This project is to develop antennas which enable beyond line of sight (BLOS) command and control for UAVs. We will take advantage of newly assigned provisional Ku-band spectrum for UAVs and use unique antenna designs to avoid interference with ground systems. This will involve designing antennas with high isotropic effective radiated power (EIRP) and ultra-low sidelobes. The antennas will be made with polymer aerogel as a substrate to both reduce weight and improve performance, as demonstrated in an Aero Seedling. In addition, designing the antennas to be conformal to the aircraft fuselage will reduce drag.

Overview/Description

Feasibility Assessment / Benefit if Feasible

- Antenna performance and flight requirements/feasibility defined
- Demonstration of conformable aerogel (1 m bend radius in 1 cm thick substrate/no need to mold to net shape)
- Demonstration of high directivity antenna array and beam steering capabilities in lab environment/25-30 dB reduction exceeding acceptable level of interference in controlled environment
- Demonstration of 20 dB sidelobe reduction from standard parabolic dish antenna in flight test/meets requirements for reducing interference with fixed service ground stations

Partners

- LMN/GRC: (Aerogel synthesis and characterization) Mary Ann Meador (PI), Stephanie Vivod, Rocco Vigliano, Boochau Nguyen, Linda McCorkle, Jessica Cashman; Haiquan Guo, LCA/GRC: (ITU guru) Robert Kerczewski
- LCF/GRC: (Antenna design, fabrication and testing) James Downey (co-PI), Bryan Schoenholz, Marie Piasecki, Bushara Dosa, Peter Slater
- LaRC: (Design and trade-off studies on aero-dynamics, structural, mass saving, robustness) Scott Kenner, Anne Mackenzie, Mark Cagle, Ray Rhew, Jeremy Smith, Bill Fredericks
- AFRC: (Integration, ground test and flight test of concept design on the Ikhana UAS) Andy Gutierrez, Patricia Martinez, Ricardo Arteaga, Kelly Snapp,
- ARC: (Flight test simulations) Richard Alena, Aaron Cohen,

Status

- Polymide aerogels with higher bendability at 2-3 mm thickness demonstrated
- Antenna Element/Subarray designed and simulated
- Fabricated single element antenna with aerogel and conventional substrate
- Performed beam steering in antenna range with T/R modules and conventional substrate
- Far/near field scanner designed for hangar test of antennas on Ikhana
- Models built to simulate performance of full size array on curved surface
- Flight simulation of aircraft to ground interference

Next steps

- Multilayer sandwich fabrication of full subarray prototype antenna
- Design and fabrication of antenna support structure and control systems to enable flight test
- Fabrication and testing of antennas with high EIRP and ultra-low sidelobes in lab environment
- Flight test to demonstrate 20 dB reduction in antenna sidelobes