The Weather Vane
by Tony Tighe

Rumblings from afar...

At the time of writing we are in the throes of an Indian summer with sunshine by day and nothing more threatening than some mist or fog patches by night. However, since August 16th, the Icelandic volcano, Bardarbunga, has teased the aviation community with the threat of eruption. Warning colour codes issued by the Icelandic Meteorological Office are fluctuating between orange and red on an almost daily basis.

At this point, monitoring the earthquake and pre-eruption activity associated with Bardarbunga is a task undertaken by seismologists and volcanologists. Predicting when a volcano will erupt is a very difficult task fraught with high levels of uncertainty. However, when an eruption does occur and volcanic ash and associated gases are pumped into the atmosphere the event becomes a meteorological one – with the atmospheric sciences employed to determine the likely trajectory and dispersion of the erupted material.

BA Flight 9 – a first hand experience of flying through volcanic ash:

In 1982 a British Airways flight from London to Auckland experienced the dramatic consequences of flying into a volcanic ash cloud as it flew just south of Java. The pilots' windscreens turned opaque due to severe abrasion caused by the hard ash particles, a sulphurous smoke filled the passenger cabin and all four engines failed. Thankfully, on exiting the ash cloud the engines restarted one by one and disaster was ultimately averted with a successful emergency landing, made entirely on instruments, at Jakarta airport.

Photo courtesy of Gerry Humphreys

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The international response:

This potentially calamitous incident prompted action from the international aviation community with ICAO establishing nine Volcanic Ash Advisory Centres (VAAC) worldwide during the 1990's. The VAACs responsibilities include monitoring volcanic events and liaising with relevant experts in an attempt to determine eruption risk levels across the globe.

In the case of a volcanic eruption the responsible VAAC will produce volcanic ash advisories and graphical guidance products using a combination of seismological data, satellite-based data, ground-based and aircraft-based observations. Weather forecast models and ash dispersion models are used to predict the temporal and spatial extent of ash cloud movement. Attempts are also made to quantify variations in ash concentration levels throughout the affected airspace in order to identify areas of greatest risk. Met Eireanns' aviation weather forecasters would then use the guidance issued from our local VAAC (hosted by the UK Met Office) as a key input to the Volcanic Ash SIGMET production process.

The London Volcanic Ash Advisory Centre was established in 1992 - but it was not until the night of April 14th 2010 that it was called into action. It was on that night that, after many days and weeks of threatening, Eyjafjallajökull finally erupted and pumped ash up to 30,000ft into the atmosphere with a trajectory headed directly towards northwest Europe and into Irish airspace. This event caused the greatest disruption to European air transport since World War 2 with airspace closed in almost 20 countries and 10 million passangers affected.

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I was the forecaster working that night shift and until that point I (like most of my European forecasting colleagues) had not encountered a real-time volcanic ash event. My only experience was gained through involvement in international, simulated, Volcanic Ash exercises. When notification issued from the Volcanic Ash Advisory Centre (VAAC) that an actual eruption was occurring it was a case of action stations for all of the aviation stakeholders across Ireland, the UK and the rest of Europe.

Many questions were to be answered that night: Would the lessons learned from the simulated exercises be enough to handle a real life volcanic ash emergency? Would the co-ordinating, technical, operational and communications systems hold up? Would the warnings issued provide adequate information to air traffic managers and the airlines to guarantee passenger safety and mitigate the economic cost of the disruption?

The systems in place on the night Eyjafjallajökull erupted proved robust with the airlines and ATC receiving warnings as provided for in the ICAO regulations. However, as days passed and airspace closures remained in force it became clear that the Volcanic Ash SIGMET message alone was not sufficient as a warning tool for the airlines.

Volcanic Ash SIGMETs are issued *whenever ash is expected in the airspace* – but *regardless of actual ash concentration levels*. Consensus is now building to suggest that a focus on measuring and forecasting ash concentration levels would be more valuable in terms of air traffic management - and contribute more in terms of both safety and efficiency. For example, in cases of very low volcanic ash concentrations flights of short duration could well take place safely and with no risk to man or machine. And so, current research efforts involving the VAACs, in conjunction with the airlines and aircraft manufacturers, are focussed on finding solutions that will enhance flight safety - but also prevent the needless grounding of aircraft.

Currently, the situation in Iceland is: '*The Icelandic Civil Protection Agency has ordered an evacuation of scientists working near the eruption site... (as)... fissure eruption under the ice would lead to extensive flooding and potentially to an explosive ash-producing eruption...*'

So for now we continue to closely monitor Bardarbunga – and keep our fingers crossed.