WHY VOLCANIC SAMPLING?

- Volcanoes' plume poses a danger to people and airplanes
- The gas and rock particles constantly move in currently poorly predictable ways.

Planes engines are destroyed by the debris expelled by volcanoes.
The plume grounds flights through large airspaces due to its variable nature.

MISSION PLANNING

Finding the perfect point for the relay plane
1. Create circles for the range of each communication point
2. Find the intersections of all the circles
3. Remove any that do not fall on or in every circle
4. Average the points

Missions are scripted using python and can perform any reasonable planned course.
The placement of the relay plane is calculated during the mission.

SIMULATION

- Ardupilot (our auto-pilot) is connected
- Mission Planner* directs the autopilot and simulation
- XPlane10 simulates the flight and provides feedback to the autopilot

- Multi-plane simulations can be run with multiple computers
- Allows testing of built mission scenarios

RESULTS

- Transmission ranges during flight of home (red), the mission plane (blue), and the relay plane (green).
- The relay plane is sent just as the mission plane leaves the Home stations transmission range.
- The mission plane can always communicate with the Home station.

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3NASA Ames Research Center, Intelligent Systems Division
4Open source software created by DIY Drones

Figure 1: Plume of Volcán Reventador. 2002
Figure 2: British Airways engine after a run in with a volcanic ash plume. 1982
Figure 2: British Airways engine after a run in with a volcanic ash plume. 1982

Distance between Planes

How close to the edge of the home base's communication range do we let the mission plane get to before launching the relay plane?

- Sending the relay plane as late as possible allows power to be saved.
- Launching when the mission plane is at 70% of the transmission range ensures the plane will not be out of the safe zone.
- Launching at 90th the relay plane into the uncertain transmission range, .9 - 1.0 miles