

DFD10-2010-020078

Abstract for an Invited Paper
for the DFD10 Meeting of
the American Physical Society

An Overview of Aero-Optics

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Although Aero-Optics deals with the aberrating effects of variable index-of-refraction turbulent flows on lasers projected through them, it is specifically limited to compact turbulence due to flow over exit or receiving apertures, as opposed extended propagation paths through the atmosphere, for example. The origin of the word “Aero” in the description of the discipline is because compact, aberrating, turbulent flows are concomitant to airborne laser/optical systems. This talk will give a general overview of aero-optics starting with work in the 1970’s and progressing through its resurgence in the 1990’s due to the emphasis on shorter-wavelength lasers. The maturation of our understanding of the causes of the aberrating characteristics of aero-optical turbulence will also be discussed. Included in the talk will be the advances in wavefront-sensing technology and how this has led to the ability to properly scale aero-optic data and develop models for predicting its affect on system performance and explore mitigation techniques. The continued advance of these instruments is now allowing us to get a better appreciation for the impact of aero-optic flows on free-space communication even when the flow remains attached over the aperture, a condition that has little impact on directed energy systems.