



Ash in Europe next time

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Flightglobal



Eyjafjallayokull



The plume: all the way to UK



Can you fly near this?



- Well, *he* did

European disruption to global aviation



The European Commission's director of air transport Daniel Calleja-Crespo estimated that the decision to ground European airlines and ban international inbound flights cost the airlines €1.7 billion. Stephen Perkins, head of the OECD's joint transport research centre, put global primary and secondary losses at \$1.1 trillion

Why we have to get our act together



Dr Haraldur Sigurdsson, volcanologist:
“The Eyjafjallajökull eruption was minuscule on a historic scale, and more powerful events are just a matter of time”

But why ground aeroplanes?



- The pictures are of engine parts from a pair of Finnish AF F-18s that got airborne on 15 April 2010
- BA Flight 9, 24 June 1982, 747-200. All four engines failed over Indonesia
- KLM Flight 867, 15 Dec 1989, all four engines failed over Alaska

Ash: developing global knowledge

- After the BA 009 incident, in which the aircraft flew - at night - into unforecast ash from Mt Galunggung, the aviation world realised that it had to monitor volcanic activity, and set up a system for tracking and reporting atmospheric ash, so Volcanic Ash Advisory Centres (VAAC) were set up. There are now 9 VAACs covering the globe except for Antarctica.
- London VAAC is operated by the Met Office, and it covers UK and Irish airspace, and the eastern side of the North Atlantic. Toulouse VAAC covers mainland Europe, most of Asia, and all of Africa and the eastern side of the South Atlantic.
- VAACs report four times a day on the geographical disposition of atmospheric ash, both horizontally and vertically, and they chart its estimated intensity in contours.

Atmospheric ash: new resources since the 2010 event



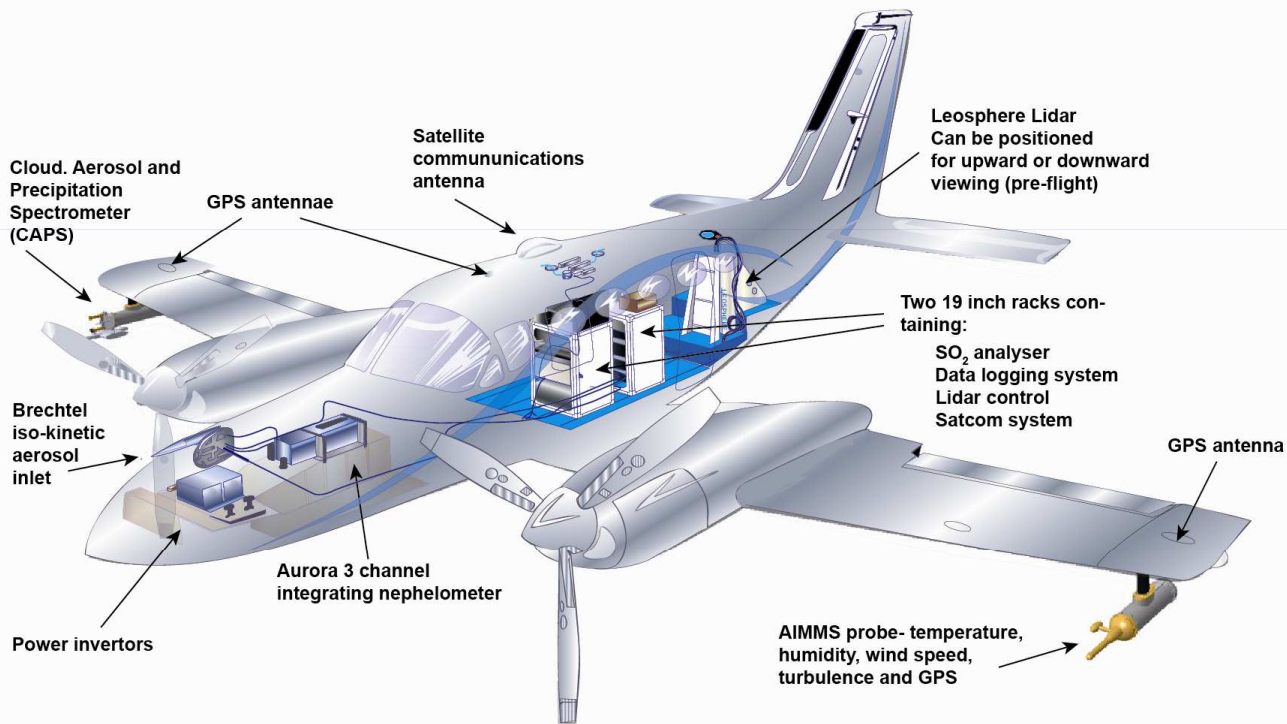
- The UK Met Office now uses a piston-engined, pressurised Cessna 421C to find and measure atmospheric ash and gases. The Met Office Civil Contingencies Aircraft (MOCCA)
- Airbus's senior flight test engineer Manfred Birnfeld, commenting on the company's probing flights during the 2010 ash says: "Ash probing is meaningful only together with precise measurement of what is encountered."

The aircraft

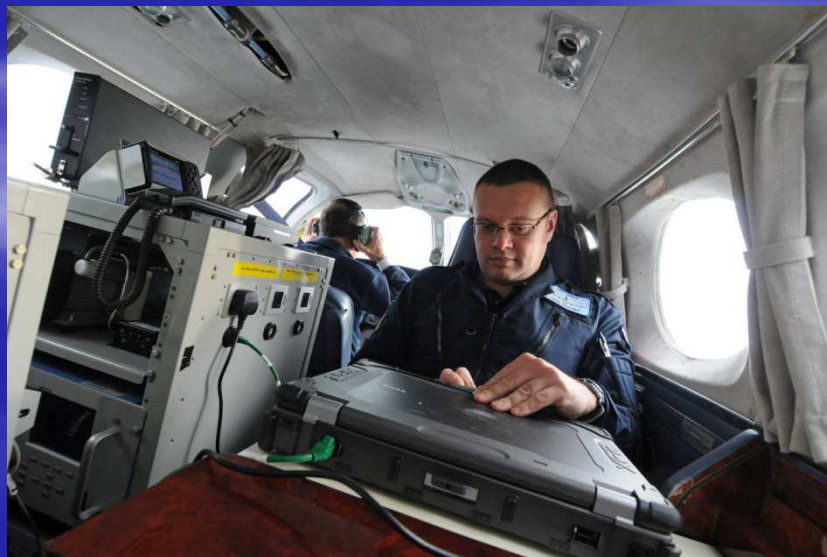
- The aircraft, built in 1977, is pressurised to 29,000ft without crew oxygen, powered by two Teledyne Continental turbocharged engines.
- Specialist equipment selected and owned by the Met Office, installed by Cranfield Aerospace, the aircraft owner.
- The operator is special missions company DO Systems based at Bournemouth. A typical mission crew is a single pilot and a Met office systems operator
- Funding is provided by the UK CAA



Mission equipment



MOCCA sensors



MOCCA's role

- Data on ash and other atmospheric pollutants is gathered and transmitted in frequent bursts by satellite communications to receivers on the ground at the London Volcanic Ash Advisory Centre, which is at the Met Office's main base in Exeter.
- Managing Director of Cranfield Aerospace David Gardner says the aircraft, while primarily intended to enable safe aviation operations when volcanic ash is affecting Europe's airspace, can also detect and monitor other atmospheric pollutants, hence the Cessna's generic description as a "civil contingencies" aircraft.
- Europe has a fleet of about 40 aircraft – microlights to a Tupolev 154 - at its disposal for various kinds of atmospheric and topographical research , and details of those resources can be found at www.eufar.net – the European Facility for Airborne Research.

EasyJet, NILU and AVOID



- Like many other carriers in 2010, EasyJet reckoned there must be a better way, and decided to do some research
- Sensors under this microlight's wings (AVOID under port wing), Etna in the background

What EZY did

- During the European volcanic ash grounding in April 2010, EasyJet's head of engineering Ian Davies began to wonder if there was a better way, so he googled “volcanic ash” and emerged with a name: Dr Fred Prata of NILU, the Norwegian Institute of Air Research.
- Dr Fred had been working for years on systems for tracking volcanic ash by satellite and was probably the world's foremost expert on it, so Davies hit the jackpot first time. But Dr Fred was also working on developing an aircraft-mounted infra-red ash sensor, called AVOID, that could provide pilots with a display a bit like a weather radar showing them where the worst ash was so they could avoid it. At FL200 it can see ash about 100km (54nm) ahead.
- Airbus will soon be joining the trials to provide the high-altitude test capability.



Flight Design CT ultralight, op by Dusseldorf University

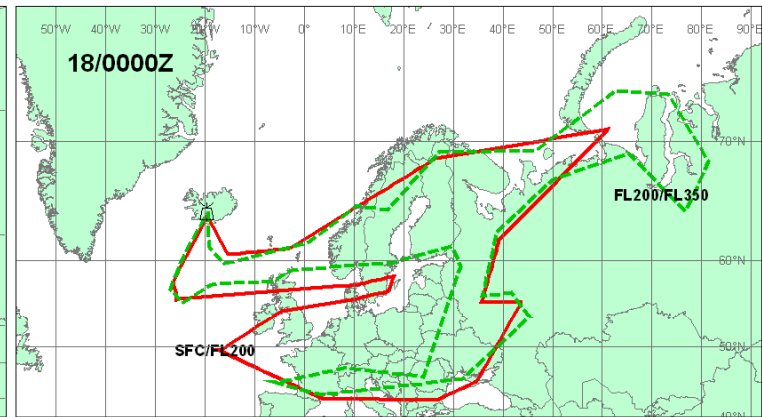
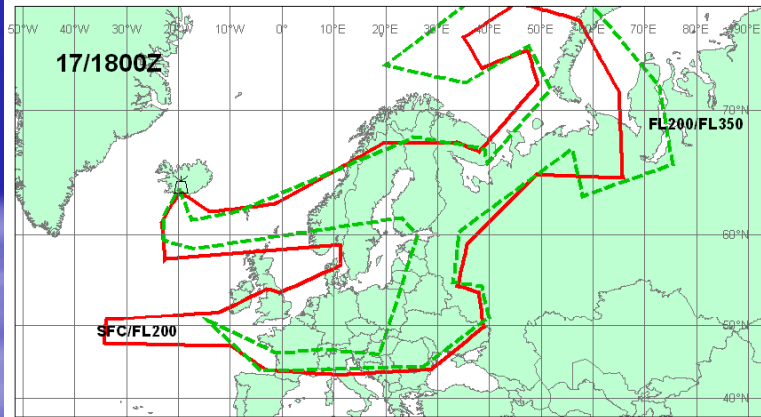
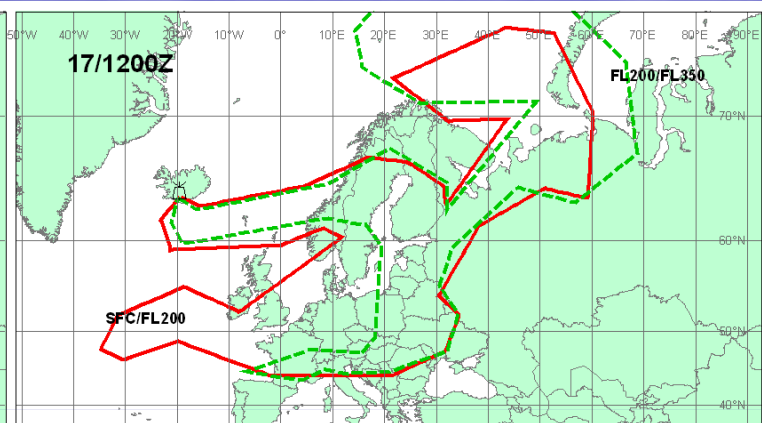
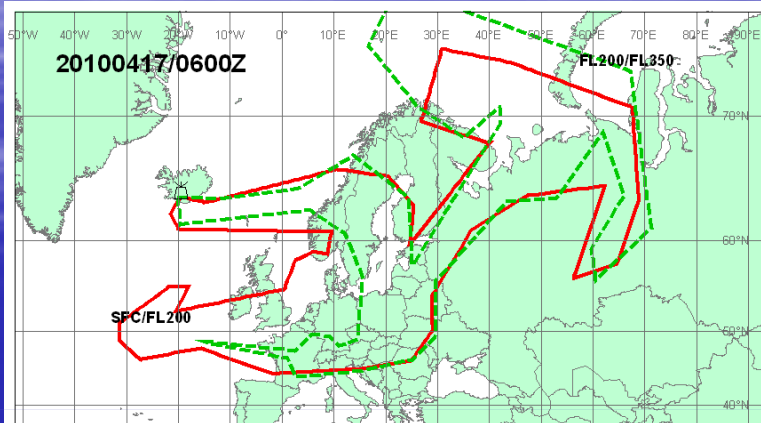
L-R: Uwe Post, the pilot of the Flight Design CT ultralight, Dr Fred Prata of NILU, and Prof Konradin Weber of Dusseldorf University. The AVOID pod is below the wing on the right

EZY's ash vision

- The AVOID pod is expensive, making it rather unlikely that airlines will choose to fit it. But EZY is going to fit it to 20 of its A320 series fleet, and it hopes other European carriers will fit about 80 more to aircraft based around the continent. If they do, this exercise will achieve much more than just providing tactical avoidance capability to the airframes actually fitted with AVOID.
- When the next ash event happens, the crews of these aeroplanes can send back pireps telling ATC where stuff actually is. This enables comparisons to be made with the predicted location of the various densities of ash, so the predictive algorithms can be refined, and the accuracy of the surveillance picture provided by satellite sensors and ground-based lidar stations can be checked in reality.
- The whole exercise is about building confidence in the total system, and continually adding to the knowledge base.

London VAAC 17 Apr 2010

Let's go back to the event!



VA ADVISORY
DTG: 20100417/0600Z
VAAC: LONDON
VOLCANO:
EYJAFJALLAJOKULL
PSN: N6338 W01937
AREA: ICELAND

SUMMIT ELEV: 1666M
ADVISORY NR: 2010/013
INFO SOURCE: ICELAND MET OFFICE
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: SIGNIFICANT ERUPTION
CONTINUING, CONSTANT, REACHING FL280.
ASH TYPE 58% SI02

RMK: NO SIGNIFICANT ASH RISK ABOVE FL350
NXT ADVISORY: 20100417/1200Z

Did Europe have to shut down?

- **YES**, because although knowledge of how to deal intelligently with ash events exists among those who have to deal with it regularly, there was no such operational knowledge in Europe in 2010.
- At the time of the European ash event the ICAO SARP for operating near ash was: “AVOID, AVOID, AVOID”. That standard was based on the premise that atmospheric ash usually occurred in areas of low traffic density, and it was always possible to fly around it.
- Europe had no contingency plan for reacting to ash: not at EU level, nor at EASA level, nor at individual national levels.
- In the event, the gathering of information and the decisionmaking took just a week to do. It could have been worse. Without the UK CAA’s leadership it *would* have been far worse!
- But just as Europe agreed an interim plan, the North Atlantic wind changed and the ash went harmlessly northeast.

What knowledge existed in 2010?

- The US FAA has plenty of experience because of regular volcanic activity in Alaska and the Rockies (Mt St Helen), which it monitors and records very closely.
- Alaska Airlines has established SOPs for ash operation (more of that later)
- Europe's long-established intercontinental airlines have their own SOPs for operating elsewhere in the world when ash incidents occur (Indonesia)
- Individual airline operating practices used today are based on shared, hard-won trial-and-error experience
- BA's SOP is to operate 100nm from the visible plume. It has done that for years and never had a bad experience. But it has not recorded how often it has done this, nor taken atmospheric measurements while doing it, so CAA policy cannot be formulated on BA's experience.
- The engine manufacturers know a lot more than they were prepared to say at the time. They are terrified that if they provide, in good faith, ash density levels that they believe are harmless to engines, the lawyers will get them in the event of an occurrence.

Keilir Aviation Academy, Keflavik

(Europe getting its head around what happened)



Rolls-Royce on ash and engines

The senior vice-president technical services at Rolls-Royce Patrick Emmott said at Keflavik:

- The tolerance of modern jet engines to ash is 10 times that assumed by European agencies when Eyjafjallajökull erupted...
- That the existing models for predicting the location of atmospheric ash need to be more accurate: “Inspections of engines predicted to have been exposed to ash proved they had usually not been exposed at all”.
- That attempts to design engines to be more resistant to ash damage would inevitably result in increased fuel burn and emissions.

So what's been done since?

- One of the most catastrophic European weaknesses that Eyjafjallajökull brought to light - the lack of co-ordination between the NAAs - is less likely to happen next time, because of the creation since then of a **European Aviation Crisis Coordination Cell**
- The director of ICAO's Air Navigation Bureau Nancy Graham told the Keflavik conference that **a new body, the International Volcanic Ash Task Force**, would address the need for global co-ordination of the gathering and dissemination of additional scientific knowledge on volcanic ash as it relates to airworthiness, operations, and ATC
- Europe and the North Atlantic are now operating an interim **"volcanic ash contingency plan"** while improved data is researched. This consists of a three-zone area based on VAAC ash predictions.

Avoiding dangerous ash: the three-zone system

- At the heart - basically where the visible plume is located - is a no-fly zone (NFZ).
- Surrounding that will be a time-limited zone (TLZ) based on predicted ash concentrations defined according to engine manufacturer advice,
- ...and outside that an enhanced procedures zone (EPZ). Aircraft flown through the EPZ have to follow manufacturer advice on additional inspections following use of that airspace
- Head of the UK Civil Aviation Authority's airworthiness division Padhraic Kelleher: "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."
- The main change will be what Kelleher predicted: a transfer of risk management from the regulator to the operator. The authorities will provide the information and a set of guidelines for making decisions, then the go/no go decisions will be made by the airlines.

Capt Bob Graves, head of ops, Alaska Airlines



How Alaska does it

- Capt Bob Graves provided the Keflavik conference with a description of operational considerations in an area frequently affected by volcanic ash.
- Far from becoming complacent through familiarity, Graves' description painted a picture of an airline fully aware of the risks, and with a comprehensive set of strict operating guidelines for flight and ground crews, plus the provision of regular training for pilots in ash encounter drills.
- An extract from the company flight manual gives a flavour of this: "For night and/or instrument meteorological conditions, flights will be planned at least 35nm horizontally from known or forecast ash clouds. In the event of a major event we will continually evaluate and adjust any restrictions."
- In carrying out that policy, Graves and his team work closely with the Alaska VAAC, which has remote video cameras and radar and lidar watching volcanoes, of which there are many on the mainland and in the Aleutians.
- Alaskan walks the walk. The airline takes responsibility for its own decisions knowing it will live or die by them.

I could stop there, but if we have
time...



The trip to Eyjafjallayokull



The old RAF tower at Reykjavik



The Flugfélag Dash 8-100



Thanks for inviting me

Questions?

www.flightglobal.com/blogs/learmount



