JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

SPRING 2021 CEAFM VIRTUAL SEMINAR

"Spreading and Decay of Axisymmetric Drag Wakes"

Presented by Dr. Curtis Saunders

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Hosted by Scott Wunsch (JHU - APL)

Abstract: The spreading and decay of drag wakes is of interest to a wide variety of applications in geophysics and engineering, such as the wakes of mountains, seamounts, and buildings. For axisymmetric bodies, the classical self-similar scaling law formulated by Swain (1929) has long been widely accepted (Tennekes and Lumley 72) and used to describe the wakes of spheres (Bevilaqua and Lykoudis 78) and slender bodies (Pao & Lin 73). However, recent experiments both at APL and in the broader community have cast doubt on this century-old classical theory (Bonnier and Eiff 02; Nedic, Vassilicos, and Ganapathisubramani 13), indicating more rapid wake spreading and decay than the classical result.

In this talk, new laboratory data gathered in the Hydrodynamics Research Laboratory (HRL) from a dimpled sphere are presented. The Reynolds number (50,000) exceeds previous experiments, and the dimples alleviate issues with Strouhal vortex shedding. Particle Imaging Velocimetry (PIV) data are used to illustrate various aspects of the wake decay to downstream distances of ~170 sphere diameters. The observed wake decays at a greater rate than suggested by the classical theory, consistent with other recent experiments but extending to much greater downstream distances. These observations are compared with various new theoretical explanations for self-similar wake decay.

Bio: Curtis Saunders is a researcher at the Johns Hopkins Applied Physics Laboratory and a member of the Oceanic, Atmospheric, and Remote Sensing Sciences group. Curtis received his Ph.D. in Mechanical Engineering from the University of Vermont. His Ph.D. research as an NSF IGERT Fellow focused on investigating the role of wind turbine wake interactions both in causing unsteady forces on turbine blades and the role these wake interactions can play in reducing the variability in electric power output from large wind farms. His recent research interests include drag wakes, vortex dynamics, computational fluid dynamics (CFD) simulations, and scalar turbulence.

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