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The volcano calls – results and outlook for the mission

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View of the ash cloud from the DLR's research aircraft

The German Aerospace Center's (Deutsches Zentrum für Luft- und Raumfahrt; DLR) Falcon 20E research aircraft returned on schedule to DLR's research airfield at Oberpfaffenhofen. It landed on Monday, 3 May 2010 at 15:28 CEST after completing its volcanic ash investigation mission over Iceland. The return flight of the Falcon involved two one-day legs.

At 16:45 on Sunday, 2 May, the DLR jet took off from Keflavik, the airport near Iceland's capital city of Reykjavik, and flew its first leg to Stornoway on the Isle of Lewis, one of the Outer Hebrides off the coast of Scotland. Scientists used this flight for a very special undertaking – the world's first measurement of the eruptive mass flow of this volcano, conducted from a safe distance. From this value, the source strength of the volcano can be inferred, which improves the ability to make forecasts about the ash clouds.

A globally unique data record

At a distance of roughly 450 kilometres from the Eyjafjallajökull volcano, the Falcon dived into the upper edge of the ash cloud at 60°N, 5°W. Visibility for the crew reduced progressively and the smell of sulphur dioxide – a characteristic feature of volcanic material – spread throughout the cabin of the Falcon. DLR scientists confirmed their first impressions during this measurement phase of the flight: "After 30 seconds in the ash cloud, we decided to leave this layer as rapidly as possible – but first of all we had to find our way back out of it," said mission leader and DLR scientist Oliver Reitebuch as he summarised this somewhat precarious situation. The measuring manoeuvre ultimately lasted scarcely

three minutes – but that was quite long enough for the aerosol instrument to complete its planned investigation of this layer of volcanic ash, which was barely seven hours old. After a flight lasting about 90 minutes, the ash cloud investigator landed safely at the Scottish airfield of Stornoway.



View from the research aircraft

The headline statement from the mission was this: 3000 kilograms per second. That is the mass flow of fine ash particulate that can be transported to Central Europe. This reading does of course require further examination, but it certainly provides a good starting point. The measurements taken in the layer of volcanic dust over the North Atlantic indicated high concentrations of fine particulate with a grain size of up to 30 micrometres, a high concentration of sulphur dioxide – in excess of 150 nanomols/mol; high carbon monoxide levels – up to 180 nanomols/mol; and reduced ozone concentrations of 10 – 60 nanomols/mol. "Taken together with the results from previous measurement flights, we now have a unique data record against which we can verify our models and forecasts for these volcanic ash clouds," reported Professor Ulrich Schumann, Director of the DLR Institute of Atmospheric Physics in Oberpfaffenhofen.

There was yet more good news on the morning after this flight by the Falcon – there were no traces of damage caused by volcanic ash to the engines or to the aircraft itself. That meant that the DLR crew was able to set out on the last leg of their flight with complete peace of mind, landing in Oberpfaffenhofen on 3 May at 15:28. "We were able to collect some incredibly valuable data – and it was most spectacular to witness Eyjafjallajökull in action. It is seriously impressive to be so close to an erupting volcano," said Bernadett Weinzierl, a scientist at the DLR Institute of Atmospheric Physics.

As one mission ends, another begins

National autonomy in the planning and delivery of the volcanic ash investigation mission was an essential requirement for the rapid and effective action taken by the DLR in this exceptional situation in Europe. The mission was supported by Iceland, by the German Airline Association (Bundesverband der Deutschen Fluggesellschaften; BDF) and by the German Ministry of Transport, Building and Urban Development (Bundesministerium für Verkehr, Bau und Stadtentwicklung; BMVBS). The Falcon is now on standby in Oberpfaffenhofen and remains ready for new missions. Due to the increased volcanic activity on 5 May and the way the ash cloud has been spreading southwards and out over the Atlantic, further disruption may be caused to air traffic in Ireland and the UK, as has indeed been occurring over the last few days. Given that measurements of this kind also pave the way to better and more coordinated organisational response to volcanic eruptions, it is possible that the Falcon could soon be flying more missions. On average, somewhere on Earth, a volcano erupts every week. Also, other kinds of incidents could affect atmospheric conditions over Europe, such as extreme weather, chemical accidents or large forest fires. The research activities of DLR and the Falcon, Germany's Emergency Aircraft, may in future play a role in finding answers to the question of how to prevent economic damage which can run into billions as a consequence of extreme situations.

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