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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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**WACAF workshop on the
provision of information on
volcanic eruptions and ash
clouds**

16 to 20 June 2025



WACAF workshop on the provision of information on volcanic eruptions and ash clouds

2

Best Practices in developing SOP for Volcanic Ash Events

ICAO

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Outline

- Introduction
- Key actors involved in International airways volcano watch
- Volcanic ash information management
- Volcanic ash contingency operations
- Factors to consider in developing Standard Operating Procedures

Introduction

International airways volcano watch (IAVW)

- IAVW consists of international arrangements for monitoring and providing warnings to aircraft of volcanic ash in the atmosphere. Intended to keep aircraft in flight and volcanic ash in the atmosphere entirely separate.
- Nothing can be done to prevent volcanic ash erupting into the atmosphere and being carried by the upper winds across international air routes. The aviation community has the responsibility to ensure, as far as possible, that when this happens, the ash cloud is monitored, pilots concerned are advised and aircraft routed safely around it.

Maintenance of IAVW

- Safety and economic implications of volcanic ash to aircraft operations require to maintain the ICAO IAVW much in the same way that the *aerodrome fire services* are maintained: **in constant readiness** but with the fervent hope that it rarely has to be used.
- Essential channels of communication between volcano-observing sources and the relevant ACCs, FICs and MWOs
- Currency of the local staff instructions and procedures.

Key actors involved in International airways volcano watch

Volcanological Observatory Established by States which have active volcanoes

- Continuous monitoring of active volcanoes and short-term forecasting based on the monitoring of the volcano; Information on significant volcanic activity to ACCs/FICs, VAAC and MWOs through VONA.

VAAC Specialized MET centres designated by ICAO

- Provide advice to MWOs and ACCs/FICs in their area of responsibility of the forecast trajectory of the volcanic ash and the flight levels likely to be affected.

MWO Meteorological watch offices (MWOs)

- Issue the required SIGMET on volcanic activity

ACC/FIC Area control centres (ACCs)/flight information centres (FICs)

- Submit a request for ASHTAM/NOTAM on volcanic ash to its associated NOF/AIS.

NOF NOTAM Office (NOF)

- Promulgate ASHTAM/NOTAM based on information provided by the ACC/FIC

Key actors involved in International airways volcano watch

AC Operators

Air users impacted by volcanic ash events

- Ensuring airborne observation through special air-report of volcanic activity.
- Flight crew adherence to ACC/FIC re-routing instructions
- Consideration of information available on volcanic activity for flights dispatching

AD Operators

Operators of aerodromes likely to be affected by volcanic ash

- Ash deposit on and around the aerodrome, contaminating electronic, electrical and mechanical ground equipment and, if due care is not taken, aircraft parked or taxiing around the aerodrome.

Volcanic ash information management

Monitoring volcanoes and forecasting volcanic eruptions (*Doc 9691 §1.5*)

- Monitoring volcanoes involves measuring, recording and analyzing a variety of phenomena including seismic events such as earth tremors, ground deformation, gas emission and ground water chemistry and temperature and variations in local electrical, magnetic and gravitational fields, all of which are associated with magma movement deep in the earth.
- Seismic events often provide the earliest warning of increased volcanic activity.
- In addition to the occurrence of earthquakes, the actual shape of the volcano surface itself also changes during the build-up to an eruption. Such deformation of the surface can be observed and measured accurately using tiltmeters and various geodetic networks.
- States that have volcanoes in their territories have established **Volcanological Observatories** for monitoring their active volcanoes.
- Forecasting volcanic eruptions in the long term is not possible and is not expected of vulcanologists. However, short-term forecasting based on the monitoring of the volcano is proving successful.

Volcanic ash information management

Observing part of IAVW - Ground-based observing stations (*Doc 9691 §6.3.1*)

- Several international organizations, and ICAO Contracting States, agreed to cooperate in the IAVW observing networks :
 - ✓ World Organization of Volcano Observatories (WOVO):
 - *volcano observatories* — *vulcanologists' internet* — *seismological stations*
 - ✓ World Meteorological Organization (WMO):
 - *meteorological observatories* — *climatological stations* — *hydrological and rainfall stations*
 - *agricultural stations* — *merchant ships*
 - ✓ United Nations Disaster Relief Organization (UNDRO):
 - ✓ ICAO Contracting States
 - ✓ United Nations Comprehensive Nuclear Test Ban Treaty Verification Networks.
- **Information** on a volcanic eruption or volcanic ash cloud **must be sent immediately to the nearest ACC or MWO** through existing dedicated communications channels or by telephone, telex or facsimile

Volcanic ash information management

Observing part of IAVW - Airborne observations (*Doc 9691 §6.3.2*)

- pilots with their commanding view from the cockpit and regular travel over remote areas are often the first to observe a volcanic eruption or volcanic ash cloud.
- On many occasions pilots will continue to be the first to report volcanic activity. To assist pilots in making these reports, volcanic activity, volcanic eruptions and volcanic ash clouds were included in the international regulatory documents as phenomena warranting the issuance of a special air-report.
- The international special air-report of volcanic activity reporting (VAR) format should be used. This format is given in Appendix 1 of the PANS-ATM, Doc 4444.
- This **information is to be transmitted by radio to ATS units** as soon as pilot workload permits.

Volcanic ash information management

Observing part of IAVW - Space-based observation (*Doc 9691 §6.3.3*)

- The satellites which are currently used for observing volcanic eruptions and volcanic ash cloud are polar-orbiting and geostationary meteorological satellites.
- These satellites form an integral part of the Global Observing System of the World Weather Watch which is coordinated and administered by WMO.
- WMO has committed itself to cooperating with ICAO in the development of satellite techniques to steadily improve the effectiveness of satellite data interpretation and analysis in monitoring volcanic eruptions and ash cloud.

Volcanic ash information management

Advisory and warning part of IAVW - ACCs/FICs and AIS (Doc 9691 §6.4.1)

- ACCs/FICs are the critical interface between ground units and aircraft in flight.
- ACC/FIC must keep aircraft advised of operational information which could affect them. Such information may be exchanged between ACCs/FICs in adjacent FIRs by radio, telephone and NOTAM.
- In the case of related to volcanic ash, the information received by an ACC/FIC in a NOTAM is transmitted immediately by radio to aircraft in flight concerned.
- The special series NOTAM called the ASHTAM is specifically intended for volcanic activity. States may choose to use either format, but are **encouraged to use the ASHTAM because the name immediately denotes its content and facilitates the routing of the information to the aircraft quickly.**

Volcanic ash information management

Advisory and warning part of IAVW - Meteorological watch offices (Doc 9691 §6.4.2)

- The MWO maintains a watch over the meteorological conditions in the FIR or control area and issues SIGMET and AIRMET messages, warning aircraft of specified observed or forecast en-route weather or other phenomena in the atmosphere that may affect the safety of aircraft operations.
- Volcanic ash is included as a phenomenon which requires issuance of a SIGMET.
- The volcanic ash related SIGMET is issued for a validity period of six hours.
- If a volcanic eruption ejects volcanic ash into the atmosphere in a particular FIR, or volcanic ash is transported into the FIR from an adjacent FIR by the upper winds, the **MWO responsible for that FIR is required to issue a SIGMET for volcanic ash.**

Volcanic ash information management

Advisory and warning part of IAVW - Volcanic ash advisory centres (VAACs) (Doc 9691 §6.4.3)

- The VAAC provides expert advice to ACCs/FICs/MWOs in its area of responsibility regarding the extent and forecast movement of a volcanic ash cloud.
- This information is **required by the MWOs for issuing SIGMETs for volcanic ash**.
- The **VAACs monitor the volcanic ash cloud** using the data received mainly from relevant geostationary and polar-orbiting meteorological satellites, and **forecast the movement of the ash cloud** using volcanic ash transport and dispersion computer models.

Volcanic ash information management

Communication and coordination in IAVW (*Doc 9691 §6.5*)

- Communications links between air traffic services, meteorological services and airlines are of long standing and should already be fully operational and reliable.
- Experience has shown that while the links themselves may be functional, the coordination necessary to make effective use of such links is sometimes lacking.
- The lack of coordination between ACCs/FICs and MWOs had in occasions when NOTAM were issued for volcanic ash, but no parallel SIGMET was issued for the same FIR, or information in the SIGMET and NOTAM was inconsistent.
- If the MWO learns of a volcanic eruption or volcanic ash cloud in its FIR or in adjacent FIRs, the ACC/FIC must be informed immediately, and vice versa.
- Subsequent issuance of NOTAM and SIGMET must be the subject of continuous mutual coordination for the consistency of the information given therein.

Volcanic ash contingency operations

General procedures to mitigate the effect of volcanic ash to Aircraft (*Doc 9691 §4.5*)

- Procedures are recommended by aircraft manufacturers in the aircraft flight manual in instances where an aircraft has inadvertently encountered a volcanic ash cloud.
- Flight crews should always follow aircraft manufacturer procedures and recommendations under such circumstances.
- In the absence of specific procedures or recommendations, generic procedures which States may require flight crews to use are provided at *Doc 9691 §4.5.1, items a) to l)*
- Guidance should also be included in aircraft maintenance manuals regarding the necessary maintenance or inspections to be undertaken on an aircraft following an encounter with volcanic ash.
- Pilots must be provided with a set of air-start procedures which also cover procedures in volcanic ash contaminated air, and simulator air-starts must be part of basic and recurrent pilot training.

Volcanic ash contingency operations

Contingency measures for Aerodrome (*Doc 9691 §5.1*)

- Volcanic ash can also have a serious effect on aerodromes located downwind of a volcanic ash plume.
- The ash is deposited on and around the aerodrome, contaminating electronic, electrical and mechanical ground equipment and, even, aircraft parked or taxiing around the aerodrome.
- Problems caused by volcanic ash on the runways include a reduced runway friction coefficient for landing aircraft, especially when ash is wet, and severe deterioration in local visibility as the ash on the ground is disturbed by engine exhausts from aircraft taxiing, landing and taking off.
- For airports which are considered likely to be under threat from volcanic ash fall, procedures should be in place for following aspects:
 - ✓ standing pre-eruption arrangements;
 - ✓ volcanic eruption, including initial ash fall over the airport through to airport closure; and
 - ✓ post-eruption clean-up and re-opening of the airport.
- Arrangements on volcanic ash fallout over the aerodrome could be included in the part of the airport emergency plan related to natural disasters or could be developed as a separate document.

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Volcanic ash contingency operations

Air traffic procedures for an ACC (*Doc 9691 §5.2.4*)

- If a volcanic ash cloud is reported or forecast in the FIR for which the ACC is responsible, the following procedures are followed:
 - ✓ relay all information available immediately to pilots whose aircraft could be affected to ensure that they are aware of the ash cloud's position and the flight levels affected;
 - ✓ suggest appropriate rerouting to avoid area of known or forecast ash clouds;
 - ✓ remind pilots that volcanic ash clouds are not detected by airborne or air traffic radar systems. Pilots should assume that radar will not give them advanced warning of the location of the ash cloud;
- if an aircraft advises that it has entered a volcanic ash cloud and indicates a distress situation:
 - ✓ consider the aircraft to be in an emergency;
 - ✓ do not initiate any climb clearances to turbine-powered aircraft until the aircraft has exited the ash cloud; and
 - ✓ do not attempt to provide escape vectors without pilot concurrence.

Factors to consider in developing Standard Operating Procedures

Awareness of the structure of the IAVW

- Identification of the relevant actors.
- Description of responsibilities and interfaces of the actors.
- Points of contact

Communication links

- Establishment and maintenance of communication links
- Testing communication links

Effective coordination among all actors

- agreement between interfaces
- Strategic coordination
- Operational coordination

Training of the operating personnel

- Inclusion of handling of volcanic ash events in training programs, for both initial and refresher trainings

Testing of volcanic ash messages

- Issuance on agreed regular basis of test messages including, VONA, Volcanic ash advisory, SIGMET, NOTAM and ASHTAM

Volcanic ash exercises

- Conduct on agreed regular basis of Volcanic ash exercises
- Involvement of all concerned actors



Thank you!
Merci beaucoup!