

# ECE 412 - 1 Minute TED Talks

## TEAM-03 - COATL-AIRCRAFT

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### Background and Motivation

Particles in the atmosphere, such as volcanic ash, mineral dust, and wildfire smoke, pose risks to aviation by damaging engines, eroding components, and potentially causing engine failure. A good example of this is seen in the 1982 Jakarta incident, where British Airways flight 009 flew through volcanic ash from Mount Galunggung (in Indonesia), causing all four engines to fail. Additionally, aircraft in dusty environments, like the Middle East, experience accelerated wear and tear compared to those in cleaner air.

This capstone project aims to construct an electrostatic dust analyzer (EDA) to detect particle clouds and volcanic ash during flight by measuring currents induced by electrostatically charged particles. The EDA will provide real-time particle data, aiding pilots in identifying hazards like volcanic ash and wildfire smoke. Beyond emergencies, widespread deployment of EDAs could offer helpful information about atmospheric dust trends.

### Questions

- What's the biggest technological risk?
  - Noise currents from external sources interfering with data measurements
- What's the biggest project risk?
  - Harsh weather conditions when attached to an airplane could damage sensors
  -

*(Don't need to mention below, just reference if anyone asks)*

### Comparison Table:

Material	Charge Level	Notes
Regular Air	~0 fC	Neutral molecules, no significant charge.
Clouds (Water Droplets)	10-100 fC (Normal)	Slight charge, much higher in thunderstorms (kilo to mega fC).
Smoke (Wildfire)	100-1,000 fC	Friction and chemical ionization give moderate charge.
Volcanic Ash	1,000-10,000 fC	Highly charged due to friction and ionization in volcanic plumes.

ChatGPT:

"Hello, adventurers of the sky! Ever wondered what could make a mighty plane tremble up high? Well, it's not just the usual suspects like turbulent weather—tiny particles like volcanic ash, mineral dust, and wildfire smoke are the silent troublemakers."

*Slide 2: Comic-style dramatic reenactment of British Airways Flight 009 with speech bubbles saying "Oh no!" as it encounters a huge ash cloud.*

"Let's take a quick flight back to 1982. Picture this: British Airways Flight 009, cruising from Kuala Lumpur to Perth, unwittingly dives into a volcanic ash cloud from Mount Galunggung. Suddenly, all four engines gasp and fail! Quite the sky-high drama, right? Luckily, they got the engines back up before a crash landing—phew!"

*Slide 3: A vibrant and simplified diagram of the Electrostatic Dust Analyzer (EDA), looking like a high-tech spy gadget.*

"But fear not! We're on a mission to make the skies safer with our secret weapon at the Coffee And Telesensing Lab—the Electrostatic Dust Analyzer, or EDA. This clever device can sense these invisible intruders by catching the tiny zaps from their electrostatic charges—think of it like sensing static shocks from touching a doorknob."

*Slide 4: Illustration of various planes with EDAs installed, cheerfully zipping through clouds with smiley faces.*

"Our goal is bold yet simple: arm planes with our trusty EDA so they can detect these pesky particles in real-time. Imagine pilots being able to see and avoid these particle villains, making flying safer for everyone. Plus, gathering data from flights all over could tell us more about these mysterious particles and how they love to travel."

#### **End of Ted Talk:**

"So, next time you're jet-setting across the globe, remember that our flying detectives are on the case, keeping the skies clear and your journey safe. Thank you for soaring with us today in the exciting world of air safety innovations!"