International Civil Aviation Organization
European and North Atlantic Office

What are the safety regulations regarding volcanic ash and why?

Atlantic Conference on Eyjafjallajökull and Aviation

Keflavik, Iceland, 15 and 16 September 2010

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ICAO EUR/NAT Office

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Some history first

- **24 June 1982...**
  - B747 from Kuala Lumpur to Perth lost power to all four engines at 37,000 FT.
  - During 16 minutes, A/C descended to 12,000 FT without power. Restarted 3 engines.
  - Successfully landed at Jakarta
- **The suspected culprit...**
  - Volcanic ash from Mount Galunggung, Indonesia
- **Three weeks later...**
  - Singapore Airlines B747 flying to Melbourne reported a similar incident. Landed also successfully at Jakarta

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Recognizing the threat posed to aviation

- **To meet the newly recognized threat...**
  - **ICAO ANC developed interim guidelines and contingency arrangements in the early to mid-1980's**
  - **Formal amendments were subsequently developed with the assistance of the ICAO Volcanic Ash Warnings Study Group (VAWSG)**
  - **Amendments adopted by the ICAO Council in March 1987**
- **Prompted the development of the International Airways Volcano Watch (IAVW)**

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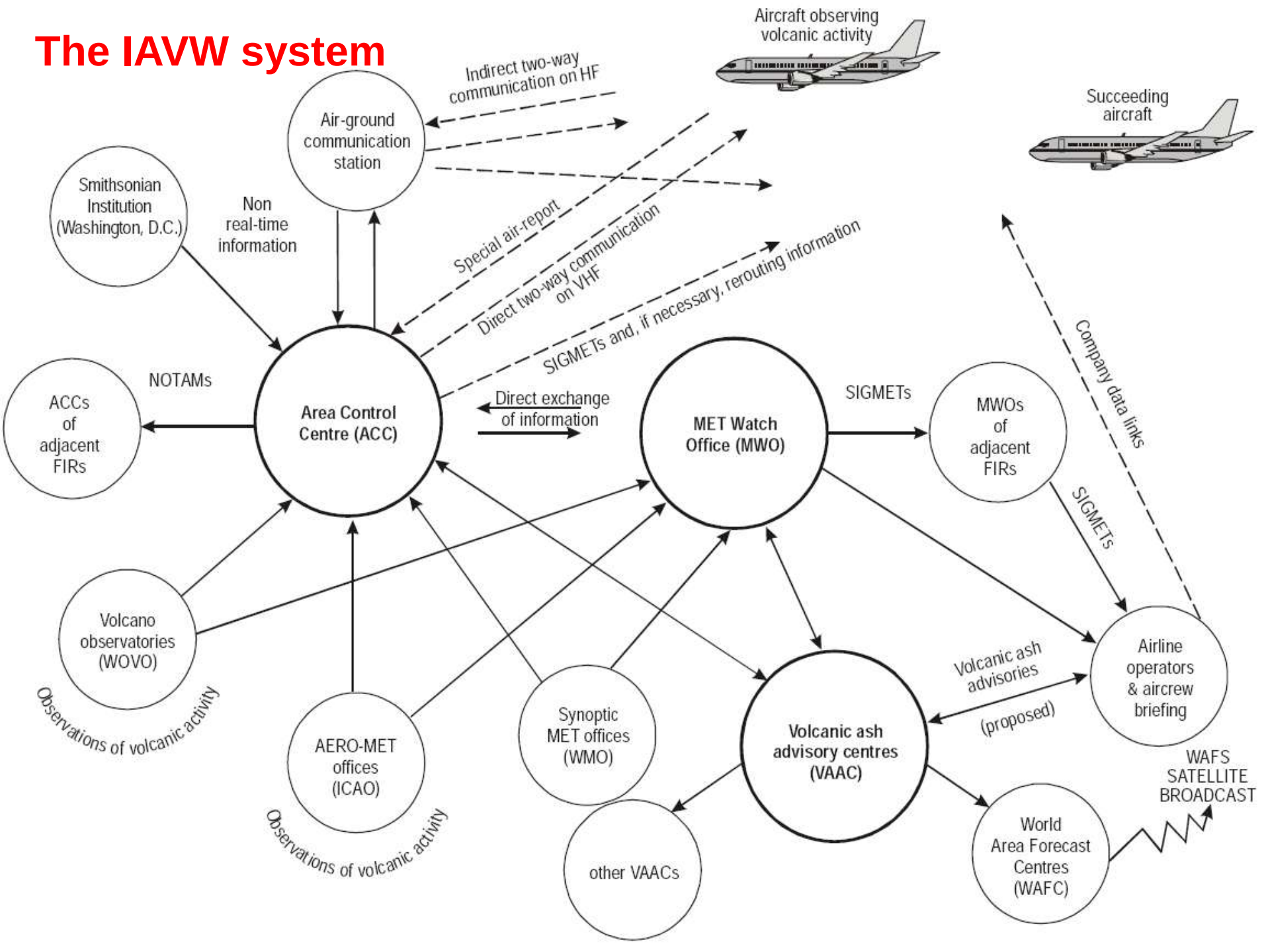
International Airways Volcano Watch (IAVW)

- **Coordinated by ICAO**
  - With the cooperation of other concerned international organizations
  - Aviation and non-aviation operational units, including nine Volcanic Ash Advisory Centres (VAACs)
- **IAVW Operations Group (IAVWOPSG)**
  - The nine VAACs – IAEA – IATA – IFALPA – IUGG - WMO
- **The IAVW provides international arrangements**
  - For monitoring and providing warnings to aircraft of volcanic ash in the atmosphere

The IAVW system



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IAVW international requirements

- **International service requirements, notably:**
  - **Annex 3 – Meteorological Service for International Air Navigation**
  - **Annex 11 – Air Traffic Services**
  - **Annex 15 – Aeronautical Information Services**
- **Supporting guidelines and procedures in ICAO Docs, including:**
  - **Doc 4444 – PANS Air Traffic Management**
  - **Doc 8896 – Manual of aeronautical MET practice**
  - **Doc 9691 – Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds**
  - **Doc 9766 – Handbook on the IAVW**
  - **EUR Doc 019/NAT Doc 006 Part II – Volcanic Ash Contingency Plan for EUR and NAT Regions**

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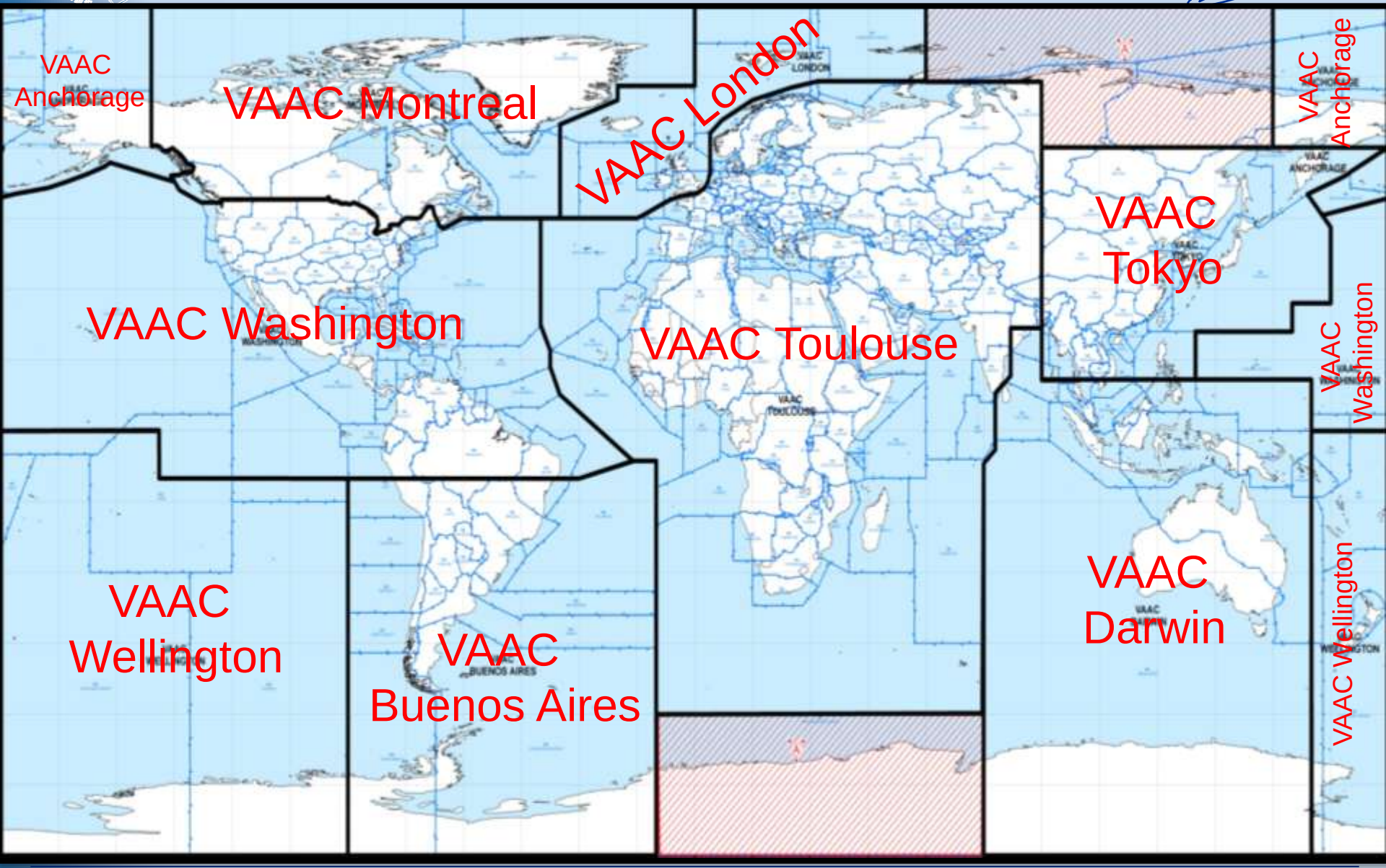
International Airways Volcano Watch (IAVW)

- **Observing component**
  - Detection and tracking of volcanic ash clouds
  - Data from volcano observatories
  - Satellite imagery
  - Aircraft observations (AIREPs, Special AIREPs)
  - Other sources (ground based and airborne measurements)
- **Warning Component**
  - Volcanic ash advisories and graphics (Issued by VAACs)
    - Using observing component combined with numerical weather prediction models
  - SIGMET (Issued by Meteorological Watch Offices)
    - Warning message(s) for the FIR(s) concerned
  - NOTAM / ASHTAM
    - Originated by ACC and issued through International NOTAM Office

VAAC Areas of Responsibility



VA Advisories and Graphics

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FVXX01 EGRR 031728

VA ADVISORY
DTG: 20100503/1800Z
VAAC: LONDON
VOLCANO: EYJAFJALLAJOKULL 1702-02
PSN: N6338 W01937
AREA: ICELAND
SUMMIT ELEV: 1666M
ADVISORY NR: 2010/075
INFO SOURCE: ICELAND MET OFFICE
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION CONTINUING. AT 1430Z ICELANDIC AIRCRAFT
REPORTED PLUME TOPS TO FL180.
OBS VA DTG: 03/1800Z
OBS VA CLD: SFC/FL200 N6352 W02016 - N6352 W01443 - N6309 W01232 -
N6201 W00654 - N6031 W00546 - N5843 W00529 - N5124 W01045 - N4958
W01108 - N4547 W01437 - N4551 W01533 - N4740 W01556 - N5113 W01556 -
N5617 W01221 - N5749 W01227 - N5912 W01307 - N6004 W01249 - N6256
W01828 - N6306 W02038 - N6352 W02016
FCST VA CLD +6HR: 04/0000Z SFC/FL200 N6347 W02007 - N6341 W01154 -
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W00557 - N4956 W01052 - N4713 W01228 - N4522 W01424 - N4522 W01546 -
N4626 W01625 - N4934 W01620 - N5101 W01541 - N5658 W01003 - N5801
W01042 - N6012 W01238 - N6128 W01307 - N6235 W01453 - N6244 W02022 -
N6347 W02007
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W00413 - N5555 W00349 - N5525 W00353 - N5427 W00437 - N5222 W00548 -
N5041 W00704 - N4922 W00922 - N4825 W01213 - N4543 W01408 - N4532
W01538 - N4609 W01621 - N4819 W01704 - N4937 W01659 - N5425 W00908 -
N5822 W00931 - N6019 W00931 - N6132 W01043 - N6137 W01242 - N6242
W01752 - N6242 W02014 - N6348 W02000
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N4745 W00805 - N4624 W01058 - N4605 W01416 - N4509 W01521 - N4513
W01652 - N4935 W01708 - N5010 W01416 - N5218 W00931 - N5436 W00733 -
N5722 W00645 - N5939 W00723 - N5950 W00854 - N6056 W01223 - N6236
W02011 - N6346 W01955
RMK: NO SIG ASH ABOVE FL200. LATEST MODEL RUNS HAVE TAKEN INTO
ACCOUNT REPORTED INCREASED ASH CONCENTRATIONS AND ERUPTION
OBSERVATIONS FROM ICELAND.
NXT ADVISORY: 20100504/0000Z=
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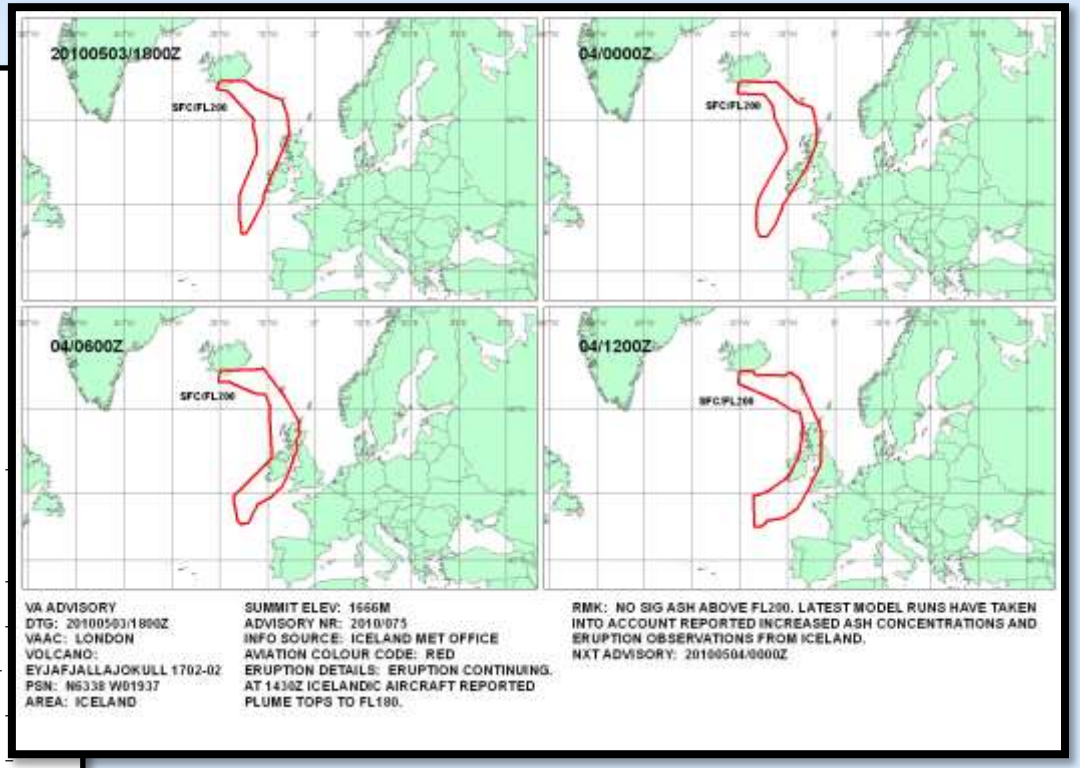

- Issued at least every six hours
- Valid T+0 to T+18 hours
- Sent to MWO, ACCs, airlines (to extent possible), WAFCs, other VAACs, and international OPMET data banks.

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What is the hazard posed to aviation?

- **No agreed values of ash concentration which constitute a hazard to jet aircraft engines**
  - **Exposure time and thrust settings at time of encounter both have a direct bearing on the threshold value**
- **Little progress over past 20 years through the work of the VAWSG and IAVWOPSG**
- **Recommendation: "AVOID AVOID AVOID"**
  - **any volcanic ash, regardless of ash concentration**

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Recent progress

- **5th International Workshop on Volcanic Ash convened by WMO in coordination with ICAO (Santiago Chile, 22-26 March 2010) noted:**
  - **Industry representative (Airbus) tasked to contact its engine manufacturers to find out if they would be in a position to establish the safe particle size and concentration of ash that would be sustainable to aircraft engines.**
- **Results to be reported to IATA who in turn would keep IAVWOPSG informed**

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Recent events... then came...

- **Eyjafjallajökull eruption in April and May 2010**
  - **Resulting unprecedented disruption to air transportation in the EUR/NAT Region and beyond**
- **The European response to resume operations as safely and as quickly as possible involved:**
  - **Airframe and engine manufacturers**
  - **Aviation safety regulators**
  - **Airline operators**
  - **Meteorological Authorities**
  - **Research community**
- **Consensus reached which permitted, *subject to appropriate precautionary maintenance*, operations in areas of volcanic ash up to a stated threshold**

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ICAO response and the future

➢ EUR/NAT Volcanic Ash Task Force

- Established 28 April 2010 by ICAO Regional Director
- Tasked to review the decisions taken by some States in EUR Region and prepare amendment to Volcanic Ash Contingency Plan of the EUR and NAT Regions
- Established threshold values for volcanic ash concentrations and the associated ATM procedures
- Completed work on 10 June 2010
- Amendment to common Plan endorsed through EANPG and NAT SPG in July 2010

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Thresholds and Procedures

- **Area of Low Contamination**
  - Volcanic ash may be encountered at concentrations equal to or less than $2x10^{-3}$ g/m^3
- **Area of Medium Contamination**
  - Volcanic ash may be encountered at concentrations between $2x10^{-3}$ g/m^3 and $4x10^{-3}$ g/m^3
- **Area of High Contamination**
  - Volcanic ash may be encountered at concentrations greater than $4x10^{-3}$ g/m^3
- **Provider State might establish Danger Area**
- **Information about ash concentration to be provided through NOTAM/ASHTAM**

ICAO response and the future

➢ International Volcanic Ash Task Force (IVATF)

- Established in May 2010 by ICAO Secretary General
- Tasked to assist the Secretariat to develop a global safety risk management framework that will make it possible to determine the safe levels of operation in airspace contaminated by volcanic ash
- Created four sub-groups:
  - Airworthiness sub-group
  - ATM sub-group
  - Science sub-group
  - IAVW coordination group

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Contracting States – roles and obligations

➢ Provider State

- A State that has accepted the responsibility for the provision of air navigation services to international aviation within a defined airspace (FIR – territorial and/or High Seas airspace)
- Provide aeronautical information about safety hazards within the area of responsibility

➢ State of the Operator / State of Registry

- A State that is responsible for regulation of
  - operators to whom it has issued an AOC; and
  - aircraft on its registry
- Establish/endorse procedures for
  - operators to assess the risk of operation in volcanic ash; and
  - flight crews to be followed in case of operation in or near airspaces contaminated by volcanic ash

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Further information

- International Airways Volcano Watch Operations Group (IAVWOPSG):
  - http://www2.icao.int/en/anb/met-aim/met/iavwopsg/Pages/default.aspx
- International Volcanic Ash Task Force (IVATF):
  - http://www2.icao.int/en/anb/met-aim/met/ivatf/default.aspx
- EUR/NAT Regional Office
  - http://www.paris.icao.int/