An Aerodynamically Functionalized Wideband Antenna

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The increasing use of unmanned aerial vehicles (UAVs) in military applications has highlighted the importance of mobile readily deployable communication systems. These can be used for the typical surveillance and reconnaissance missions or in newer applications such as forming mobile wireless hotspots in remote regions. Typical UAV topologies have the antenna and communication hardware mounted to the aerodynamic structure effectively separating the antenna structure from the aerodynamic structure. A newer approach is to integrate the electromagnetic and aerodynamic functionality into a single structure which achieves the combined goals of both areas.

This work introduces a flight-enabled antenna station in which the antenna structure serves as the main body of the aircraft. The integrated antenna is a stripline-fed radial dipole that was chosen for its wideband capabilities. This radial dipole is composed of three conductive layers that are affixed to and between two circular sheets of Rohacell foam which act as the antenna substrate as well as the aerodynamic platform. Flight is enabled and controlled through the action of a radio-controlled electric motor and electromechanically actuated flaps. The antenna was designed and simulated to achieve wideband capabilities necessary for high data rate applications and to determine the effects of aerodynamic component integration on the overall electromagnetic performance. Radiation patterns and other antenna parameters will be measured and compared to the simulated results. A computational fluid dynamic (CFD) analysis is also performed on the structure to estimate necessary control surface size, motor power requirements, and weight limitations for proper flight control and stability. Preliminary flight tests were completed at different iterations of the design process and the results from each will be presented along with ongoing work.