Airborne Electromagnetic Sounding of the Interiors of Venus, Mars, and Titan

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Target: Solid bodies with atmosphere and ionosphere – former enables long-distance aerial survey; latter enables EM-waveguided subsurface sounding using Schumann resonances.

Science:

- Assess geodynamic style of Venus
  - Measures temperatures to ~100 km depth, discriminates thick, stagnant vs. thinner, mobile lid.
- Test presence of shallow groundwater on Mars
  - Do Recurring Slope Lineae (RSL) imply widespread near-surface aquifers?
- Measure ice thickness and variability for Titan
  - Four-fold uncertainty in shell thickness and heat flux strongly affects concepts for geological evolution.

Objectives:

- Demonstrate that the Schumann resonances 8 – 34 Hz can be characterized in the stratosphere.
- Demonstrate vertical form of the horiz. electric field as predicted by lossy waveguide theory.
- Determine simultaneously the frequency-dependent electrical conductivities of the ground and ionosphere.
- Determine requirements to advance to TRL 6 and assess unique atmospheres, ionospheres, and EM sources of Venus, Mars, and Titan.

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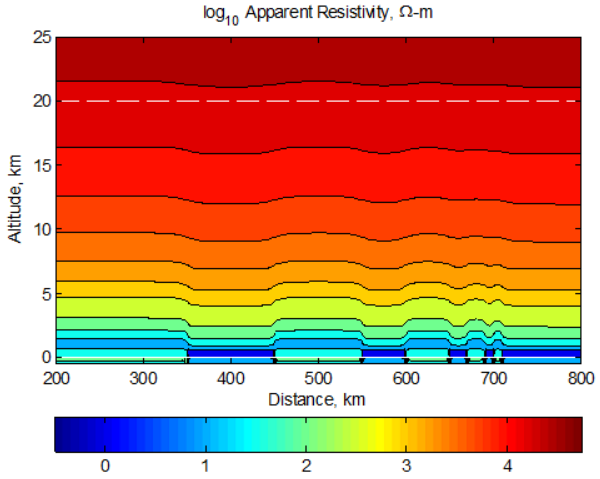
Transverse electromagnetic waves trapped between the ground and ionosphere are sensitive to the properties of the boundaries at any altitude – this provides freedom to perform high-altitude flights and characterize planetary lithospheres and crusts over long distances without ground contact.



Key Milestones (Two-Year Project)

- 9/16 Kickoff, 12/16 Final design
- 1-6/17 Build, integrate, lab test
- 7-8/17 Field and tethered-balloon tests
- 9/17 Flight #1, 4/18 Complete analysis and any h/w mods
- 5/18 Flight #2, 6/18 Ground-truth campaign, 8/18 End

Advance TRL from 2 to 4