Final Year Project - DTA Volcanic Ash Sampling Presentation Outline

Distal ash clouds created by volcanic eruptions can pose great risk to jet engines. Whilst civil aviation is able to reroute air traffic, unique military operations may require aircraft to fly through ash clouds so a means to characterise a volcanic ash cloud is necessary. Satellite imagery can provide accurate estimates of an ash cloud’s areal coverage but provide little information about its altitude. One key issue is that there are currently few means to safely or accurately sample and measure distal volcanic ash clouds at altitudes encountered by aircraft. To this end, the New Zealand Defence Technology Agency require a low cost unmanned airborne measurement system for measuring and sampling distal volcanic clouds.

The developed solution is to use a weather balloon deployed fixed-wing unmanned aerial vehicle fitted with an optical particle counting (OPC) sensor, an electrostatic sensor and ash particle capture system. The system uses a modified autopilot and is fully automated from takeoff to landing. Long range telemetry is used to provide the operator with real-time flight data and ash sensor data simultaneously. Candidate OPC sensors and an electrostatic sensor have been tested to verify performance. Ash particle capture methods have also been investigated by building and testing cyclone separator designs. Modelling of the system design and flight characteristics has also been performed.