

THE WILLIAM E. BOEING DEPARTMENT OF
AERONAUTICS & ASTRONAUTICS

Chair's Distinguished Seminar Series

welcomes

Professor ERIC PATERSON, Department Head
Kevin T. Crofton Department of Aerospace and
Ocean Engineering, Virginia Tech

“At the Intersection of Aerospace and Ocean
Engineering: Structure and Persistence of Ship Wakes and
the Role of Langmuir-Type Circulations”

ABSTRACT

Since the early days of manned space flight, it has been known that ship wakes persist for long duration, and can be observed from air and space. However, for the past 50 years, a first-principles explanation has eluded fluid dynamicists. In this talk, it will be shown that surface ships operating in ocean waves generate transverse surface currents which persist long after the initial ship-induced currents have decayed. These surface currents are due to the formation of large-scale Langmuir-type circulations and are suggested to be the mechanism for the concentration of surface-active materials into streaks or bands, which are regularly seen in synthetic aperture radar imagery of the ocean surface. These circulations are generated by the Craik-Leibovich vortex force, which arises due to the in-

teraction of ship--induced current with ambient surface waves, and persist due to their large-scale nearly-inviscid nature. Numerical simulations of the wake behind a surface ship in calm, head, and following seas are presented and show good agreement with radar imagery from at--sea experiments. It is demonstrated that surface currents do not persist in the absence of surface waves, but can persist for tens of kilometers through the formation of Langmuir-type circulations. Since the circulations are driven by the cross product of the Stokes drift and the wake vorticity, the structure of the persistent wake is not a function of the propeller count or rotational direction, but is instead due to the relative heading of the ship with respect to the ambient surface-wave vector.

Monday, February 5, 2018

4:00 - 5:00 pm

Johnson Hall 075

UW Campus, Seattle, WA



WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY of WASHINGTON

THE WILLIAM E. BOEING DEPARTMENT OF AERONAUTICS & ASTRONAUTICS

...Distinguished Guest Speaker...



Eric Paterson, Ph.D.

Department Head & Rolls-Royce Commonwealth
Professor of Marine Propulsion
Kevin T. Crofton Department of Aerospace and
Ocean Engineering
Virginia Tech

Biography

Eric Paterson is Department Head and Rolls-Royce Commonwealth Professor in the Kevin T. Crofton Department of Aerospace and Ocean Engineering at Virginia Tech. Dr. Paterson's teaching and research is in the broad field of fluid mechanics, where he has worked in numerous application areas, including ship hydrodynamics, wind and wave renewable energy, canine olfaction, explosives detection, cardio-vascular hemodynamics, and computational fluid dynamics algorithms and turbulence modeling. Previous to Virginia Tech, he held positions at The Pennsylvania State University, The University of Iowa, Harris Corporation - Government Aerospace Systems Division, and Clifton Precision - Instruments and Life Support Division. He earned his B.S. and PhD in Mechanical Engineering at The University of Iowa. Paterson is Editor-in-Chief of the Journal of Ship Research, chair of the SNAME (Society of Naval Architects and Marine Engineers) Technical and Research committee on Hydrodynamics, and is chair of Education for AIAA (American Institute of Aeronautics and Astronautics). He also serves as a member of the Rolls-Royce Environmental Advisory Board, and as Vice-Chair of ADCA - Aerospace Department Chairs Association. He is a Fellow of SNAME, and an Associate Fellow of AIAA.

The William E. Boeing Chair's Distinguished Seminar Series brings scholars of national and international reputation who have made an impact in the field of aerospace engineering and beyond. This seminar series will cover a diversity of topics of current interest to those in academia, industry and the general public. It is our hope that these seminars will encourage an exchange of ideas and bring aerospace engineering and science to the forefront.



WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY of WASHINGTON

Monday, February 5, 2018

4:00 - 5:00 pm

Johnson Hall 075, UW Seattle