Civil Aviation Authority
Finance and Corporate Services
Information Management

24 May 2010
FOIA reference: F0000977

Dear XXXX

I am writing in respect of your recent application of 23 April 2010, for the release of information held by the Civil Aviation Authority (CAA).

In assessing your request in line with the provisions of the Freedom of Information Act 2000, dealing with your questions in turn, we are pleased to be able to provide the information below

(a) (i) Date and Time of Initial Emergency Meeting of your Committee

The CAA is a member of the National Airspace Crisis Management Executive (NACME), along with the Ministry of Defence, the Department for Transport and NATS (the UK's Air Navigation Service Provider).

NACME provides a co-ordinating body for those organisations involved in the recovery from major incidents and unforeseen occurrences that impact on UK airspace. Activation will not necessarily be reactive; the NACME may form in anticipation of any relevant activity. NACME is chaired by the CAA's Directorate of Airspace Policy (DAP) and it is their responsibility to notify all NACME parties whenever a major Air Traffic Management (ATM) incident is anticipated or declared. Notwithstanding this arrangement, it should be noted that any NACME party can recommend its activation.

The first meeting of NACME was convened at 23:00 on Wednesday 14 April.

(ii) Information then available from Worldwide sources on the effect on aircraft of different levels of Volcanic Ash

The aviation industry's standing instructions for dealing safely with volcanic ash, published by the International Civil Aviation Organisation (ICAO), are to avoid all encounters with ash. This information is published in ICAO publications Doc 9766, Doc 9691 and EUR Doc 019. Guidance from airframe and engine manufacturers also state that operators should avoid intentional flight into known or forecast ash, in principle advising that aircraft and their engines should be exposed to a zero rate of volcanic ash.

However, there was no comprehensive information available from the manufacturers or previous research on the effect on aircraft and engines of different levels of volcanic ash.

Civil Aviation Authority
Aviation House GW Gatwick Airport South Crawley West Sussex England RH6 0YR www.caa.co.uk
Telephone 01293 768512 rick.chatfield@caa.co.uk

INVESTOR IN PEOPLE

It was recognised that urgent clarification was needed as to whether a 'zero tolerance' of volcanic ash was necessary to maintain flight safety. If not, there was an urgent need to identify a density of ash which could be safely tolerated by commercial aircraft and engines.

(iii) Action taken to discuss with manufacturers, RAF, Airlines and European Colleagues possible trials to establish levels of Volcanic ash and effect on aircraft.

The CAA hosted a series of teleconference meetings involving the world's leading aircraft and engine manufacturers, leading scientific experts in meteorology, geology and volcanology, Air Traffic Services experts, airspace managers and leading airlines. Further information can be found in the attached document 'Volcanic Ash International Teleconferences – Information Note Report of Proceedings'.

(b) (i) Date and time of meeting which decided to ban flights

The CAA did not 'ban' flights. The UK's Air Navigation Service Provider, NATS, reduced the traffic flow rate in controlled airspace as a result of the forecast encroachment of the ash contamination. The specific advice in ICAO Doc 9691 and Eur Doc 019 is that flight crews encountering ash inadvertently in flight should reduce thrust, reverse course and descend. NATS understood that the resulting unpredictable flight paths of closely controlled aircraft in the constrained airspace under their control could compromise safety as they could no longer guarantee safe separation nor avoid directing aircraft into areas of known hazard.

In accordance with the location and densities of volcanic ash predicted by the Met Office, as part of their role in the global network of Volcanic Ash Advisory Centres (VAAC), NATS reduced traffic flow in controlled airspace to a 'zero rate', which had the effect of grounding commercial flights in the affected airspace.

(ii) Data on which this decision was based, in respect of ash levels and their actual effect on aircraft.

The decision by NATS to reduce traffic flow in controlled airspace to a 'zero rate' was based on the ICAO instructions that aircraft must avoid all encounters with volcanic ash, as detailed above.

(iii) How far this was agreed worldwide

The information published by ICAO applies worldwide. The decision by NATS to reduce traffic flow in controlled airspace to a 'zero rate' applied only to the airspace where they provide an air traffic control service, which covers aircraft flying in UK airspace and over the eastern part of the North Atlantic. Communication between NATS and Eurocontrol also ensured that the necessary liaison on the effect of the airspace closures was achieved. Normal operations therefore over much of Europe also ceased as sectors fell within the London VAAC contaminated area and Eurocontrol subsequently took action as necessary.

(c) (i) Date and time of meeting which decided on lifting the ban

As a result of the teleconference meetings hosted by the CAA, an agreement on a level of ash at which operations could be permitted was reached during the afternoon of 20 April with leading aircraft and engine manufacturers. An emergency meeting of the CAA board was held at 17:30 on 20 April, at which the way forward was agreed.

This decision set new criteria, based on which NATS were able to re-consider their safety case model and remove the 'zero rate' imposed on traffic flow based on the VAAC predictions.

Further information on the agreement can be found in the attached document 'Volcanic Ash International Teleconferences – Information Note Report of Proceedings'.

(ii) Data available on levels of ash over the UK and maximum levels permissible for flights

As a result of the teleconference meetings hosted by the CAA, agreement was reached that operations could be permitted in areas of volcanic ash with densities predicted by the Met Office of up to 2 x 10^{-3} g/m^3 subject to appropriate precautionary maintenance practices being applied and the avoidance of visible ash. The Met Office forecast of the level of ash over the UK is published by the Met Office on their website at: http://metoffice.com/aviation/vaac/vaacuk_vag.html.

(iii) How far these standards have now been adopted internationally.

The UK CAA has communicated with the European Aviation Safety Agency (EASA), other European National Aviation Authorities, airframe and engine manufacturers, operators and other bodies as part of the teleconference calls to develop the strategy outlined above. The manufacturers have published revised operational and continuing airworthiness information reflecting the agreement, which has a worldwide applicability. Further work to consolidate the agreement within the ICAO documentation will follow on.

If you are not satisfied with how we have dealt with your request in the first instance you may approach the Freedom of Information Case Manager in writing at:-

Rick Chatfield
FOIA & EIR Case Manager
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR
rick.chatfield@caa.co.uk

The CAA has a formal internal review process for dealing with appeals or complaints in connection with Freedom of Information requests. The key steps in this process are set in the attachment.

Should you remain dissatisfied with the outcome you have a right under Section 50 of the Freedom of Information Act to appeal against the decision by contacting the Information Commissioner at:-

Information Commissioner's Office
FOI/EIR Complaints Resolution
Wycliffe House
Water Lane
Wilmslow
Cheshire
SK9 5AF
www.ico.gov.uk/complaints.aspx

Should you wish to make further Freedom of Information requests, please use the e-form at http://www.caa.co.uk/foi.

Yours sincerely

Rick Chatfield
FoIA & EIR Case Manager

CAA INTERNAL REVIEW & COMPLAINTS PROCEDURE

- The original case to which the appeal or complaint relates is identified and the case file is made available;
- The appeal or complaint is allocated to an Appeal Manager, the appeal is acknowledged and the details of the Appeal Manager are provided to the applicant;
- The Appeal Manager reviews the case to understand the nature of the appeal or complaint, reviews the actions and decisions taken in connection with the original case and takes account of any new information that may have been received. This will typically require contact with those persons involved in the original case and consultation with the CAA Legal Department;
- The Appeal Manager concludes the review and, after consultation with those involved with the case, and with the CAA Legal Department, agrees on the course of action to be taken;
- The Appeal Manager prepares the necessary response and collates any information to be provided to the applicant;
- The response and any necessary information is sent to the applicant, together with information about further rights of appeal to the Information Commissioners Office, including full contact details.

VOLCANIC ASH
INTERNATIONAL TELECONFERENCES

17-23 April 2010

INFORMATION NOTE
REPORT OF PROCEEDINGS

Padhraic Kelleher
Head of Airworthiness
UK Civil Aviation Authority

Context

After three weeks of activity, Iceland's Eyjafjallajokull volcano erupted on 14 April 2010 for the first time in almost 200 years. The ejected debris plume reached over 30,000 feet into the atmosphere and was carried by the prevailing wind over the UK and Northern Europe.

The aviation industry's standing instructions for dealing safely with volcanic ash, published by ICAO, are to avoid all encounters with ash. This advice has been incorporated into safety management systems operated by leading air traffic services and airspace management organisations. The "zero tolerance" of ash inherent in this advice led directly to a sequence of decisions that reduced air traffic flow through UK, Irish and Continental European airspace to a "zero rate" in those sectors identified as falling within the London Volcanic Ash Advisory Centre (VAAC) contaminated area.

The plume persisted over the British Isles and Northern Continental Europe for a number of days; the continued application of "zero rate" halted commercial aviation operations. By 18 April, commercial aviation movement through the airspace of 23 European countries had ceased and restrictions were in place in two other countries. Over 300 airports, representing 75% of the European network, closed. Precautions were taken to protect grounded aircraft from potential ashfall and to prepare aerodromes to deal properly with ashfall.

Urgent confirmation was needed as to whether a "zero tolerance" of volcanic ash was necessary to maintain flight safety. If not, then there was an urgent need to identify a density of ash which could be safely tolerated by commercial aircraft and engines; it was acknowledged that even if it could be established that operations in such ash densities were safe, there might be economic penalties in relation to an escalation in the engineering interventions necessary to sustain airworthiness standards.

Response

On 17 April, UKCAA hosted the first of a series of teleconference meetings aimed at gathering together the world's leading aircraft and engine manufacturers to focus on this issue. Supporting these discussions were leading scientific experts in meteorology, geology and volcanology, many of whom were directly monitoring the Eyjafjallajokull eruption and ash plume. Air Traffic Services experts, airspace managers and leading airlines also supported the work.

More than 60 organisations participated in a series of six teleconferences between 17 and 23 April. Instrumented flight test aircraft were made available to the group and the resulting data communicated after each flight sequence to the group.

On 20 April, the aircraft and engine manufacturers determined that their aircraft and engines would tolerate operations in an ash density of $2x10^{-3}g/m^3$. Flight operations in the UK recommenced shortly after this consolidated position had been determined. By 22 April, activities had resumed across Europe apart from airspace in southern Finland.

Eurocontrol has reportedly estimated that more than 100,000 flights were cancelled affecting the travel plans of around 10 million passengers. The airlines estimate their

losses in the order of €1.4 billion, the airports €250 million, ground handlers €200m and Air Navigation Service Providers €175 million with wider impacts beyond this grouping.

Agreed Position

The position agreed by the manufacturers on 20 April 2010 was presented in the following form:

Statement from the international conferences of airframe and aero engine manufacturers, aviation safety regulators, operators and specialist meteorological and research agencies

20 April 2010

In response to the exceptional operational circumstances currently being experienced in the UK due to volcanic ash, the airframe and engine manufacturers have held extensive discussions with regulators, operators, research centres, air traffic control service providers and meteorological agencies with a view to finding a way to resume operations in UK airspace.

1) The limited data available from previous volcanic ash encounters involving a variety of manufacturers' products has been analysed.

2) The understanding of previous volcanic ash eruptions is that flight operation restrictions have ensured that encounters with volcanic ash are minimised and appropriate precautionary inspections are carried out to identify whether encounters have occurred.

3) Based on the available data, a consensus has been reached among the parties to permit operations initially in areas of volcanic ash with densities predicted by the UK Met Office, of up to 2 $x10^{-3}g/m^3$ subject to appropriate precautionary maintenance practices being applied and the avoidance of visible ash.

4) The possible long-term effects of operation in volcanic ash are not known. In view of this, additional maintenance measures will be required to be developed by airframe manufacturers in conjunction with their engine suppliers to monitor for any possible long-term airworthiness effects resulting from operations in volcanic ash concentrations up to this level.

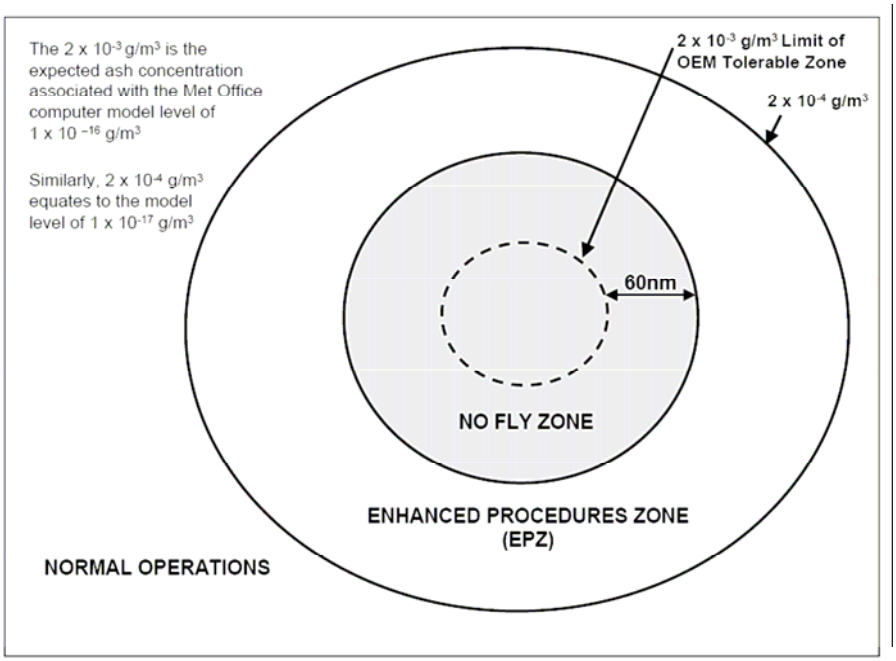
5) Industry and regulators are committed to continuing to work to acquire and analyse information arising from operational experience which would appear to offer an improved understanding of any longer term effects and to further modify maintenance programmes when appropriate.

Implementation

As well as defining a tolerable ash density level, the manufacturers group also considered how the tolerable level could be used to aid flight planning. The majority view supported the creation of a "No Fly" zone at ash concentrations above $2x10^{-3}$ g/m^3 with normal operations beyond this zone. There was a significant minority view in support of adding an intermediate "enhanced procedures" zone (below $2x10^{-3}$ but above $2x10^{-4}$).

The European National Supervisory Authorities (NSAs) and Air Navigation Service Providers (ANSPs) elected to adopt the 2 x 10^{-3} limit and to also apply a 60 nautical mile buffer around it in order to create an extended “No Fly” zone. An intermediate “Enhanced Procedures Zone” (EPZ) was also introduced as shown in the diagram.

To facilitate flight planning, the NSAs and/or ANSPs agreed to publish a NOTAM every 6 hours setting out the specific coordinates of the No Fly zone. The Enhanced Procedures Zone was defined on a revised chart published by the UK Met Office in its role as the London VAAC. Work to provide the necessary information in one published source continues.



For UK commercial operators, the UK CAA required operators, in planning flights through the EPZ, to carry out a risk assessment. CAA also encouraged operators to report any events they suspected could be linked to a volcanic ash encounter.

The CAA also reaffirmed its belief that the manufacturers are best placed to decide what the appropriate maintenance procedures should be in preparation for, or following, a flight in the EPZ. As no evidence existed of any additional safety concerns for operations within this zone, the CAA did not require enhancements to the instructions judged by the manufacturers necessary for their particular products.

By 23 April, all participating manufacturers, and a wider range of companies worldwide, had issued to operators of their aircraft and engines the engineering instructions necessary to ensure continued airworthiness of aircraft operating in ash density up to $2x10^{-3}$g/m^3.

Technical Assessment

In deciding that $2x10^{-3}g/m^3$ was a tolerable ash density level, the manufacturers were able to take account of information and advice regarding:

- The rationale behind the ICAO "zero tolerance" approach and confirmation that it was not based on known safety concerns at low concentrations of ash (as briefed by FAA and US Weather Service staff who participated in that work)
- The use by the London VAAC of a predicted ash density of $2x10^{-4}g/m^3$ as the limit of the extant "no fly" zone and the value to restoring operations were it possible safely to reduce this limit to $2x10^{-3}g/m^3$ (as briefed by UK Met Office and NATS staff)
- The London VAAC ash density forecasting process including modelling, measurements and data blending and, with help from experts from the FAA and US Weather Service, comparisons of the London VAAC techniques with those used at the Washington and Anchorage VAACs
- An independent assessment of the London VAAC forecasts by the UK National Centre for Atmospheric Sciences confirming confidence in the Met Office products
- Instrumented flight test measurements from the UK Facility for Airborne Atmospheric Measurements (FAAM) and NERC, the UK Natural Environment Research Council, LIDAR laser measurements and meteorological balloon data all confirming that the forecast levels accorded well with the peak values being measured in the atmosphere
- The physical and chemical properties of particulates in the plume based on information from the Icelandic Met Office
- The calculated rate of accumulation of ash within the core of turbine engines and its expected subsequent behaviour and effects
- The robustness of airframe systems (e.g. Total Air Temperature probes, pitot probes and static ports) in relation to ash intake and flow erosion
- The operational experience in the presence of ash after the Mount Redoubt eruption in 1989 as reported extensively by Alaskan Airlines albeit that readily accessible data on the specific ash densities encountered was not available
- Detailed information on a range of specific encounters with ash including the KLM B747-400 incident in 1989 resulting in a four-engined flame out in a calculated ash density of $2g/m^3$
- Data from "pathfinder" flights flown by some European airlines between 15 and 19 April and for which manufacturers had had direct involvement in data acquisition pre and post flight; again there was typically a paucity of credible data on the specific ash densities encountered.

The manufacturers were clear that although they were content that $2x10^{-3}g/m^3$ represented a tolerable density level for their products, any further increase in this level would require more data on, and analysis of, the effects of ash contamination on airframes and engines.

Future Work – near term

By 26 April, the eruption from Eyjafjallajokull had subsided from a peak material ejection rate approaching 1,000 tonnes/second to a rate closer to 10 tonnes/second. However, fresh eruptions from this volcano can be expected for some time to come. Furthermore, the UK Geological Survey advises that 3 out of 4 eruptions of the current active volcano result in Katla, the larger volcano in that region of Iceland, also erupting. Hence, further work in relation to tolerability at higher ash concentrations is advisable in the near term.

It would seem sensible to consider assessing the tolerability of ash and other particulates at densities of the order of 10^{-2} g/m^{3}.

The Group also noted the potential value in examining the case for flights that transition through areas of contamination for a portion of the flight only. It might be possible to accommodate such flights were it possible to specify not only a tolerable rate of accumulation per hour of exposure but also a maximum total accumulation per flight. Were such an approach possible, it could provide aircraft operators with a mechanism to permit safe flight planning and to anticipate the necessity for post flight actions.

With this in mind, manufacturers are continuing to gather data from the current operations and from instrumented specialist atmospheric research aircraft in order to further validate current assumptions and to provide a basis for further work.

Additional airborne research assets are being identified internationally and arrangements made to coordinate their efforts with those of the UK assets. Early data acquisition is being aimed at exploring the outer edges of the no fly zone to confirm the forecast ash densities, to confirm the overall makeup of the ash plume and to provide information to the Health Protection Agency regarding health of aircraft occupants. The data is being committed to the repository run by EUFAR, the European Facility for Airborne Research which coordinates European atmospheric research assets.

In parallel, the UKCAA has alerted aircraft owners and operators, both private and commercial, of the need to report any actual or suspected encounters with ash. These occurrence reports are being gathered, examined and made available through a data repository being established by Eurocontrol. Manufacturers are also receiving such reports directly from the operators of their products.

In addition, manufacturers have worked with some airlines to establish a data gathering programme involving a selected group of aircraft which are being specifically monitored and their condition reported on an ongoing basis as they continue to operate within and outside of the Enhanced Procedures Zone.

Future Work – mid term

The group established a specialist group to compare the forecasts produced by different VAACs, to identify any variations in approach that might exist and to recommend best practice taking into account such inputs as the manufacturers and operators would make in relation to the usability of the solutions generated.

The specialist group is also drawing together such knowledge, data and research as they can find in order to contribute proactively to the development of new ICAO standards, practices or guidelines. Again, the continued involvement of the manufacturers has been identified as a key aim.

Padhraic Kelleher
Head of Airworthiness
UK CAA
5 May 2010

ATTENDANCE ON THE CONFERENCE CALLS

This table summarises known participation in a series of conference calls from Saturday 17 to Friday 23 April 2010. There was no call on 21 April.

- Total number of organisations involved: 63.
- Total number of organisations actively participating in calls: grew from 20 to 43.

It is likely that there were many more participants than recorded here due to difficulties for organisations in responding to the on-call registration process and because many organisations fielded teams of experts on each call: 12 from Boeing on Call 1, for example. "Linked" organisations were in contact with proceedings.

	Call 1	Call 2	Call 3	Call 4	Call 5	Call 6	Linked
Airframe Manufacturers							
Airbus	✓	✓	✓	✓	✓	✓	
ATR							✓
BAE Systems – Regional Aircraft					✓	✓	
Boeing	✓	✓	✓	✓	✓	✓	
Bombardier Aerospace				✓	✓	✓	
Bombardier Shorts Brothers				✓	✓	✓	
Cessna Textron							✓
Dassault					✓	✓	
Embraer				✓	✓	✓	
Gulfstream							✓
Engine Manufacturers							
General Electric	✓	✓	✓	✓	✓	✓	
Honeywell International				✓	✓	✓	
International Aero Engines						✓	
Pratt & Whitney	✓	✓	✓	✓	✓	✓	
Pratt & Whitney Canada			✓	✓	✓	✓	
Rolls Royce	✓	✓	✓	✓	✓	✓	
SNECMA		✓	✓	✓	✓	✓	
Williams International							✓
Air Navigation Service Providers							
Eurocontrol	✓						
FAA Air Traffic Control	✓	✓	✓	✓	✓	✓	
Meteo France (Toulouse VAAC)		✓		✓			
Met Office, Iceland							✓
Met Office, Netherlands		✓			✓		
Met Office, UK (London VAAC)	✓	✓	✓	✓	✓	✓	
National Oceanic and Atmospheric Administration (NOAA), US (Anchorage VAAC and Washington VAAC)	✓	✓	✓	✓	✓	✓	
NATS	✓	✓					
US Air Force Met Service						✓	

	Call 1	Call 2	Call 3	Call 4	Call 5	Call 6	Linked
Scientific Agencies							
CEV, National Flight Test Centre of France	✓						
Chief Scientific Adviser, UK				✓	✓	✓	
FAA Weather Group	✓	✓	✓	✓	✓	✓	
Facility for Airborne Atmospheric Measurements, UK (FAAM)	✓	✓	✓	✓		✓	
National Centre for Atmospheric Sciences, UK (NCAS)		✓	✓	✓	✓	✓	
Natural Environment Research Council, UK (NERC)	✓						
NLR, German Research Centre					✓		
US Geological Survey						✓	
Operators							
Air Canada						✓	
Air France						✓	
Astraeus							✓
British Airways	✓		✓		✓		
easyJet							✓
FlyBe				✓	✓	✓	
bmi					✓	✓	
Lufthansa				✓	✓	✓	
Monarch				✓	✓	✓	
Ryanair						✓	
Thomas Cook				✓	✓	✓	
Thomson Airways				✓			
United Airlines						✓	✓
Virgin Atlantic					✓	✓	
Representative Bodies							
Aerospace Industries Association						✓	
General Aviation Manufacturers Association						✓	
Oil & Gas UK							✓
Regulators							
AESA, Spain			✓	✓	✓	✓	
CAA, Netherlands	✓	✓	✓	✓			
CAA, Norway				✓			
CAA, UK	✓	✓	✓	✓	✓	✓	
DGAC France	✓	✓	✓	✓	✓	✓	
EASA	✓	✓	✓	✓	✓	✓	
FAA Airworthiness Certification	✓	✓	✓	✓	✓	✓	
Irish Aviation Authority			✓	✓	✓	✓	
MAA, UK Military Aviation Authority				✓	✓	✓	
Transport Canada				✓	✓		
UK DfT		✓	✓	✓		✓	

ENDS

in focus

a briefing from the Civil Aviation Authority - 14 May 2010

Civil Aviation Authority

Volcanic Ash

On 20th March 2010 the Icelandic volcano Eyjafjallajökul began erupting for the first time in 190 years, sending a cloud of ash over Northern Europe. Volcanic ash is a known hazard to aircraft, and the unequivocal guidance from the International Civil Aviation Organisation (ICAO) - based on such events as the multiple engine failure that affected a British Airways flight over Indonesia in 1982 - is that aircraft encountering volcanic ash must avoid it completely. The ICAO guidance, which is based on the evidence from a number of previous volcanic events, states simply that operators should AVOID, AVOID, AVOID.

Volcanoes erupt frequently, but normally only affect areas where air traffic is light and airspace is uncongested. Their ash clouds are tracked by nine global Volcanic Ash Advisory Centres, which provide information to allow flights to reroute their flight paths around any area of contamination.

Satellite Image of the ash plume on 19 April 2010. Source Met Office

The disruption to UK flights on 15 April and the five days that followed was caused by unprecedented conditions - frequent eruptions from Eyjafjallajökul combining with a weather pattern that sent volcanic ash into airspace where there was simply not the room to avoid it. As the severity of the situation increased UK air traffic control service provider NATS announced it would not provide IFR clearances into the contaminated airspace in accordance with International Civil Aviation Organisation (ICAO). As such, no flights could take place in the UK's Controlled Airspace. At this stage given the ICAO guidance documentation, there was no alternative strategy that would have allowed NATS or the CAA to provide the necessary assurance of safety.

The UK was not alone in restricting flight operations, with many other European countries following suit as the ash cloud drifted into their airspace.

Safety first

Safety always comes first in aviation. The UK has one of the world's best safety records, secured by strict guidelines. When the scale of the problem and extent of airspace closures became evident on 15 April, and looked set to continue for some time, the challenge facing the CAA was evident. It had to establish whether the guidelines from ICAO could safely be revised to allow aircraft to fly through a low density of ash (instead of the zero tolerance specified which was not based on hard scientific evidence) and to better understand and predict the height and density of ash contamination in UK airspace.

Aircraft with special instruments to measure the ash cloud's density were used, complementing the data provided by six ground-based lasers located across the UK. Over the course of the first weekend further evidence was gathered from commercial jets, without passengers, flying a flight path behind the instrument-bearing aircraft. Before and after any flights, engines were intensively examined to check for any correlation between ash density and engine damage. Meanwhile, work was underway with manufacturers to frame new guidance for allowing aircraft to safely fly through Europe's skies.

How was the new level set?

The scale of the challenge was enormous. International and European regulators, manufacturers and aviation experts had to co-ordinate their expertise and agree a new zoning system for the airspace affected by volcanic ash and to establish new airworthiness guidance. The CAA, with NATS, took the lead in getting both of these workstreams underway, and after five days of intensive conference calls with hundreds of experts the necessary data was amassed for the basis of the agreed new guidelines. Politicians, airlines and tour operators were kept abreast of developments.

On Monday 19 April, Europe agreed a proposed new zoning system for allowing flights to operate in low levels of ash. This established a no-fly zone where the predicted ash density exceeded the proposed ash tolerance figure. This however proceeded any final approval from manufacturers to allow flights in any amount of ash. This allowed identification of a secondary zone where flying could be resumed, albeit subject to some additional inspections of the aircraft if evidence of ash contamination was found and a tertiary, ash-free zone where normal operations could be conducted.

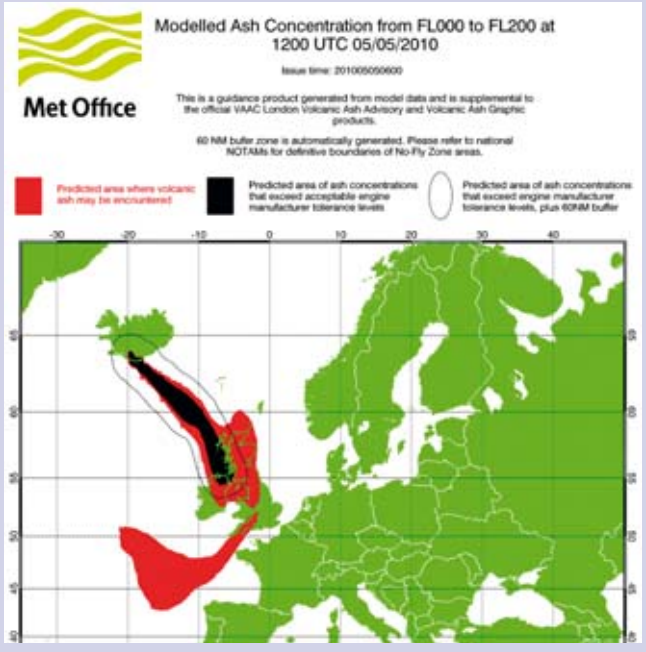
By the afternoon of Tuesday 20 April, key manufacturers had provided the CAA with agreed revised guidelines which would not compromise safety. This resulted in the manufacturers setting an agreed limit of low levels of ash that were deemed to be safe. Forty-five minutes after securing that agreement, the CAA board met in emergency session and agreed the new guidelines. Two hours after the meeting, the skies reopened and the first flights landed at Heathrow – three of them reporting smells of sulphur – an indication that they had flown through, or near to areas of ash contamination. The new limit of tolerable ash density is set at 2X10-3 grammes of ash per cubic metre of air.

This meant that no fly zones were established where the ash had a higher concentration than that agreed as being safe by the manufacturers, the secondary zone was where ash was present but at lower concentrations (down to an ash density of 2X10-4 grammes of ash per cubic metre of air) so aircraft were allowed to fly with additional safety measures and a strict inspection regime in place, and a tertiary ash free zone (below 2X10-4 grammes of ash per cubic metre of air) where aircraft could continue operations as normal. Eurocontrol, the air traffic provider for much of European controlled airspace, imposed a further 60 nautical mile buffer around the no-fly zone as a contingency measure, in place until there was evidence in place to show the buffer was unnecessary.

Since then airline operations have resumed without major incident, or any reports of airframe or engine damage. There have been cases of aircraft encountering some suspected ash and ash deposits have been discovered on aircraft after a flight. This is to be expected as the ash cloud has not gone away and therefore aircraft will be encountering ash as they fly through it.

The no fly zone has since affected parts of the UK a number of times, but relatively small areas and for much shorter periods of time. Transatlantic flights have been disrupted, most significantly over the weekend of 8/9 May when a large no fly zone was put in place to the west of Ireland. Spanish airspace has also been affected, causing a lot of disruption to flights in and out of Spain.

Maximising safe flying is the objective of all involved. As such the CAA is constantly reviewing the measures in place and, based on the evidence of the flights that have taken place so far around the ash, the CAA decided on 10 May to remove the requirement for a 60 nautical mile buffer around the area of higher ash concentration. This has been welcomed by industry and it is expected that the rest of Europe, once they have completed their own checks, will make the same judgement.



Illustrative Met Office modelled ash concentration chart from 05 May 2010

What happens now?

Eyjafjallajökul is continuing to erupt. Airlines are examining aircraft engines and airframes before and after flights, including assessing the effects of cumulative exposure to ash. Scientists are constantly monitoring the ash cloud's movements.

As the UK has some of the most congested skies in the world, no fly zones will continue to disrupt UK flights until the volcano stops emitting large volumes of ash, the weather patterns change or the aviation industry comes up with technical solutions to allow aircraft engines to fly through denser levels of volcanic ash.

As the volcano and the weather are out of our control, the emphasis of the CAA's future is on working with industry and other partners on continuing to improve the airworthiness solution.

The CAA is also continuing to drive activities across Europe to develop more detailed scientific understanding of the problem. As the aviation sector's UK regulator, we are working hard to bring the industry together to address the issue. We are continuing to provide expert guidance, and are looking to engine and aircraft manufacturers, working in conjunction with airlines, to build the evidence for new technical guidelines.

Manufacturers can perform testing based on ash intake into engines and certify its effect on airframes and instrumentation, and would be responsible for making any changes to technical guidelines.

Throughout this process, the CAA will ensure that the public is at the heart of all our work, and our goal will be to allow as much flying as safely possible, working with all stakeholders to be sure that safety is not compromised and disruption is minimised.

Timeline of events

Saturday 20 March

Icelandic volcano Eyjafjallajökull begins erupting for the first time in 190 years.

Wednesday 14 April

More forceful eruption, emitting plumes of ash.

CAA is informed & advice is provided to airlines.

Late evening, as the extent of the ash cloud emitted become apparent, the National Airspace Crisis Management Executive (NACME) convenes, sponsored by CAA's DAP, including CAA's SRG, MoD, NATS, DfT and others. Thereafter NACME meets up to three times daily throughout the crisis.

Thursday 15 April

Early morning, the ash cloud reaches Scottish airspace making it unsafe for flights.

CAA starts internal briefings on ICAO guidelines.

NATS announces that from 1200 until at least 1800, it will not provide IFR clearances into the contaminated airspace in accordance with International Civil Aviation Organisation (ICAO) guidance that flying should not take place where there is ash in the atmosphere. CAA follows this with a NOTAM reenforcing the decision with advice to VFR pilots.

Six ground based LIDAR (Light Detection and Ranging) radars detect ash in the atmosphere. Dornier 228 aircraft launched for airborne evaluation.

Friday 16 April

Evidence of ash presence detected at various locations throughout UK. Small window allows Manchester to open briefly.

CAA, NATS, and Met Office in contact with Eurocontrol. CAA meets Transport Secretary and agrees further updates and briefings throughout the day, including afternoon meeting with airline & BAA representatives. Regular contact continues throughout the period.

CAA establishes international teleconference call, drawing together almost 100 organisations to assess whether slightly denser contamination than the current ICAO level would be an acceptable risk based position.

Dornier instrumented aircraft from NERC deployed to verify Met Office models.

Volcanic activity intensifies with ash up to 30,000ft.

Continued on back page

CAA timeline of events

Continued

Saturday 17 April

First International Teleconference chaired by CAA with International Airframe and Engine Manufacturers, Service Providers, Operators, Specialist Meteorological, Research and Geological Agencies and with European and International Aviation Safety Regulators.

There is no positive prognosis for allowing flights to recommence due to further eruptions, settled weather patterns and N/NW winds.

Operator in Penzance detects ash on airframe on landing. Similar reports from MoD in West Wales and North England.

Throughout weekend LIDAR data scrutinised – all showing continuing mild presence of contamination.

Sunday 18 April

Second International Teleconference call. More data is requested by engine manufacturers on likely levels of contamination.

Instrumented Dornier flight ahead of BA flight, to measure contamination levels and practical impact.

Overflight policy circulated. Leads to proposals as announced at Eurocontrol conference 10.00am Monday morning.

Monday 19 April

CAA work continues to seek agreement from aircraft engine manufacturers - overnight work in US suggests a solution may be possible.

European Transport Ministers meet and agree a three band model consisting of:

- a no fly zone within 60 nautical miles of the higher ash density area;
- a second zone where flying will not in principle be impeded (subject to agreed risk assessments and measures) even though some ash is present and where the decisions about operations will be taken by national authorities;
- a third zone which is not affected by ash.

Eurocontrol Press conference announces new zoning to take effect 0600 20 April.

Third International Teleconference. Data examined from further instrumented Dornier flights which show low level contamination. Still no uniform agreement from engine manufacturers about changing the tolerance level.

UK FIR open for overflight, above area of volcanic ash, above FL200.

Tuesday 20 April

At morning meeting with Transport Secretary, airlines, tour operators and NATS, CAA updates on progress towards a solution, explains evidence base and informs all that CAA Board is on standby for emergency meeting.

Fourth International Teleconference happens.

CAA Emergency Board meeting held at 17.30 and agrees way forward:

- 2X10-3 g of ash per cubic metre of air set as an acceptable safety limit.
- Requirements to be placed on Aircraft Operators, Air Navigation Service Providers and Aerodromes; including range of inspections to reduce risk based around continued serviceability of engines and airframes between flights, and requiring airlines to conduct their own safety risk assesments.
- Instrumented flights to continue to check on density.
- Use banding model delineated by Eurocontrol.

CAA briefs Transport Secretary and airlines on Board decision, distributes position statement to International Teleconference Group and makes press announcement that airspace will be reopened at 2200.

Nine engine manufacturers go public with support for new safety threshold.

3 - 5 May

Ash plume returns to cover parts of UK airspace at levels above the 2X10-3 g per cubic metre threshold for several days, resulting in airports being closed in Scotland and Northern Ireland.

8 - 10 May

High concentrations of ash in airspace over parts of south west, southern and central Europe lead to airport closures.

Monday 10 May

CAA announces that the 60nm buffer zone in place around areas of high ash concentrations can safely be removed following two more weeks of examination of the data, thereby safely reducing the maximum extent of the no fly zone around areas of higher ash density.

More information about volcanic ash, the monitoring of ash flows, and the authorities' response can be found from the following websites:
The CAA - www.caa.co.uk
The UK Met Office - www.metoffice.gov.uk
NATS - www.nats.co.uk
The British Geological Survey - www.bgs.ac.uk