

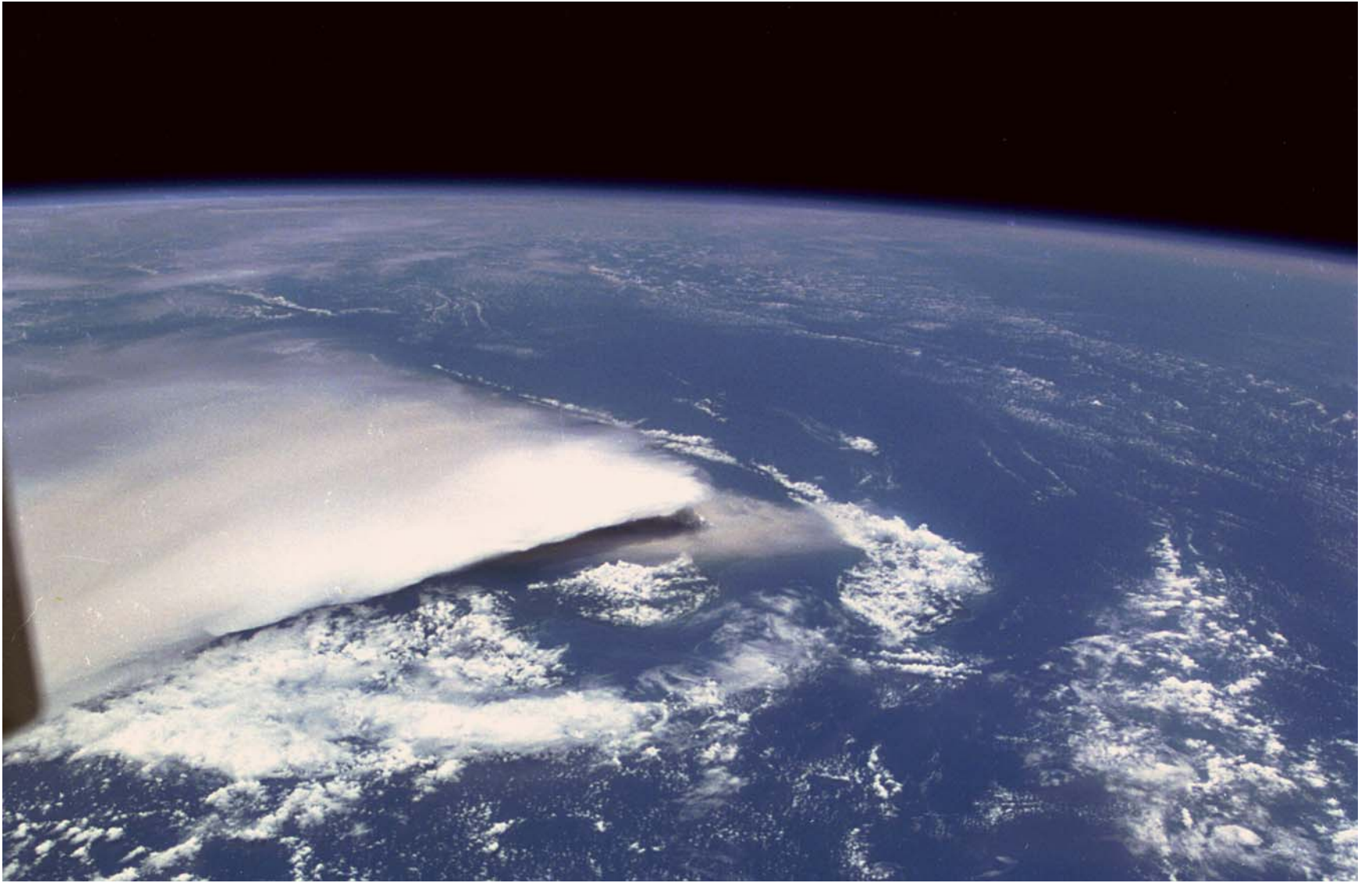
# Volcanic Ash: A Serious Threat To Aviation Worldwide

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# The Operational Threat

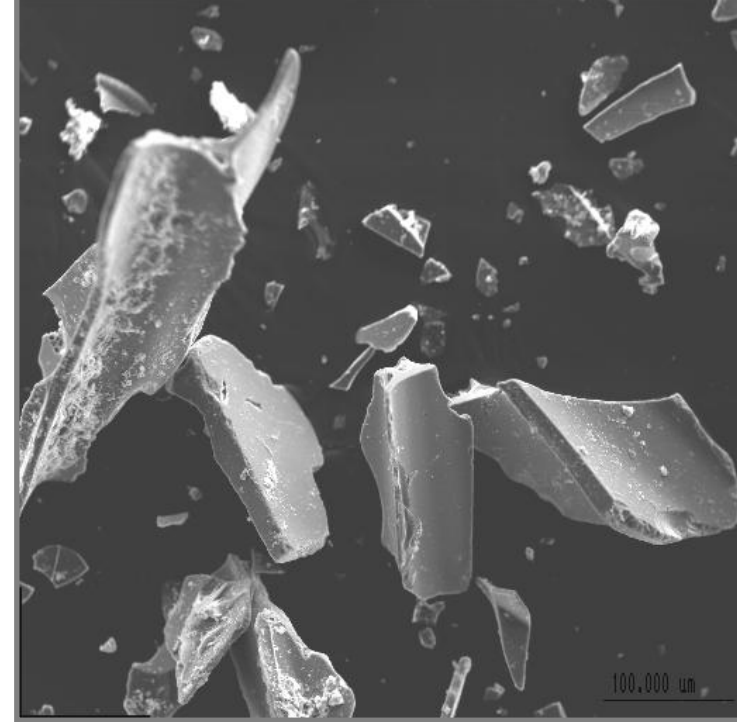
Hundreds of active volcanoes that can potentially impact aviation

Most are along the Pacific rim, however, explosive eruptions can affect air space over the entire planet.

50-60 eruptions occur each year; about 10 send ash to altitudes of concern to en route air traffic.

Extrapolation of North Pacific volcanic record suggests that ash is expected to be at flight levels ~20 days/yr somewhere in the world.

Ash clouds can drift – invisible to current onboard instrumentation – up to thousands of miles from a volcano, remaining aloft for days to months.



# The Danger

Ash clouds can rise thousands of feet per minute and reach 100,000 feet above sea level for the largest of eruptions.

Ash is highly abrasive and begins to melt well below operating temperatures of modern jet engines.

Ash erodes turbine blades and can melt and adhere to critical parts potentially causing complete engine failure.

Aircraft engulfed in a volcanic ash cloud will suffer severe erosion of surfaces such as the windshield and landing light covers causing serious loss of forward visibility.

Electrical disturbances within the ash cloud may interfere with VHF radio communications.

# The Danger

Deterioration of vulnerable aircraft components such as acrylic windows, air frames, and exterior paint.



Ash falling on and near airports is also a severe hazard to operations on the ground as well as to aircraft on approach and departure.

Ash reduces braking effectiveness of aircraft and wet ash is extremely slippery.

Fine ash can be re-suspended by surface winds until removed from the tarmac.



# Mitigation

Avoidance of the ash/gas cloud is key

In the United States, USGS, NWS, and FAA share responsibility for formal message streams to disseminate information about volcanic hazards to aviation

USGS and NWS have greatly improved satellite capabilities to detect and track ash clouds

A number of models are now available to forecast the motion of ash clouds

**In general, dispatchers believe current information dissemination is adequate and graphical tools effective when displaying ash threats.**

# Recent Progress and Accomplishments

Increased use of fixed and portable radar to verify ash emission and determine cloud height

Increased use of web-cameras

Availability of new, high-resolution satellite sensors and techniques (e.g. GPS, INSAR)

Improved eruption source parameter characterization will result in better ash cloud trajectory forecasts

Improved volcanic activity notification formats from US volcano observatories





# Ongoing Challenges

Inadequate geophysical monitoring of potentially active volcanoes

Lack of adequate, stable funding

Lack of ground-based monitoring in the highly volcanically active parts of the world

Challenge in accurate ash cloud height determinations and resulting inaccuracies in model output for ash cloud trajectories

Tracking and understanding distant ash and aerosol clouds: how hazardous are dilute ash and gas clouds to aircraft?

# Near Term Objectives

## Research Community

Monitor more volcanoes & tailor eruption reports to needs of aviation industry.

Improve dispersion models for better cloud forecasts.

Design sensors specific to ash, including on-board sensors (“tactical” to augment “strategic” flight planning).



# Near Term Objectives

## Aviation Industry

Provide regular training for pilots & dispatchers.

Include specific ash-related procedures in aircraft operations & maintenance manuals, as well as in aircraft manufacturers' flight manuals.

Require air crews to practice engine air-restart procedures in simulator on recurring basis.

Improve hazard awareness within MWO's ; improve VAAC operations.

Provide rapid download & processing of satellite data. (Remedy loss of split-window method on US GOES).

# Near Term Objectives

## Together

Refine communication protocols  
(table-top exercises, multi-agency  
operational plans.

**BUILD AWARENESS OF THE  
HAZARD.**





# Thank You

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