

# Aerospace Seminar



# Derek Paley

**Willis H. Young Jr. Professor of Aerospace Engineering Education**

## Multi-vehicle Control and Autonomy for Swarming Quadrotors

**Thursday, March 7, 2019 | DLC | 12:00 P.M.**

**Abstract:** This talk will present a cooperative-control framework designed to enable swarms of quadrotors to autonomously detect moving people and vehicles in an uncertain and complex environment. The talk will first describe inspiration from prior work in swarming and pursuit behavior in wild malarial mosquitoes. Then I will describe a distributed control for concurrent mapping and search. Swarm agents have a finite field of view and they collaborate to map the environment represented by a graph. Nodes of the occupancy graph indicate the target likelihood ratio and inform the swarm's search strategy. The evolving priorities of the swarm are represented by a spatially varying sampling priority surface that is used to identify tasks of high value. The candidate tasks are assigned to agents in the swarm using a consensus-based auction algorithm. Ongoing efforts seek to demonstrate the swarming framework using a multi-vehicle testbed under development at the University of Maryland's outdoor netted Fearless Flight Facility. To enable reliable outdoor flight in wind, we are investigating improvements in attitude stability that are obtained by equipping each quadrotor with an onboard wind-velocity probe.

**Biography:** Derek A. Paley is the Willis H. Young Jr. Professor of Aerospace Engineering Education in the Department of Aerospace Engineering and the Institute for Systems Research at the University of Maryland. Paley received a B.S. degree in Applied Physics from Yale University in 1997 and Ph.D. in Mechanical and Aerospace Engineering from Princeton University in 2007. He received an NSF CAREER award in 2010, the Presidential Early Career Award for Scientists and Engineers in 2012, and the AIAA National Capital Section Engineer of the Year in 2015. Paley has authored more than 125 peer-reviewed publications including one textbook. He teaches introductory dynamics, advanced dynamics, aircraft flight dynamics and control, and nonlinear control. Paley's research interests are in the area of dynamics and control, including cooperative control of autonomous vehicles, adaptive sampling with mobile networks, and spatial modeling of biological groups. Paley is an Associate Fellow of AIAA and Senior Member of the Institute of Electrical and Electronics Engineers. He serves as Associate Editor of AIAA Journal of Guidance, Control, and Dynamics.



Smead Aerospace  
UNIVERSITY OF COLORADO BOULDER

# Be Boulder.