A Complimentary Antenna Development Approach for Small UAV

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Small unmanned airborne vehicles (UAV) have a strong tactical value with their range and longevity of flight for close-in support. Versatile use of the UAV's surveillance data requires a system of antennas to cover the 30 MHz to 3 GHz frequency range. Conventional airborne monopoles are protrude too far from the exterior and patch antennas are usually too narrow band. Additionally, many surfaces on the small UAV are made from composite materials and are poor conductors. A minimum number of antennas, having no need for active tuners, is desired. The use of tuners is avoided due to their insertion loss and extra payload requirements.

A generic 6 ft UAV is assumed. On this generic UAV, a development strategy is presented for incorporating antennas into the fuselage, wing, and tail. Multiple wire and slot antennas are developed from the airframe structure using method of moment computational modeling to cover the frequency range. Although all frequencies are desired, certain sub-bands are more critical to operations. In these sub-bands, the development strategy emphasizes the need for omni-directional antenna patterns. The size of the UAV severely restricts the development of frequency independent antennas with vertical polarizations. Overlaps in frequency between antennas with complimentary polarizations are targeted to eliminate overall pattern nulling.

Embedded antennas on a small UAV require careful knowledge and management of payload and structural elements. Antenna feed placement, payload contents and placement, and physical notches are considered parametrically on the generic UAV to develop guidance for the layout or structural design of similarly sized UAV's. The generalization of the development process allows for the customization of the antenna suite to the UAV's body. Conversely, the antenna designs may drive the material selection of many surfaces and internal components within the UAV. For the generic 6 ft UAV, computational modeling and scale model measurements are compared. These results validate the overall design methodology.