Challenges in Managing Aviation Risk from Ash Hazards – An Engineer's View

- Clear blue sky (i.e. homeopathic concentrations of ash) – no problem flying in this
- EASA, OEMs – Avoid discernible or visible ash

- Is there an ash concentration/dose that incurs minimal economic damage?
- Is there an ash concentration/dose that represents a flight safety threshold?

- Thick ash plume – definitely wouldn’t fly in this
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- Is there a justification for exploring where the economically acceptable or safety threshold is in visible or discernible ash?

- Because EASA are requiring aircraft/engine OEMs to define VA susceptibility – CS-25 1593 and CS-E 1050

1. Engines are susceptible to ‘visible’ ash
   - So ash is only damaging if it has actually been seen…..?

2. Engines are susceptible to ash that could, or would, be ‘visible’ to the human eye in good light
   - Ash at 0.01 mg/m³ can be seen, but is it damaging to engines?

3. Engines are susceptible to ash that can be discerned by satellite based IR imagery
   - Effectively ash concentrations >0.2 mg/m³ – probably still a little conservative

4. Engines are not susceptible to ash that is not discernible nor visible
   - Almost certainly true, but not terribly useful

5. Engines are susceptible above an actual concentration of \( z \) mg/m³, a or a dose equivalent to \( x \) mg/m³ for \( y \) minutes
   - Noting that engines see the actual ash concentration, they don’t know about predicted concentrations

6. Relate new engines to susceptibility of in-service engine types
   - e.g. 2015 engine is \( x\% \) more/less susceptible than an engine from 1990
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• Is there a justification for exploring the possibility of operating in visible or discernible ash?

• What cost to aviation and society for avoiding discernible/visible ash?

• Is there an ash concentration/dose up to which safe flight operations can be conducted that would reduce this cost to say <$5M /yr?
  - Combined cost of flight disruption and slight engine deterioration

• What would it cost to establish such a concentration/dose?

• Could such a concentration/dose be of practical operational use?