally signing-off the Post-Implementation Safety Case;
- Monitoring the remaining 25 to 8.33 kHz conversions and the State aircraft equipage.

This work is mainly of a routine monitoring nature, and can be followed up as part of the EUROCONTROL ESSIP/LSSIP reporting process. The main members of the Agency 8.33 kHz Above FL195 Team, in particular the Programme Support Office, have been reassigned to other activities. A new Agency Team is being formed to tackle 8.33 kHz Below FL195.

The main focus of the Agency's 8.33 kHz work will now turn to 8.33 kHz below FL195. The ICAO EANPG 50 meeting – held December 2008 - concluded on the need to proceed

with a phased implementation. The SCG10 meeting – held February 2009 – agreed to proceed with a phased implementation, and requested the Agency to develop and Implementation Plan. The European Commission has indicated that the Agency should proceed with revising EC regulation 1265/2007, including forward-fit and a phased 8.33 kHz deployment below FL195.

## 7. MAIN CONCLUSION

The Close-Out report concludes that the original planning and assumptions contained in the Implementation Plan have been largely satisfied by the actual execution of the 8.33 kHz above FL195 phase.

## 8. RECOMMENDATIONS

The 8.33 kHz working arrangements and affected stakeholders are recommended to take into account the results of this Close-Out report, in particular when developing the Implementation Plan for 8.33 kHz below FL195. The following recommendations are highlighted:

- a) From the outset, to ensure a coherent approach between the development of the EUROCONTROL Implementation Plan and the revision to the European Commission Regulation 05/6. This will facilitate a coherent approach and a consensus amongst all affected stakeholders.
- b) Plan on the assumption that the main frequency planning benefits will start to emerge once a significant number of 25 to 8.33 kHz conversions have been coordinated in the ICAO COM2 table. In the case of the above FL195 phase, significant frequency planning benefits have only emerged in the period 6 to 18 months after the mandatory carriage date.
- c) To provide as much advanced notice as possible for implementing the airborne element, and to provide the affected stakeholders (aircraft operators, airframe manufacturers, modification centres, and avionics suppliers) with carriage dates that are credible and will be respected. In particular, advanced notice in the form of AICs and complimentary awareness material is essential.
- d) To plan on the basis that a Pan-European approach should eventually prevail. The above FL195 phase has demonstrated that final goal of a harmonised Pan-European approach will provide the greatest frequency planning benefits, whilst maintaining safety levels and minimising any negative operational impact.
- e) With regards to any remaining activities on the above FL195 phase, the EUROCONTROL ESSIP/LSSIP process should be used to monitor progress.