An Intelligent, Decentralised, Unmanned Air System for Atmospheric Research

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Motivation

- Radiosondes are not ideally suited for in-situ observations of large blocks of airspace
- Trajectory prediction capability helps, but controlled glide much more cost-effective
Two development streams

- Multi-objective, constrained optimization of trajectories
- Software and HIL simulations + flight testing

Images and diagrams illustrate the processes involving JSBSim, FDM, Flightgear, and wireless communications.
Trajectory construction

- Greedy, heuristic stepping algorithm
- Searches paths produced in JSBSim
- Stitching together of paths produces flyable trajectories
- Computational time reduced
Interesting questions around ‘space-fillingness’

- The technology is in place for generating space-filling clouds (Morris-Mitchell hypercubes for optimal sampling efficiency), but curves (especially constrained curves) are more difficult.
An Objective Function

• Matrix describing uncertainty

• At each waypoint a radial basis function is used to reduce uncertainty in surrounding cells

• Second objective can be included to artificially increase uncertainty, creating hot spots that attract aircraft
Case Study: South Georgia

Thank you for listening.

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