Abstract Submitted
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Instrument to Measure Lightning Electric Fields Integrated with a Small Unmanned Aircraft[1] RICHARD SONNENFELD, DANIEL JENSEN, GRAYDON AULICH, New Mexico Tech / Langmuir Laboratory, BRIAN ARGROW, JAMES MACK, University of Colorado, Boulder / Aerospace Eng. — For lightning research an unmanned aircraft (UAS) can provide rapid and reliable (compared to balloons), and safe (compared to manned craft) access to severe storms, hurricanes and tornados. Our first UAS project seeks to measure vector electric fields aloft from nearby lightning. Integration of an electric field sonde (Esonde) with a UAS required weight reduced from 6 to 2 pounds and diameter decrease from 6 to 2.5 inches (compared to our balloon-borne Esondes). A custom data system streaming 16-bits at 500 kSamples/s to SD cards aided this reduction. Four channels of induced charge are measured by electrodes on the streamlined Esonde pod now mounted atop a Tempest UAS airframe. $\vec{E}$-field is derived from linear combinations of charges induced on each of the four electrodes. The linear coefficients are calculated by solving $\nabla^2\phi = 0$ for ϕ and $\vec{E}$ on the Esonde geometry. For balloon-borne sondes, approximate analytical solutions exist for a long cylinder in a constant $\vec{E}$-field. In contrast, the airframe mere inches from the Esonde pod necessitates numerical simulations for Laplace's equation (using COMSOL). While we found the fiberglas airframe to be only half as disruptive as a metal aircraft would be, its effect is still significant.

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Richard Sonnenfeld
New Mexico Tech

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