Science Media Centre Round-up

[FOR IMMEDIATE RELEASE THURSDAY 22 APRIL 2010]

Expert reaction to questions on science behind safety testing for flying through volcanic ash

Eric Gillies, Senior Lecturer in Aeronautical Engineering, University of Glasgow, said:

Where was the scientific advice?

"The scientific data on the concentration, composition and distribution of the volcanic ash plume particulates, and its chemically reactive layers (sulphur dioxides) was derived from volcanologists (from various UK universities and especially the British Geological Survey) and forecast by the UK Met Office (who undertook forecasting based on winds and their NAME computational model) and NCAS (who forecast using the Hysplit model).

"These forecast models agree well together (providing verification) and have been validated against measured data from UK FAAM aircraft (a Dornier turboprop and a BAE 146 jet aircraft that are fitted with instruments capable of detecting the plume and characterizing its components). Data and observations from the engines on these aircraft, and from the engines of airliner aircraft that were flown through regions of the ash plume have been continuously monitored by the engine manufacturers (General Electric, Pratt &Whitney, Rolls Royce, SNECMA) and CAA internal specialist staff (SRG Gatwick mostly).

"The information from this interdisciplinary group of scientists and aeronautical engineers was collated in 24hr email exchanges and daily teleconferences chaired by the CAA Safety Regulation Group."

Who did the information go to?

"There has been little standard 'command and control', it's all happened on the basis of everybody telling everybody everything and scientists / decision makers pulling out and using the relevant information. The process of different scientific groups and aeronautical engineering groups sharing information and working on different aspects has worked very well."

Was it proper scientific advice?

"Yes, the scientific advice on the plume, and its effect on aero engines at various concentrations (which was not known in any detail prior to this study), has been delivered by the world's best atmospheric scientists and aeronautical engineers who have been working round the clock to get this information. As ever it would have been nice to have more time to collect the data, but aircraft safety has been the guiding principle throughout."

This is going to happen again and again - what will be the process of communicating scientific advice in future?

"Almost certainly as at present: everybody talking to everybody else with government and organisation chief scientists and ministerial/cabinet offices tapping into various points in the information flow as well as being more formally advised by the most senior scientists and engineers (e.g. Met Office Chief Scientist Julia Slingo, Head of CAA SRG Gretchen Burrows.)"

John Turton, IET Aerospace Network, said:
"We need to start with an understanding as to what the material actually is. The term 'Volcanic Ash' is perhaps misleading, as the material is not ash as would be generally understood by the public - 'Powdery residue as left after combustion' - the dictionary definition of ash - as one would see for example from burning coal in a fire. The material is actually tiny particles of rock that have been created by blowing out molten lava with tremendous force from a volcano, so a title of 'Rock Aerosol' would probably be more correct and less misleading.

"The material is highly abrasive and mildly corrosive, and because it is formed from mineral can aggregate into larger lumps, perhaps glass like, when subjected to high temperatures such as would be seen in the combustion process in the gas turbine engine. When it comes into contact with aeroplanes flying at around 500mph, there is an immediate abrasive effect on external surfaces of the aircraft, as well as the internal gas passages and blades of the jet engine. As potentially troubling are the minute cooling holes in the turbine rotor and stator blades, which could be prone to blocking, particularly as this is an area of high temperature with combustion temperatures in the engine approaching 1300C. There may also be secondary considerations, for example compressor bleed air is used to pressurise the cabin so will be breathed in by the passengers, so some health considerations potentially there also.

"The internationally agreed position before this event was to avoid this material completely. This, of course, became highly undesirable when large parts of Europe became continuously covered by this material. However, to make a decision that the level of risk could be considered acceptable, there needed to be examination of data taken from real experience of contact with typical conditions and concentrations of the material. As I understand it this collection of data and analysis has been underway in recent days as reported in the media, and has led to a re-assessment of the level of risk in operating continuously in these conditions. To what extent, however, there was a really rigorous consideration of issues such as the potential blocking of blade cooling holes is not clear to me, although I would expect that all involved would have been intensely aware that to make an incorrect assessment of the level of risk could have disastrous consequences.

"However, I think it is important to consider that just because a decision has been taken to accept the risk based on recent assessments that may not be the end of the matter. Issues such as the potential clogging of turbine blade holes in these particular conditions will only really be tested by the typical intense operations of commercial aircraft over a number of weeks or months. It will therefore be interesting to see if there are any reported incidents of blade overheating or failure, engine in-flight shutdowns etc in the coming months."

Note to editors

The Science Media Centre (SMC) is an independent venture working to promote voices, stories and views from the scientific community to the news media when science is in the headlines. Over 70 supporters including scientific institutions, media groups, charities, universities, corporate organisations and individuals fund the Centre, with donations capped at 5% of the running costs to preserve its independence. The team at the Centre is guided by a respected Scientific Panel and