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Numerical Simulations of Beam Propagation through a Free Shear Layer JURGEN SEIDEL, STEFAN SIEGEL, TOM MCLAUGHLIN, US Air Force Academy — On airborne platforms, the propagation of light or laser beams is severely hampered by the flow field around the turret typically mounted on the air vehicle. Flow separation from the turret results in a free shear layer, which, due to its natural Kelvin-Helmholtz instability, develops large, coherent structures. These structures and the associated density variations result in large optical distortions because of the dependence of the index of refraction on the density. While current experimental techniques can measure the integrated aberrations in terms of the optical path length, no direct measurements of the density field are possible. Therefore, correlating the observed aberrations with the flow structures is exceedingly difficult. Using high resolution computational fluid dynamics, the structure of the flow as well as the optical aberrations are studied in detail, which provides insight into the correlation between flow features and these optical aberrations. The notion that the vortex cores are responsible for the largest aberrations is critically examined.

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