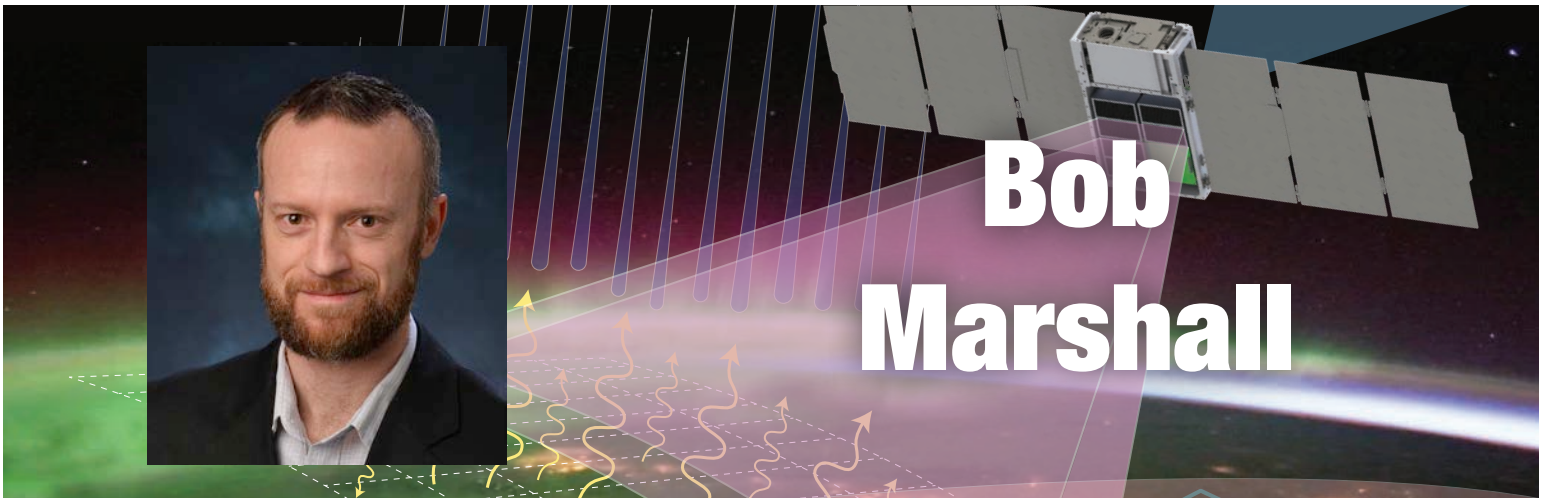
AES Seminar



Assistant Professor, Smead Aerospace

Radiation Belt Electron Precipitation and its Effects in the Upper Atmosphere

Wednesday, Sept. 19, 2018 | DLC | 12:00 P.M.

Abstract: The Earth's radiation belts contain energetic electrons and protons in two concentric belts that surround our planet and extend out to geosynchronous orbit. They are of particular interest due to their significant threat to spacecraft and astronauts. Radiation belt particle fluxes increase by orders of magnitude during geomagnetic storms, and subsequently decay over timescales from days to weeks. This "loss" occurs primarily by precipitation into the upper atmosphere, dubbed radiation belt electron precipitation (REP). These energetic electrons affect atmospheric chemistry and circulation, particularly driving the ozone concentrations in the mesosphere and stratosphere.

Measurements of REP are particularly difficult, and for this reason data and models do not agree well on radiation belt lifetimes nor their effects in the atmosphere. In this talk, I will present two new techniques under study to quantify and monitor REP. First, I will present a method to "image" REP using subionospheric very-low-frequency (VLF) remote sensing, implemented with an array of overlapping VLF signal paths and an inversion based on an ensemble Kalman Filter technique. Second, I present a mission proposal to measure REP via the bremsstrahlung X-rays emitted by the upper atmosphere. From X-ray measurements, the source precipitating flux and spectrum can be inferred from a least-squares best fit model inversion. Together, these techniques promise to provide unprecedented measurements of REP, helping to quantify the effect of REP on both the radiation belts and the upper atmosphere.

Bio: Bob Marshall is an assistant professor in Smead Aerospace Engineering Sciences and a member of the Colorado Center for Astrodynamics Research (CCAR). He leads the Laboratory for Atmosphere, Ionosphere, and Radiation Belts Research — the LAIR. His research ties together instrument design and development, data analysis, and numerical modeling of electromagnetic and plasma phenomena in the near-Earth space environment. Areas of study include thunderstorms and lightning and their impact on the upper atmosphere and ionosphere; very-low-frequency wave propagation in the lower ionosphere and its use as a remote sensing tool; coupling of radiation belt particles to the upper atmosphere and ionosphere; and the impact of meteors on the atmosphere.

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