

No volcanic ash clouds to rain on Australia's parade

BY KATE LAHEY

Volcanic ash clouds have been such a rarity for the Australian public that among the frequently asked questions the nation's Volcanic Ash Advisory Centre receives is: "Where can I buy some in bulk?"

The team of forecasters at the Darwin-based centre, one of only nine such centres in the world, doesn't, in fact, sell ash (often used by farmers), but instead monitors and plots volcanic ash movement. Their role, in doing this work, is to protect aircraft in flight.

When Chile's Puyehue-Cordon Caulle erupted on 4th June 2011, the centre became a hub of advice for airlines and pilots as the cloud made its way over Australian, South African and South American skies.

While the event was a new experience for many Australians, international airlines and passengers had faced a

major ash cloud event only a year earlier, when Iceland's Eyjafjallajökull volcano erupted on April 14, 2010 and caused worldwide travel chaos, as a large chunk of European airspace was closed.

Yet even this event, on the other side of the world, was relatively uncommon and since then, authorities and airlines have been keenly pursuing better systems and more information to help them prepare for the consequences of volcanic eruptions.

This may seem odd: volcanic eruptions are hardly new, and aeroplanes have been flying commercially for almost a century, but the potentially catastrophic consequences of flying through an ash cloud only really came to light in 1982.

With increased air travel today, and the experience of the Chilean and Icelandic plumes, the risk of flying through ash is now well and truly on the radar.

There have been no known fatalities, but in the 1982 incident, a British Airways 747 travelling from Kuala Lumpur to Perth encountered an ash cloud from the Galunggung eruption in Java, Indonesia.

All four of the plane's engines failed and it was forced to make an emergency landing.

"That was the first documented case of the risk volcanic ash posed for aviation," says Rebecca Patrick, Manager of the Darwin-based Volcanic Ash Advisory Centre.

"After that, there was a huge international push to create a system which was known as the international airways volcano watch, and that



With Geoscience Australia, VAAC members have been regularly visiting Papua New Guinea and Indonesia to forge closer ties with their volcano observatories and meteorological offices.

involved meteorological forecasting centres as well as the volcanic ash advisory centres, air traffic control, airlines, and volcano observatories.

“It’s a collaborative system and there are a lot of different organisations that need to go into it.”

The Darwin office of the Bureau of Meteorology was seen as the logical spot for a centre, not only because it is close to volcanic activity in the region but because it has a specialised meteorological centre with tropical expertise. It is already looking at imagery over the tropical region and has direct satellite access for that part of the world.

The centre was established in 1993. The VAAC duties are part of the centre’s general aviation duties. An aviation forecaster is rostered on at any one time and part of their role is monitoring satellite images and issuing volcanic ash advisories.

“It’s a very active area,” Ms Patrick says. “There are about 130 active volcanoes in Indonesia alone at the moment and we’ve also got Papua New Guinea and the Philippines as well that we need to keep an eye on – so there are always volcanoes erupting.

“Generally they’re only small eruptions to low levels and not a huge impact on the aviation industry,” she says.

“It’s the big ones we want to focus on and there are maybe one or two a year.”

As it happens, this year has been busy, with three major eruptions in Indonesia, as well as the Cordon Caulle event

and the Bromo eruption that affected Denpasar airport, Ms Patrick says.

“That was a different event in that it was a low level eruption which normally isn’t such a big deal, but because of its proximity to the airport, it started to affect aviation and people in Australia wanting to fly to Bali.”

Forecasters in the Darwin centre are trained specifically to monitor and forecast ash movements. Ms Patrick says this generally follows meteorological effects and they are able to rely on existing models that will show which way winds are blowing and allow them to forecast how the ash will move and disperse in the atmosphere.

“The difficult part is working out when the volcano is going to erupt. Obviously we need to have close collaboration with the volcano observatories in that.”

A challenge here is that the volcanoes tend to be in developing countries.

Over the last 15 years, AusAID has provided funding to improve seismic monitoring in the region. On top of helping neighbouring countries prepare for disasters, it’s one of the ways Australia can build its own resilience to these events, by having more, and better information on volcanic activity in the area.

With Geoscience Australia, VAAC members have been regularly visiting Papua New Guinea and Indonesia to forge closer ties with their volcano observatories and meteorological offices.

“The face to face contact is quite important,” Ms Patrick says. Yet, even with increased monitoring, and better relationships, knowing when a volcano will erupt is difficult to pinpoint, she says.

“It varies a lot. I’d like to say volcanoes

have personalities; one volcano might show signs for months beforehand, but then there might be other volcanoes that just go bang with very little warning.

“It’s very difficult, and we’re not volcanologists, so we’re relying on the experts to give us that advice. Hopefully they can do the monitoring and let us know in advance of an eruption, but if they can’t let us know, we’re pretty dedicated with our monitoring and making sure we’re watching the satellite imagery 24 hours a day.”

When Puyehue-Cordon Caulle erupted in June, forecasters at the Darwin VAAC initially resolved to ‘wait and see’, Ms Patrick says.

“When the ash cloud moved over into the Atlantic, around the 7th[of June], we were thinking, ‘ok, it’s coming our way’ and we started running some scenarios for it to see if it was going to affect us.

“We had probably three or four days prior notice that it was going to be coming over to our area of responsibility.

“But we couldn’t say ‘it’s going to be this airport or exactly where it was going to go’,” Ms Patrick says.

It was the first time since the VAAC was formed that an ash cloud affected southern Australia and Ms Patrick says for this reason, there were some things that were done on the fly. Some of that was educating smaller, southern airlines who had never had to deal with ash clouds before, about what the effects and limitations of the situation were.

Among the recommendations of the National Strategy for Disaster Resilience adopted by the Council of Australian Governments in February 2011, is to ensure people are equipped to know what to do with the information they are given.

“Empowering individuals and communities to be more disaster resilient involves more than just providing them with information,” the strategy says.

“It requires the availability and accessibility of transparent, accurate and trusted sources of information in

various forms, and the provision of tools to help communities understand and act on the material provided.”

Ms Patrick said this gap between accessing information and understanding it, did create some confusion about the ash cloud.

“Smaller airlines were phoning us directly asking ‘what does each part of the advisory mean?’

“There was a lot of confusion because of what had happened in Europe. Procedures were put in place in Europe, the first expectation was that it was going to be exactly the same here. For example in Europe they were producing concentration charts and all these extra things that we were reluctant to produce, for various reasons.”
Ms Patrick says.

Ash-concentration charts are a very new tool and have rarely been used.

Since the event in Europe, there has been more work done in this area. “We have found that concentration forecasts from computer models can be quite misleading, and for this reason the international community is now looking into how we can use different types of satellite data to ‘ground truth’ these models and get a better idea of which are the most dangerous areas of volcanic ash.” Ms Patrick says.

A new International Volcanic Ash Task Force has been established to speed up the process of learning more about planes and volcanic ash, through examining the science, volcano watch system, air traffic management and airworthiness and flight operations.

“Before about 18 months ago, no one had worked out what sort of concentration of ash is really hazardous to aircraft,” Ms Patrick says.

“There wasn’t really any kind of indication if it’s just a *bit* of ash in the atmosphere that is to bring down a plane, or does it need to be a whole *lot* of ash?”

“So we were just warning for ash or no ash, if we could see something we’d

put a warning out for that area. Since the Eyjafjallajökull eruption ... they decided there needed to be a bit more consideration in terms of pointing out the areas that have a higher density of ash compared to areas that have light amounts of ash. But there’s still no agreed international concentration standard yet – it’s a work in progress.”

The Civil Aviation Safety Authority allows airlines to determine their own procedures and responses to a volcanic ash cloud. No one is allowed to fly through the cloud itself, but each airline determines how much of a buffer it will allow around, above or below the cloud – and this can vary, based on the different constraints of different aircraft.

Several months after the ash cloud cleared Australia for the second time in June, CASA spokesman Peter Gibson said the authority was still reviewing its response to what was a unique event, through both an internal review and as part of an international network.

“Whatever we do here we want to make sure we’re reflecting best practice around the world. There are lessons being learned from it,” Mr Gibson said.

However, it seemed highly likely the power to make decisions about the response would remain with airlines, based on the information they receive from the Darwin VAAC and elsewhere.

“We have the power to close airspace if certain circumstances warranted it, we could close airspace entirely,” Mr Gibson said.

“Our preferred approach is to allow airlines to make those judgements themselves.”

“CASA would step in if it believed an airline was not responding appropriately, but closing airspace, as a blanket response, could create problems,” he said.

“CASA would need to determine what would trigger an entire closure of airspace, and then what would trigger its reopening. This may not be the best approach in what is a constantly changing situation,” he said.

“It’s a moveable feast, as the weather pushes through, so does the ash,” Mr Gibson said.

According to information from the VAAC, the main risk of flying through an ash cloud is that ash will get into the engine, and melt at high temperatures, before resolidifying and causing the engine to stall.

Small pieces of rock in the cloud can also create what some describe as a “sandblasting” effect on the windscreen.

Ms Patrick says sulphur dioxide in the ash clouds can also form sulphuric acid in the atmosphere, which can have corrosive effects on parts of the aircraft as well.

“And it’s not just flying through an ash cloud, it’s the amount of time that you’re in that cloud as well, that will have an effect,” she says.

It remains such a new area for authorities and airlines that the priorities of the International Volcanic Ash Task Force include:

- Study feasibility of safe aircraft operation in contaminated airspace and develop acceptable levels of ash concentration.
- Determine achievability of volcanic ash risk management framework.
- Assess engine tolerance to ash exposure in view of safe operating levels.

In July, CASA updated its information on volcanic ash clouds, to include recommendations for aircraft operators and to introduce a formalised risk assessment process. The process was developed by the international task force, under the International Civil Aviation Organization and is designed to be globally applicable.

When the Chilean ash cloud arrived over Australian in June, Qantas had already had some experience in this area. Aside from its exposure to the Icelandic event, its flights to Buenos Aires were already being disrupted.

However, this did not stop the southern ash cloud causing what the company has since reported as the “Greatest ever disruption to [the] group – 10 times that caused by the European ash cloud in 2010”. This remains the case despite the more recent grounding of the Qantas fleet as part of an industrial dispute.

As a result of the ash cloud, more than 2,000 Qantas group flights were

cancelled and hundreds of thousands of customers were disrupted, as Qantas ceased all flights and chose to resume only once air space was confirmed safe. The group includes Jetstar and Qantas link, among other divisions, and operates in what Qantas says is the third busiest passenger route in the world, Melbourne-Sydney.

In a financial context, the series of natural disasters and major weather events had a total impact of \$224 million on Qantas' end of year profit before tax, which was \$552 million.

These included floods and cyclones in Queensland, earthquakes in Christchurch and Japan and the resulting tsunami, snow in the UK and Europe, as well as the Chilean ash cloud. The ash cloud was responsible for \$49 million.

(Despite all this, the group's net profit after tax rose 115 per cent to \$249m.)

Virgin has estimated the ash plume had a \$7 million effect on its figures and, with the financial consequences of other natural disasters as well, reported a loss after tax of \$67.8 million.

At the time of reporting the Qantas results, chief executive Alan Joyce said that while natural disasters and weather disruptions were "an unavoidable reality for the aviation industry," the frequency and severity of disruptions seen in the 2011 financial year was "unprecedented".

"Throughout these events, safety and

the interests of our passengers were our top priorities," Mr Joyce said at the time.

"Thanks to the operational resilience we have developed as a business, we were able to respond effectively and recover quickly on each occasion."

Daniel Liddell is Qantas' Manager, Group Business Resilience. He says that in the last few years, the group has very deliberately adopted a "resilience approach," which stood it in good stead for the Chilean ash cloud.

"We recognise that we will have to deal with a whole range of events that we can't predict," Mr Liddell says.

"We've had an almost unprecedented series of events starting in April 2010. Our process of rapidly looking at 'what have we learned from it?' really helped us out in this case."

This series of events included the Icelandic ash cloud, the group's decision to ground its entire fleet of A380s after an engine failure in Singapore in November 2010, as well as all of the natural disasters since.

"By the time the [Chilean] ash cloud came, we were probably about as well prepared as we could be. We'd been so practised in those events...I won't say it was business-as-usual but the organisational effort was a lot less, despite the fact it was a bigger event," Mr Liddell says.

Qantas' resilience approach includes establishing good links with everyone its airlines deals with, from its trusted information-sharing networks, to regional communities, right up to the Department of Foreign Affairs and Trade and Emergency Management

Australia, Mr Liddell says. The benefit of this goes beyond learning from each other, it means when something does happen, those people know who to turn to in Qantas, and vice versa, he says. "It's too late if, in the moment you need to pick up the phone to call someone, you're finding out who that person is."

Also crucial to building resilience is relying on simplicity, he says.

"If you have a plan and capability that's simple and flexible, that is therefore very agile. Simplicity is best. It means people can concentrate on what needs to be done, rather than on following a rigid and complex plan."

Unlike some airlines, Qantas decided not to fly at all in the ash cloud event.

To help its customers understand Qantas' policy and decision not to fly, the group posted a video on YouTube, titled Safety over Schedule, and used other social media, such as Twitter and Facebook to keep people constantly updated.

Mr Liddell says having access to ash concentration reports would have made a difference to the Qantas response, and it has entered a partnership with Flinders University to research this area further.

Qantas is represented in several industry safety forums, including the group developing the International Civil Aviation Organisation's guidelines on volcanic ash.

The company also invests heavily in running emergency exercises to help everyone in the organisation become familiar with its response framework.

Mr Liddell refers to this as building "muscle memory" within the organisation.

"Plus it ensures the plan works," he says.

"We do four of those a year, which is possibly three more than most organisations. We find it's very valuable.

"It's kind of like making your own luck," he says. "People say 'wow, you were lucky you did that exercise recently!' "Well, you do make your own luck."



Forecasters in the Darwin centre are trained specifically to monitor and forecast ash movements.