Meeting Notes - 11/03

After introducing ourselves Adrian began by explaining the motivation for the project.

He said that civil aviation’s approach is to basically avoid VA clouds by rerouting or grounding flights. However, often this cannot be done in the case of military applications such as search and rescue or disaster relief that may be common during volcanic events. He identified a need for better (and cost effective) tools to assess the threat.

Adrian then went to talk through the Rolls Royce presentation on VA:

- The key is investigation the questionable grey area between safe and unsafe.

- Very little data about VA in this area.

- Current CAA guidelines are to avoid clouds defined to exist within this region.

- Currently no feasible (affordable) methods for PHYSICALLY verifying density models.

- Notice that the density is in mg/m^3. There is nothing defining safe operating levels relating to ash particle size/shape/composition.

- We need to look at what happens to engines affected by ash, he said that there had been some work done in the past 5 years towards this.

- He said the lighter ash loading (2 - 10 mg) is on the boarderline of detecting visually.

This called for a new NZDF capability of airborne sampling of distal VA at up to 40,000ft and provide data to ground operators of where the ash is.

Adrian then outlined the existing methods for VA measurement:

- CAA, Volcanic Ash Advisory Centres (VAACs) exist worldwide

- the data produced has good observations of the area but is not good in the z-component (altitude of ash). He mentioned that there can be cases where the operating altitude of flights can be lowered after some eruptions.

- Satellite is not satisfactory, need to physically sense and sample at altitude.

- There is 1 LiDAR station in NZ operated by NIWA. Europe has a few sites.

- Adrian is not aware of current VA sampling methods.

- VA samples are currently taken of ash settled on rock. This does not necessarily represent what is happening at altitude.

Maan stated that NIWA were keen to get on board with the project and provide advice.

Adrian then described the project requirements:

- The sensors should be a priority as they will be a driver for the recovery system. Some aircraft have been instrumented but this is not a viable option in the New Zealand application, we need a low cost option.

Adrian described some of the potential initial leads:

- NIWA happy to provide advice: one lead is a laser-based sensor which infers ash particle size and quantity.

- Already have VA samples but will need to rig up a bench test (lab experiment) to test sensor suite.

- University of Redding in the UK, 2010, examined the Icelandic eruption and found ash stratified into a compact layer.

- The focus is on distal ash clouds and not the eruption itself.

- Aviation does not currently consider particle size as a factor of determining safety.

We asked Adrian about the budget:

- Adrian pointed out that this was something that may not be recoverable so needs to be low cost.

- Revise as we go through project scope.

- Budget on the order of 1000 up to a few thousand dollars.

Adrian described what the DTA can help with:

- Adrian is a mech eng so can provide advice on the engine side of things.

- There is a team who have developed a DTA UAV. Their systems will not be suitable for use in this project but they are happy to provide advice and are willing to help develop an autopilot system if necessary. However, they will need plenty of notice for this. The Pixhawk is the preferred option.

- This depends on the commercial of the shelf autopilot’s capability.

- For meteorological guidance there is someone at the DTA who can help with modeling, launching weather balloons.

- They have existing weather balloons at the DTA.

- Test flights should be organized through the DTA, they have access to airspace through the military and will be easier than going down the civilian route.

- We can do up to 400ft.

- They could do up to a few thousand feet fairly easily.

- Tests higher than this will be harder and take longer to be cleared.

Maan suggested that wind and temperature will be two of the biggest problems to overcome.

Other resources:

- Some componentry can be funded by DTA, otherwise they can help in other practical ways using their tools and workshops.

- Adrian plans to visit CHCH at least once during the project and at the end for presentations.

- Use telecom to communicate weekly just to make sure the project stays on a focused and desirable pathway.

- Adrian emphasized that the project scope was very ambitious and warned against trying to do everything at once.

Questions were asked by the team:

Is the existing DTA UAV suitable?

- No, too expensive and not designed for high altitudes.

Do we want to fly through fixed waypoints or have an automatic (intelligent) on-board waypoint algorithm?

- There will be limited controllability at higher altitudes but ideally it should go through programmable way points and dwell amongst the ash cloud over a large area before returning to base.

Adrian made a few more points:

- Haven’t looked at the idea of multiple balloon systems.

- Modeling is going to be a big problem (ascent rates, wind speed/direction).

- GNS can be useful for volcanic observations.

- Aviation advisory provides guidelines for operation around VA.

- NIWA will prove useful for VA info as well.

It was asked if computer vision projects will help:

- There is the AVOID system currently in use on air craft.

- IR camera combined with bandpass filters to see ash visually. This is essentially what the current satellite method uses.