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SESSION 4 "SAFETY ASPECTS"

The current UK volcanic ash safety regulations

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SLIDE 1 - COVER

1.0 Introduction

Your Excellency, Ladies and Gentlemen, my thanks to you for the opportunity to contribute to the debate today. Over the next ten minutes:

- I will outline how the "three zone approach" emerged as a means of safeguarding flight in airspace that is potentially contaminated with ash;
- I will explain why the UK CAA does not prefer this approach as the sole means of managing safety, and why we think that simply "avoiding ash" is also undesirable;
- I will describe our preferred way forward which we are working on within the ICAO International Volcanic Ash Task Force.

2.0 The "Three Zones" Approach

2.1 The No Fly Zone

Immediately after the 14 April eruption, the London VAAC published the contours required by ICAO[1] around airspace in which ash was predicted. The contours surrounded airspace where the forecast ash concentration was $2x10^{-4}g/m^3$ or more.

SLIDE 2 - CONTOUR

ICAO guidance to crews encountering ash is to immediately reverse course and descend. In our busy airspace, air traffic controllers were justifiably concerned about assuring aircraft separation and about directing aircraft into hazard. The result was an effective "No Fly Zone" (NFZ) at that ash concentration level.

SLIDE 3 - NFZ

The economic consequences were obvious. But what were the safety effects for aircraft exposed to this level of ash? Could they safely tolerate higher levels? We did not know.

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[1] Annex 3 to the Chicago Convention, *Meteorological Service for International Air Navigation* Chapters 3.1 and 7.1, Appendix 1, Model VAG, Appendix 2, para 3.1 and Appendix 6, para 1.1

2.2 The Enhanced Procedures Zone

Over the next few days, a lot of people, many here today, worked day and night to find answers. Finally, the manufacturers could confirm[2] that their aircraft and engines would tolerate exposure to ash at ten times that concentration.

SLIDE 4 - EPZ

This reduced the size of the NFZ with, for a time, a 60nm buffer zone added[3]. Flights in UK airspace resumed.

The airspace between the old contours and the new NFZ was called the "Enhanced Procedures Zone" (EPZ) as some manufacturers required enhanced maintenance procedures after flights in this airspace. The London VAAC issued supplementary charts showing the NFZ in black, and the EPZ in red.

2.3 The Time Limited Zone

Another eruption in May refocused our activity[4] generating

SLIDE 5 - TLZ

a smaller NFZ at double the EPZ concentration level for airlines whose manufacturers confirmed that their aircraft and engines would tolerate flight at that level. This grey-coloured zone was called the "Time Limited Zone" (TLZ) in case manufacturers defined limits to ash accumulation over time for airlines to build into their safety risk assessments.

In fact, apart from data gathering, most manufacturers specified no additional procedures. They did, however, recommend that visible ash be avoided and they drew a clear distinction between operating in predicted rather than actual ash densities due to uncertainties in ash forecasting.

SLIDE 6 – EUR/NAT

The ICAO EUR/NAT Volcanic Ash Contingency Plan[5] now includes a three zone approach with the EPZ, TLZ and NFZ known as Low, Medium and High Contamination areas.

2.4 Overflight and Underflight

By the way,

SLIDE 7 – Over/under/through

CAA agreed[6] to allow overflight of a NFZ using safety techniques developed for overflight of mountainous terrain; ICAO endorsed this for EUR/NAT airspace. We

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2 Described in the CAA-authored proceedings document
3 Described in CAA Buffer Zone Policy
4 Described in CAA TLZ Policy and CAA TLZ letter
5 EUR Doc 019/NAT Doc 006, Part II, July 2010
6 Described in CAA Overflight Policy and CAA FODCOM 17/10

were not able to establish suitable criteria, however, to permit underflight of ash contaminated airspace.

2.5 Non turbine aircraft

I should say that, throughout April and May, UK airspace was not closed. Ash-related restrictions

SLIDE 8 – Over/under/through

did not impact piston-powered aircraft, for example, with the result that parts of UK airspace usually denied to recreational pilots were open to them.

2.6 Discussion

SLIDE 9 – Evaluation

So, the three zone system did allow commercial flights to resume. And, for the first time, we had information about the airworthiness effects of ash and airlines had more information about the location and nature of the hazard they were trying to manage.

Unfortunately, the "three zone approach" can only work effectively as the sole means of safety assurance if the location of the ash cloud is accurately known and if the associated airworthiness hazard is clearly understood; neither is currently true.

- There are uncertainties in the forecast process - dominated by the eruptive source term.
- And the airworthiness effects of exposure to ash clouds are not well defined. We expect ash cloud composition and concentration to matter, as well as atmospheric conditions, exposure time and the specific design and condition of the aircraft and engine.

In our view, we need the three zone system as part of a wider approach. With better forecasting accuracy, particularly from an improved source term, and better information about the airworthiness effects, we could see the zones being replaced by contours that just show whatever ash cloud parameters best define the threat.

3.0 The Visible Ash Approach

3.1 Background

SLIDE 10 – Visible Ash

As to visible ash, the KLM Mt Redoubt incident"[7] suggests that it is sensible to avoid visible ash[8]. However, if our strategy is only to avoid visible ash, then we need to know what we mean by visible ash, be confident it can be identified preflight and in-flight, and know what hazard it represents. Today, none of these conditions are met.

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7 RT transmission record presented to "Volcanic Hazards – Impacts on Aviation" Senate hearing March 2006

8 "The 1989-1990 eruption of Redoubt Volcano, Alaska: impacts on aircraft operations" Thomas J. Casadevall

3.2 Defining Visible Ash and the Hazard it represents

Visible ash is not well defined. Originally it meant "visible to the naked eye"[9]. Now, as ICAO says, “it is assumed that if the ash is visible by eye or from satellite data, it still presents a hazard to aircraft”[10].

As technologies develop, less and less ash is becoming more and more “visible”. Whilst airlines avoiding visible ash then observe ever-safer thresholds, we need to be sure that these are not causing unnecessary economic hardship by being too conservative.

We really need to know whether a proposed flight into visible ash is likely to result in:

SLIDE 11– Visible Ash Outcomes

- an unsafe condition (aircraft unable to continue to planned destination),
- a safe condition (aircraft continues to planned destination but with airworthiness impacts); or
- a condition representing normal operations.

We’re not sure which outcome a flight in visible ash will produce. There is the KLM experience on one hand but, on the other, a UK met research aircraft[11] flew in visible ash in May and suffered no adverse effects.

If the outcome of flight in visible ash could confidently be predicted to be either “normal operations” or a “safe condition”, then airlines ought be able to operate - even if, in the latter case, they have to factor in increased costs and reduced operational flexibility as a result of the airworthiness effects of such flights.

3.3 Identifying the ash pre-flight and in-flight

“Visible Ash” also presents problems pre-flight and in-flight.

SLIDE 12 – Visible Ash problems

Pre-flight, visible ash images and ash reports may not be available because, as the experts tell us “As volcanic ash clouds disperse, they intermingle with meteorological clouds in the atmosphere and thus have a similar appearance when observed in infrared and visible images”[12]. In addition, images and reports of visible ash are historic which does constrain their flight planning value.

In-flight, ash is tough, if not impossible, to spot at night and in Instrument Meteorological Conditions. Even in good conditions, ash may be visible from one

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9 Expert commentary noted on UKCAA hosted teleconference 2 June 2010

10 ICAO “Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds” (Doc 9691) Draft incorporating Amendment no 1) section 4.1

11 Debrief of UK Atmospheric Research Aircraft sortie on 14 May 2010 which flew through visible ash at a measured density of $0.5x10^{-3}g/m^3$ in a layer 5,000ft deep

12 “Reducing the threat to aviation from airborne volcanic ash” Presented at 55th annual international air safety seminar, 4-7 Nov 2002, Dublin; Marianne Guffanti USGS and Capt Edward Miller ALPA

viewing angle and not another. What's more, FAA's view,[13] proven in the KLM case, is that crews do not reliably distinguish between volcanic and meteorological clouds.

3.4 Discussion

So, though avoiding visible ash seems a good idea, it cannot be relied on to protect aircraft from unsafe or damaging flight conditions. It needs to be part of a wider safety assurance approach.

4.0 The Way Forward

4.1 Risk Assessment by the Airline

SLIDE 13 – The Way Forward

The way forward begins with recognition that each airline is responsible for assessing risk before operating and the regulator's responsibility is to make sure that they are competent and capable of doing so.

Managing flight safety, in the context of volcanic activity, needs to be based on competent and capable airlines using safety risk assessments to make operational decisions within a suitable regulatory framework. This is the approach being pursued by the ICAO Volcanic Ash Task Force.

For airlines intent on keeping clear of airspace where ash is present or forecast, then we believe that that operator can use their normal risk management processes, as authorized by their State regulator, to decide where, when and how to operate.

However, for airlines wishing to fly in airspace where ash clouds are forecast, then their capability to do the risk assessment is at issue; they do not know what the hazard is nor can they be certain about the location of that hazard.

SLIDE 14 – Risk Framework

So, the ICAO Task Force will establish a formal safety risk assessment framework for airlines and will define guidance for States on how to evaluate these assessments. This framework will need to be sufficiently well defined and robust that States can be confident that its use by different airlines will produce consistent decisions. This is essential if such decisions are to be evaluated by one State and that evaluation be immediately accepted by all other States.

Clearly, good information is key if the safety risk assessment approach is to work. So, the Task Force is also focused on making the necessary improvements in understanding which ash cloud characteristics drive airworthiness effects and what those airworthiness effects are and it is trying to increase the accuracy in forecasting and tracking cloud position.

This work is to progress with urgency and move us back to "business as usual". Until it is complete, however, we expect to use the three zone approach in European and North Atlantic airspace.

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[13] FAA Aeronautical Information Manual (11 Feb 2010) Section 7-5-9 (b)

5.0 Conclusion

SLIDE 15 – Back cover

So, thank you for the opportunity to contribute to the debate today.

I hope that my explanation of how the "three zone approach" came about has been helpful and that you can see why we believe that neither that approach, nor the approach of "avoiding visible ash" is the complete solution.

This is why the UK CAA supports the ICAO Task Force's work on a formal airline-centred safety risk assessment approach supported by much-needed improvements in information about ash, the threat it poses and where it is to be found.

Thank you for your attention.

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