Our **Operational** and **Maintenance** experiences near active volcanoes.

**ANA**
All Nippon Airways Co., Ltd. JAPAN
Operational Experience

- We have operated flights in airports nearby active volcanoes with careful attention to data of precise observation, upper wind direction and the diffusion forecast in case of eruption.

- From our experiences of Grímsvötn this year, we believe graphics or charts issued by VAAC is “useful to determine go/no go in flight operations” even though all modeled ash concentrations are subject to a level of uncertainty. ANA would like to request to all VAACs to issue trustworthy forecasted ash graphics/charts by consistent model.
Maintenance Experience

- Avoiding visible ash in flight operation is effective.

- Based on our experience, both in-flight and on-ground operation in invisible lower contaminated area does not affect airframes and engines in maintenance perspective.

- Our operational experiences along with others must be taken into account by OEM/TCHs and IVATF members in establishing maintenance instruction and guideline.
We shared our experiences in Kagoshima airport, southwest of Japan, near Sakurajima volcano.

**Operational Experience**

Dispatchers and Pilots use following resources in operation to mitigate risk of volcanic ash in case of Sakurajima eruption:

- Upper wind (around Sakurajima) forecast data from JMA.
- ANA’s internal airport report informed by Kagoshima STC.
- Explosion detection system in Kagoshima STC.

JMA: Japan Meteorological Agency

STC: ANA Station Control / Operation Office
We shared our experiences in Kagoshima airport, southwest of Japan, near Sakurajima volcano.

**Maintenance Experience**

More than 30 years of operation in Kagoshima Airport, ANA has not experienced significant damages or problems for both engines and airframes due to volcanic ash from Sakura-jima.

Volcanic ash from Sakurajima volcano, view from Kagoshima airport control tower
Maintenance Experience

- In 15-year records, actual 66-day falling ash were reported at Kagoshima airport.
- Total 551 flights were operated (landing and take-off) in the affected date and time.
- 156 airplanes and more than 353 engines were affected.
- Routine scheduled maintenance, routine BSI and engine overhaul have not shown any serious damages due to volcanic ash.

- Unfortunately, actual quantity of falling ash has not been counted at Kagoshima airport.
- However, local communities measure weight of falling ash for various reasons as such measuring effect of human health and government subsidy of agriculture.
Falling ash were reported at Kagoshima airport.

- Mizobe Local Community reported 5 g/m² accumulation and Hayato Local Community reported 75 g/m².
- Assumed at least 5 g/m² were accumulated at Kagoshima airport.
<Apr. 04, 2010 0840-1020>

- Two 737s, three 767s, one 777s and one A320 airplanes were operated at Kagoshima airport during the time.
- **Except one 767 airplane, C checks were completed for these airplanes since April 2010 and no damages were found due to volcanic ash.**
- **3 CF6-80C2, 2 PW4000 and 2 CFM56-3C1 engines were overhauled and no damages related with volcanic ash were found.**
There are 3 active volcanoes in Kyusyu-islands.

1. **Sakurajima**
2. **Kirishimayama** (Shinmoe-dake)
3. **Asosan**
~Current Sakurajima Volcano~

**Sakurajima** volcano has been erupting continuously.
(Total 1026 times in 2010, 446 times in 2011 (till June 13)

- The ash column of Sakurajima reaches about 6,000 ft in average, and sometimes exceeds 10,000 ft.
- Volcanic Ash (VA) has sometimes been observed around Kagoshima airport when upper wind flows from SW.

Ministry of Land, Infrastructure, Transport and Tourism/
Osumi river and road office live camera

Japan Meteorological Agency
Kirishimayama (Shinmoe-dake) volcano started eruptions in January, 2011.

- In the beginning of the eruption (JAN), continuous high ash column (about 15,000ft) approached Miyazaki airport.
- We were compelled to cancel some flights of Miyazaki airport due to the volcanic ash fall, and to change the air route in the area as follow:
After the middle of February, 2011, Kirishimayama volcano has been erupting intermittently like Sakurajima volcano.

We had established alternative operational plan near the volcano.

Dispatchers and Pilots use following resources in the operation to mitigate the risk of volcanic ash in case of Kirishimayama eruption:

- Upper wind (around Kirishimayama) forecast data from JMA.
- Diffusion and ash fall forecast charts from JMA and ANA.
- Actual pilot reports from served airlines (ANA, JAL, AAR).

JMA: Japan Meteorological Agency
The ash column height is about 7300〜14600ft.
Volcanic ash fall is observed ・・・ 10 days at Miyazaki airport.
1 day at Kagoshima airport.
 Dispatchers add extra fuel for avoiding VA or holding, and select suitable alternate airport for passenger handling according to the forecast data in case of Kirishimayama eruption.
The last eruption is 18APR, but seismic activity is still on active.

JMA and some universities established precise observation system, and found eruption regularities follows:

I) **Angle meter** near the volcano indicates expansion from a few days before the eruption.
II) **Seismic activity** is more active from a few days before the eruption.

JMA issues the volcanic activity data twice per week, and when the abnormal data is observed, we make a proper response.
~Kirishimayama Experience~

Pictures of Miyazaki Airport in the morning on February 3, 2011

= Fallout condition =
In the afternoon of February 2, 2011 explosive eruption was reported and invisible ash fell down to Miyazaki Airport.

All flights in the afternoon were cancelled or diverted.

From the night of February 2 through the morning of February 3, runway of the airport were swept, but were not able to be swept completely in entire airport as such ramp area and taxiway.

In the morning of February 3, operation were restored. Volcanic ash on the surface of ramp area and taxiway was not recognizable.

However, when engines were run up, we found that it was in so-called fallout condition. We believe invisible ash fell down through the night.
In the morning on February 3, two A320, one 737-800 and one 737classic airplanes took off and landed at Miyazaki Airport.

Additional BSIs and routine BSI were performed for those airplanes later and no damages were found.

These condition shows typical fallout condition at Kagoshima airport due to Sakurajima volcano ash. We had more than 30 years of operation at Kagoshima airport and found nothing serious.

In case Airframe and Engine Manufacturers establish maintenance requirement of fallout condition, Japanese airlines experiences should be fully considered.
Asosan volcano started eruptions this May, 2011.

- The average ash column height is about 4600ft, and ash fall is not observed near the airports.
- We have to note the activity of Asosan because there are many airports such as Oita, Saga, Fukuoka and Nagasaki around Asosan.
We established ‘Volcanic Level’ for the eruption.

We have four routes between Japan and Europe;
【Tokyo Narita】⇔【London】，【Paris】，【Frankfurt】，【München】

We used the following charts for decision of the level.
   I）Volcanic Ash Advisory (Issued Graphics)
   II）Modeled Ash Concentration Chart

**LEVEL 1** : No ash prediction that affect airports and flight routes.
**LEVEL 2** : Modeled Ash Concentration Chart shows Low Concentration Area covers airports and flight routes.
**LEVEL 3** : Modeled Ash Concentration Chart shows Medium Concentration Area or High Concentration Area covers airports and flight routes.
**LEVEL 4** : Airports or air space is closed by EURO control or each airport authority.
Handling Policy corresponded to the ‘Volcanic Level’

In the flight planning

**LEVEL 1**: Normal Operation as usual.

**LEVEL 2**: i) Select alternate airport that will not be covered with volcanic ash.  
   ii) Load extra fuel enough to reach other Online airports in Europe.  
   iii) The amount of loaded fuel is decided by Pilot in command and flight dispatcher.

**LEVEL 3**: Operational judgments will be done by using Modeled Ash Concentration Chart and the following data:  
   i) Information from EURO control or each airport authority  
   ii) Operational situations of other airlines  
   iii) PIREP  
   iv) Ash diffusion forecast  
   v) Satellite data

**LEVEL 4**: No operation.
Our experience in Grímsvötn ~

Handling Policy corresponded to the ‘Volcanic Level’

In the route selection

I) Avoid the area/over the area indicated by Modeled Ash Concentration Chart as much as possible.
II) Within the area of Volcanic Ash Advisory (Issued Graphics), Flight available except for Medium Concentration Area or High Concentration Area indicated by Modeled Ash Concentration Chart. (But do not fly long time in the area as much as possible)

We understand the uncertainty around the source term in the modelling, but in this time, graphics or charts issued by London VAAC was very useful to determine go/no go in flight operations!

Such information will reduce the confusion among carriers, and we would like other VAACs to issue graphics/charts like London VAAC.