**Airborne Sampling/Sensing of Distal Volcanic Ash**

**Informal Weekly Meeting Notes #2 - Friday 18 March**

Project Proposal Discussion

* Adrian said that overall it was good
* He was happy with the focus on sensors first
* Wanted to clarify a couple main points:
  + What we each plan on tackling
  + Going through sensor selection

Jamie - progress report on physical ash sampling research

* Not much out there specific to UAVs
* There was an existing UC project proposed over summer
* Not Designed for UAV use though
* Adrian mentioned an institute in Germany the worked on the FALCON 9:
  + Too expensive for us
  + Sophisticated optical particle counting
  + Adrian has the paper. It may be of interest
  + We will probably use an off-the-shelf particle count sensor

Adrian made a couple more points

* It might be worth investigating electrostatic charge on ash
* We should focus on differentiating ash and no ash
* GNS are the people responsible for volcanic ash advice/analysis in NZ
* There are a couple universities that investigate ash samples

Maan raised a few points

* Maan said that there was a volcanic ash expert in UC: Dr. Thomas Wilson
* Airborne sensors have a limited size measuring range. Is there a specific range we need to focus on?
  + Adrian: paper from Iceland seemed to indicate up to 50 micrometers. We need to find multiple sources to support this
  + Jake talked about a past student who had made their own smoke detector and that he could do something similar for ash measurement for his computer vision course

S02 sensors were brought up

* These and other chemical sensors were in the project proposal
* Adrian said that we won’t get much out of them as gases are localized only to the eruption column and not the distal ash cloud

Maan said we have some equipment in the department we can use and asked about existing ash samples

* Adrian said that they have plenty (kilograms) of volcanic ash samples
* He said he can send some samples down within the next couple weeks
* Samples were very dry, fine ash, pristine quality
* They will be good for sensor bench testing
* They can provide as much ash as we require

Ryan’s progress report - UAV central controller

* Need analog inputs and convert to digital data
* Arduino may be the best bet
  + Affordable
  + Off-the-shelf software
  + Plenty of support

Adrian added a few points

* Consider operating temperatures at altitude
* He was happy that we are considering cheap off the shelf systems (Arduino/PixHawk)
* Maan said that NIWA will have plenty of advice in operating electronics in high altitude environments

Parth progress report - chemical sensors

* Looked at CO2 and SO2 chip sensors but after this meeting it seems that we might not want to use them
* They come in very small chip packages that measure ppm for whatever compound you want to measure
* Adrian talked abut someone at the DTA who had a spectrometer
  + He would get some info about it
  + Probably to complicated to use but could be of interest

A number of other points were brought up

* Need to revisit references and have a good read to narrow down tasks, focusing on ash detection/mearurement/sampling
* Look at any other VA specs
* Look at flight modeling/stability
  + We may have access to the hardware used by the NIWA project
  + This could be useful in informing us about payload/platform design
* Need to look at max payload/size of platform
  + This will affect the rules of operation at altitude
  + Adrian will talk to the UAV guys at DTA for some insight
  + Maan said that the size limit for operation is 2kg
  + DTA is happy to talk to NZCAA to discuss what they will be flexible on. For now design to a 2kg load limit

Adrian talked about the resources we could tap into

* NIWA’s airframe available if we can get it to CHCH
* DTA autopilots - probably not use them. Use something off-the-shelf
* Telemetry - the DTA can provide advice on the best approach
* NIWA may also provide advice on telemetry
* We can use the DTA weather balloons and their own processes for launching

Adrian was happy that we were thinking about the right things and emphasized that we need to first focus on detecting ash or no ash. He said to prioritize specialist sensor selection and order these early as they can have long lead times.

* The existing off-the-shelf sensor is a viable option but not necessary to use