

## Curriculum Vitae

Notarization. I have read the following and certify that this *curriculum vitae* is a current and accurate statement of my professional record.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### **Summary vitae**

Derek A. Paley is Director of the Maryland Robotics Center and 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. He is the founding director of the UMD Collective Dynamics and Control Laboratory, the UMD Autonomous Micro Air Vehicle Team, and the UMD FIRE Autonomous Unmanned Systems Stream. Paley is an Affiliate Professor in the Department of Electrical and Computer Engineering, and a member of the Alfred Gessow Rotorcraft Center, the Maryland Robotics Center, the Program in Neuroscience and Cognitive Science, the Burgers Program for Fluid Dynamics, the Applied Mathematics & Statistics, and Scientific Computation Program, and the Brain and Behavior Initiative. Paley received the B.S. degree in Applied Physics from Yale University in 1997 and the Ph.D. degree in Mechanical and Aerospace Engineering from Princeton University in 2007. He is the recipient of the Yale University Henry Prentiss Becton Prize for Excellence in Engineering and Applied Science in 1997, the Princeton University Harold W. Dodds Honorific Fellowship in 2006, the National Science Foundation CAREER award in 2010, the Presidential Early Career Award for Scientists and Engineers in 2012, the University of Maryland E. Robert Kent Teaching Award for Junior Faculty in 2014, and the AIAA National Capital Section Engineer of the Year in 2015. Paley was a Fellow in the 2013–2014 Office of Naval Research Sabbatical Fellowship Program and is a Fellow in the 2019–2020 UMD ADVANCE Leadership Fellows Program. Paley has authored more than 130 peer-reviewed publications including one textbook: *Engineering Dynamics: A Comprehensive Introduction* (Princeton University Press, 2011). 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. His research is based on support by the Air Force Office of Scientific Research, the Army Research Office, the National Science Foundation, and the Office of Naval Research. Paley is Associate Fellow of the American Institute of Aeronautics and Astronautics and Senior Member of the Institute of Electrical and Electronics Engineers. He serves as Associate Editor of *AIAA Journal of Guidance, Control, and Dynamics*.

### **I. Personal Information**

I.A. UID, Last Name, First Name, Middle Name, Contact Information  
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#### I.B. Academic Appointments at UMD

09/19–05/20, Fellow, UMD ADVANCE Leadership Fellows Program  
07/19–present, Director, Maryland Robotics Center  
07/17–present, Professor, Aerospace Engineering & Institute for Systems Research  
07/17–present, Affiliate Professor, Electrical & Computer Engineering  
04/16–06/17, Affiliate Associate Professor, Electrical & Computer Engineering  
12/15–present, Member, Brain and Behavior Initiative  
07/15–06/19, Faculty Advisor, FIRE Autonomous Unmanned Systems Stream  
12/13–present, Willis H. Young Jr. Prof. of Aerospace Engineering Education  
07/12–06/17, Assoc. Prof., Aerospace Engineering & Institute for Systems Research  
11/13–present, Member, Burgers Program for Fluid Dynamics  
02/13–present, Member, Applied Math & Statistics, and Scientific Computation  
08/11–present, Member, Alfred Gessow Rotorcraft Center  
03/10–present, Member, Maryland Robotics Center  
07/09–present, Member, Program in Neuroscience and Cognitive Science  
04/10–06/12, Affiliated Member, Institute for Systems Research  
08/07–06/12, Assistant Professor, Department of Aerospace Engineering

#### I.D. Other Employment

06/18–12/18, Consultant, AST, Inc.  
06/15–12/15, Consultant, Heron, Inc.  
06/13–05/14, Consultant, Primordial, Inc.  
08/13–05/14, Sabbatical Fellow, Naval Research Laboratory  
10/00–08/02, Software Engineer, Bluefin Robotics Corporation  
07/97–10/00, Analyst, Metron, Inc.

#### I.E. Educational Background

1997, B.S. in Applied Physics, Yale University, *magna cum laude* with distinction  
2007, Ph.D. in Mechanical & Aerospace Engineering, Princeton University

### **II. Research, Scholarly, Creative and/or Professional Activities\***

#### II.A. Books

##### II.A.1 Books Authored

1. N. J. Kasdin and D. A. Paley. *Engineering dynamics: A comprehensive introduction*. Princeton University Press, 2011. [Review] [Errata].

#### II.B Chapters

##### II.B.1. Books

5. **D. Goswami** and D. A. Paley. Global bilinearization and controllability of control-affine nonlinear systems. Submitted.

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\*Names in boldface indicate graduate students under Derek A. Paley's direct supervision at the time of submission. Names of supervised undergraduates are boldface and italic; postdocs are italicized.

4. D. A. Paley, **L. DeVries**, and **N. Sydney**. Data-driven routing of autonomous vehicles for distributed estimation of spatiotemporal fields. Submitted.
3. D. A. Paley. Autonomy underwater: Ocean sampling by autonomous underwater vehicles. In *Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2016 Symposium*, pages 43–49. National Academy of Engineering, 2017.
2. **F. D. Lagor** and D. A. Paley. Active singularities for motion planning in an  $N$ -vortex system. In S. Ravela and A. Sandu, editors, *Proc. First Int. Conf. Dynamic Data-driven Environmental Systems Science 2014*, number 8964 in Lecture Notes in Computer Science, pages 334–346. Springer, 2015.
1. R. Sepulchre, D. Paley, and N. Leonard. Collective motion and oscillator synchronization. In V. Kumar, N. Leonard, and A. S. Morse, editors, *Cooperative Control: A Post-Workshop Volume of the 2003 Block Island Workshop on Cooperative Control*, number 309 in Lecture Notes in Control and Information Sciences, pages 189–228. Springer-Verlag, 2005.

## II.C. Refereed Journals

### II.C.1 Refereed Journal Articles

59. A. Wolek, **S. Cheng**, **D. Goswami**, and D. A. Paley. Cooperative mapping and target search over a unknown occupancy graph using mutual information. Submitted.
58. **J. Boehm**, E. Berkenpas, C. Shepard, and D. A. Paley. Tracking performance of model-based thruster control of a remotely operated underwater vehicle. Submitted.
57. **W. Craig**, D. Yeo, and D. A. Paley. Geometric attitude and position control of a quadrotor in wind. Submitted.
56. **D. Goswami** and D. A. Paley. Non-Gaussian estimation and output feedback using the Gaussian Mixture Model Kalman Filter. Submitted.
55. D. A. Paley and A. Wolek. Mobile sensor networks and control: Adaptive sampling of spatiotemporal processes. Accepted for publication in *Annual Reviews Control, Robotics, and Autonomous Systems*.
54. **F. D. Lagor**, K. Ide, and D. A. Paley. Non-Gaussian estimation of a potential flow using a controlled Lagrangian sensor guided to invariant set boundaries by augmented observability. To appear in *IEEE J. Oceanic Engineering*.
53. **D. F. Gomez**, F. D. Lagor, P. B. Kirk, A. Lind, A. Jones, and D. A. Paley. Data-driven estimation of the unsteady flowfield near an actuated airfoil with embedded pressure sensors. *AIAA J. Guidance, Control, and Dynamics*, 2019.
52. N. N. Goldberg, X. Huang, C. Majidi, A. Novelia, O. M. O’Reilly, D. A. Paley, and W. Scott. On planar discrete elastic rod models for the locomotion of soft robots. *Soft Robotics*, 2019.
51. M. J. McHenry, J. L. Johansen, A. Soto, **B. Free**, D. A. Paley, and J. C. Liao. The pursuit strategy of predatory bluefish (*Pomatomus saltatrix*). *Proc. Royal Society B*, 286:1–6, 2019.

50. **D. Shishika** and D. A. Paley. Mosquito-inspired distributed swarming and pursuit for cooperative defense against fast intruders. *Autonomous Robots*, 43(7):1781–1799, 2019.
49. **B. Free**, M. J. McHenry, and D. A. Paley. Probabilistic analytical modeling of predator-prey interactions in fishes. *J. Royal Society Interface*, 16(20180873):1–11, 2019.
48. **D. Goswami**, **E. Thackray**, and D. A. Paley. Constrained Ulam Dynamic Mode Decomposition: Approximation of Perron-Frobenius Operator for Deterministic and Stochastic Systems. *IEEE Control Systems Letters*, 2(4):809–814, 2018.
47. D. Yeo, N. Sydney, and D. A. Paley. Onboard flow sensing for multi-rotor pitch control in wind. *AIAA J. Guidance, Control, and Dynamics*, 41(5):1196–1201, 2018.
46. **B. Free** and D. A. Paley. Model-based observer and feedback control design for a rigid Joukowski foil in a Kármán vortex street. *Bioinspiration & Biomimetics*, 13(3):1–15, 2018. Special issue on bioinspired swimming: sensing and control.
45. M. A. Bell, I. Pestovski, W. Scott, K. Kumar, M. K. Jawed, D. A. Paley, C. Majidi, J. C. Weaver, and R. J. Wood. Echinoderm-inspired tube feet for robust locomotion and adhesion. *IEEE Robotics and Automation Letters*, 3(3):2222–2228, 2018.
44. **D. Shishika**, J. K. Yim, and D. A. Paley. Robust Lyapunov control design for bio-inspired pursuit with autonomous hovercraft. *IEEE Trans. Control Systems Technology*, 25(2):509–520, 2017.
43. D. Yeo, **N. Sydney**, D. A. Paley, and D. Sofge. Downwash detection and avoidance with small quadrotor helicopters. *AIAA J. Guidance, Control, and Dynamics*, 40(3):692–701, 2017.
42. **N. Sydney**, D. A. Paley, and D. Sofge. Physics-inspired motion coordination for information-theoretic target detection using multiple aerial robots. *Autonomous Robots*, 41(1):231–241, 2017.
41. **A. Chicoli** and D. A. Paley. Probabilistic information transmission in a network of coupled oscillators reveals speed-accuracy trade-off in responding to threats. *Chaos*, 26(116311):1–9, 2016.
40. **C. G. Hooi**, **F. D. Lagor**, and D. A. Paley. Height estimation and control of rotorcraft in ground effect using spatially distributed pressure sensing. *J. American Helicopter Society*, 61(4):1–14, 2016.
39. **F. D. Lagor**, K. Ide, and D. A. Paley. Incorporating prior knowledge in observability-based path planning for ocean sampling. *Systems & Control Letters*, 97:169–175, 2016.
38. F. Zhang, **F. D. Lagor**, H. Lei, X. Tan, and D. A. Paley. Robotic Fish: Flow-relative control behaviors using distributed flow sensing. *Mechanical Engineering*, 138(3):S2–S5, 2016. Special issue on bio-inspired systems.
37. D. A. Paley, C. Majidi, E. Tytell, and N. Wereley. Bioinspired Soft Robotics: Preface to the Special Issue. *Bioinspiration & Biomimetics*, 10(6), 2016.

36. L. DeVries and D. A. Paley. Wake sensing and estimation for relative-position control of autonomous aircraft in formation flight. *AIAA J. Guidance, Control, and Dynamics*, 39(1):32–41, 2016.
35. **A. Chicoli**, J. Bak-Coleman, S. Coombs, and D. A. Paley. Rheotaxis performance increases with group size in a coupled phase model with sensory noise. *European Physical J. Special Topics*, 224(17):3233–3244, 2015. Special issue on dynamics of animal systems.
34. *F. Zhang*, **F. D. Lagor**, *D. Yeo*, **P. Washington**, and D. A. Paley. Distributed flow sensing for closed-loop control speed control of a flexible fish robot. *Bioinspiration & Biomimetics*, 10(6), 2015. Special Issue on bioinspired soft robotics.
33. **L. DeVries**, **F. D. Lagor**, H. Lei, X. Tan, and D. A. Paley. Distributed flow estimation and closed-loop control of an underwater vehicle with a multi-modal artificial lateral line. *Bioinspiration & Biomimetics*, 10(2):1–15, 2015. Special Issue on hybrid and multi-modal locomotion.
32. **T. Severson** and D. A. Paley. Distributed multi-target search and track assignment with consensus-based coordination. *IEEE Sensors J.*, 15(2):864–875, 2014.
31. **T. Severson** and D. A. Paley. Optimal sensor coordination for multi-target search and track assignment. *IEEE Trans. Aerospace and Electronic Systems*, 50(3):2313–2320, 2014.
30. **D. Shishika**, N. C. Manoukis, S. Butail, and D. A. Paley. Male motion coordination in anopheline mating swarms. *Nature Scientific Reports*, 4(6318):1–7, 2014.
29. **A. Chicoli**, **S. Butail**, **J. Lun**, J. Bak-Coleman, S. Coombs, and D. A. Paley. The effects of flow on schooling *Devario aequipinnatus*: school structure, startle response and information transmission. *J. Fish Biology*, 84(5):1401–1421, 2014.
28. N. C. Manoukis, **S. Butail**, M. Diallo, J. M. Ribeiro, and D. A. Paley. Stereoscopic video analysis of *Anopheles gambiae* behavior in the field: Challenges and opportunities. *Acta Tropica*, 132(1):1–6, 2014.
27. **N. Sydney** and D. A. Paley. Multivehicle coverage control for nonstationary spatiotemporal fields. *Automatica*, 50(5):1381–1390, 2014.
26. **F. D. Lagor**, **L. DeVries**, **K. Waychoff**, and D. A. Paley. Bio-inspired flow sensing and control: Autonomous rheotaxis using distributed pressure measurements. *J. Unmanned System Technology*, 1(3):78–88, 2013.
25. J. Bak-Coleman, A. Court, D. A. Paley, and S. Coombs. The spatiotemporal dynamics of rheotactic behavior depends on flow speed and available sensory information. *J. Exp. Biology*, 216:4011–4024, 2013.
24. **S. Butail**, N. Manoukis, M. Diallo, J. M. Ribeiro, and D. A. Paley. The dance of male *Anopheles gambiae* in wild mating swarms. *J. Medical Entomology*, 50(3):552–559, 2013.

23. **C. Peterson** and D. A. Paley. Distributed estimation for motion coordination in an unknown spatially varying flowfield. *AIAA J. Guidance, Control, and Dynamics*, 36(3):894–898, 2013.
22. **S. Napora** and D. A. Paley. Observer-based feedback control for stabilization of collective motion. *IEEE Trans. Control Systems Technology*, 21(5):1846–1857, 2013.
21. S. Sherman, D. A. Paley, and N. M. Wereley. Parallel simulation of transient magnetorheological direct shear flows using millions of particles. *IEEE Trans. Magnetism*, 48(11):3517–3520, 2012.
20. **L. DeVries**, S. J. Majumdar, and D. A. Paley. Observability-based optimization of coordinated sampling trajectories for recursive estimation of a strong, spatially varying flowfield. *J. Intelligent and Robotic Systems*, 67(3-4):527–544, 2012.
19. **S. Butail**, N. Manoukis, M. Diallo, J. M. Ribeiro, T. Lehmann, and D. A. Paley. Reconstructing the flight kinematics of swarming and mating in wild mosquitoes. *J. Royal Society Interface*, 9(75):2624–2638, 2012.
18. **L. DeVries** and D. A. Paley. Multivehicle control in a strong flowfield with application to hurricane sampling. *AIAA J. Guidance, Control, and Dynamics*, 35(3):794–806, 2012.
17. **S. Butail** and D. A. Paley. Three-dimensional reconstruction of the fast-start swimming kinematics of densely schooling fish. *J. Royal Society Interface*, 9(66):77–88, 2012.
16. **R. Mellish**, **S. Napora**, and D. A. Paley. Backstepping control design for motion coordination of self-propelled vehicles in a flowfield. *Int. J. Robust and Nonlinear Control*, 21(12):1452–1466, 2011.
15. **C. Peterson** and D. A. Paley. Multivehicle coordination in an estimated time-varying flowfield. *AIAA J. Guidance, Control, and Dynamics*, 34(1):177–191, 2011.
14. **S. Hernandez** and D. A. Paley. Three-dimensional motion coordination in a spatiotemporal flowfield. *IEEE Trans. Automatic Control*, 55(12):2805–2810, 2010.
13. L. Techy, D. A. Paley, and C. A. Woolsey. Unmanned aerial vehicle coordination on closed convex paths in wind. *AIAA J. Guidance, Control, and Dynamics*, 33(6):1946–1951, 2010.
12. N. E. Leonard, D. A. Paley, R. E. Davis, D. M. Fratantoni, F. Lekien, and F. Zhang. Coordinated control of an underwater glider fleet: An adaptive ocean sampling field experiment in Monterey Bay. *J. Field Robotics*, 27(6):718–740, 2010.
11. D. A. Paley and **C. Peterson**. Stabilization of collective motion in a time-invariant flowfield. *AIAA J. Guidance, Control, and Dynamics*, 32(3):771–779, 2009.
10. D. A. Paley. Stabilization of collective motion on a sphere. *Automatica*, 45(1):212–216, 2009.

9. D. A. Paley, F. Zhang, and N. E. Leonard. Cooperative control for ocean sampling: The Glider Coordinated Control System. *IEEE Trans. Control Systems Technology*, 16(4):735–744, 2008.
8. R. Sepulchre, D. A. Paley, and N. E. Leonard. Stabilization of planar collective motion with limited communication. *IEEE Trans. Automatic Control*, 53(3):706–719, 2008.
7. D. A. Paley, N. E. Leonard, and R. Sepulchre. Stabilization of symmetric formations to motion around convex loops. *Systems & Control Letters*, 57(3):209–215, 2008.
6. F. Zhang, D. M. Fratantoni, D. A. Paley, J. M. Lund, and N. E. Leonard. Control of coordinated patterns for ocean sampling. *Int. J. Control*, 80(7):1186–1199, 2007.
5. D. A. Paley, N. E. Leonard, R. Sepulchre, D. Grünbaum, and J. K. Parrish. Oscillator models and collective motion: Spatial patterns in the dynamics of engineered and biological networks. *IEEE Control Systems*, 27(4):89–105, 2007.
4. R. Sepulchre, D. A. Paley, and N. E. Leonard. Stabilization of planar collective motion: All-to-all communication. *IEEE Trans. Automatic Control*, 52(5):811–824, 2007.
3. N. E. Leonard, D. A. Paley, F. Lekien, R. Sepulchre, D. M. Fratantoni, and R. E. Davis. Collective motion, sensor networks and ocean sampling. *Proc. IEEE*, 95(1):48–74, 2007.
2. E. Fiorelli, N. E. Leonard, P. Bhatta, D. A. Paley, R. Bachmayer, and D. M. Fratantoni. Multi-AUV control and adaptive sampling in Monterey Bay. *IEEE J. Oceanic Engineering*, 31(4):935–948, 2006.
1. D. Raj, D. Paley, A. W. Anderson, R. P. Kennan, and J. C. Gore. A model for susceptibility artefacts from respiration in functional echo-planar magnetic resonance imaging. *Phys. Med. Biol.*, 45(12):3809–3820, 2000.

## II.D. Published Conference Proceedings

### II.D.1. Refereed Conference Proceedings

80. A. Wolek, S. Cheng, D. Goswami, and D. A. Paley. Cooperative mapping and target search over a unknown occupancy graph using mutual information. Submitted.
79. J. Lidard, D. Goswami, D. Snyder, G. Sedky, A. Jones, and D. A. Paley. Output feedback control for lift maximization of a pitching airfoil. Accepted for presentation at *SciTech 2020*.
78. H. Nguemou-Hyousse, W. Scott, and D. A. Paley. Distributed control of a planar elastic rod model for caterpillar-inspired locomotion. To appear in *Proc. DSCC'19*.
77. J. Lee, S. Santana, B. Free, and D. A. Paley. State-feedback control of an internal rotor for propelling and steering a flexible fish-inspired underwater vehicle. In *Proc. American Control Conf.*, pages 2011–2016, Philadelphia, Pennsylvania, 2019.

76. **J. Boehm**, E. Berkenpas, C. Shepard, and D. A. Paley. Feedback-linearizing control for velocity and attitude tracking of an ROV with thruster dynamics containing input dead zones. In *Proc. American Control Conf.*, pages 5699–5704, Philadelphia, Pennsylvania, 2019.
75. **D. F. Gomez** and D. A. Paley. Closed-loop control of the position of a single vortex relative to an actuated cylinder. In *Proc. American Control Conf.*, pages 3563–3568, Philadelphia, Pennsylvania, 2019.
74. **W. Craig, J. T. Lewis**, and D. A. Paley. Stabilization of a quadrotor in wind with flow sensing: Linear modeling and control for attitude and position hold. In *Proc. VFS Autonomous VTOL Technical Meeting*, pages 1–10, Mesa, Arizona, January 2019.
73. **W. Craig**, D. Yeo, and D. A. Paley. Geometric control of a quadrotor in wind with flow sensing and thrust constraints: Attitude and position control. In *Proc. AIAA SciTech*, number AIAA-2019-1192, San Diego, California, 2019. Invited session on “Autonomous Small UAS Urban Flight”.
72. **D. F. Gomez**, F. D. Lagor, P. B. Kirk, A. Lind, A. Jones, and D. A. Paley. Unsteady DMD-based flow field estimation from embedded pressure sensors in actuated airfoils. In *Proc. AIAA SciTech*, number AIAA-2019-0346, San Diego, California, 2019. Invited session on “Unsteady Aerodynamics — Surging and Surging/Pitching”.
71. **D. Goswami, E. Thackray**, and D. A. Paley. Constrained Ulam Dynamic Mode Decomposition: Approximation of Perron-Frobenius Operator for Deterministic and Stochastic Systems. In *Proc. IEEE Conf. Decision and Control*, pages 1–6, Miami Beach, Florida, 2019. Invited session on “Koopman Operator Techniques in Nonlinear Control Theory”.
70. **H. Nguewou-Hyousse** and D. A. Paley. Microfluidic circuit dynamics and control for caterpillar-inspired locomotion in a soft robot. In *Proc. IEEE Conf. Control Technology and Applications*, pages 286–293, Copenhagen, Denmark, August 2018.
69. **B. Free**, M. McHenry, and D. A. Paley. Non-deterministic predator-prey model with accelerating prey. In *Proc. American Control Conf.*, pages 1202–1207, Milwaukee, Wisconsin, June 2018.
68. **D. Goswami** and D. A. Paley. Global bilinearization and controllability of control-affine nonlinear systems: A Koopman spectral approach. In *Proc. IEEE Conf. Decision and Control*, pages 6107–6112, Melbourne, Australia, December 2017.
67. **W. Scott** and D. A. Paley. Geometric gait design for a starfish-inspired robot with curvature-controlled soft actuators. In *Proc. ASME Dynamic Systems and Control Conf.*, pages 1–9, Tysons Corner, Virginia, 2017.
66. **W. Craig** and D. A. Paley. Geometric control of quadrotor attitude in wind with flow sensing and thrust constraints. In *Proc. ASME Dynamic Systems and Control Conf.*, pages 1–8, Tysons Corner, Virginia, 2017.



65. **D. Shishika, K. Sherman,** and D. A. Paley. Competing swarms of autonomous vehicles: Intruders versus guardians. In *Proc. ASME Dynamic Systems and Control Conf.*, pages 1–10, Tysons Corner, Virginia, 2017.
64. **D. Goswami** and D. A. Paley. Non-Gaussian estimation and observer-based feedback using the Gaussian Mixture Kalman and Extended Kalman Filters. In *Proc. American Control Conf.*, pages 4550–4555, Seattle, Washington, May 2017.
63. **B. Free, M. Patnaik,** and D. A. Paley. Observability-based path-planning and flow-relative control of a bioinspired sensor array in a Karman vortex street. In *Proc. American Control Conf.*, pages 548–556, Seattle, Washington, May 2017.
62. **D. Shishika** and D. A. Paley. Mosquito-inspired swarming for decentralized pursuit with autonomous vehicles. In *Proc. American Control Conf.*, pages 923–929, Seattle, Washington, May 2017.
61. **B. Barkley** and D. A. Paley. Multi-target tracking and data association on road networks using unmanned aerial vehicles. In *Proc. IEEE Aerospace Conf.*, pages 1–11, Big Sky, Montana, March 2017.
60. P. Nolan, K. Kroeger, and D. A. Paley. Multi-UAS path-planning for non-uniform data collection in precision agriculture. In *Proc. IEEE Aerospace Conf.*, pages 1–12, Big Sky, Montana, March 2017.
59. **N. Lauer, D. Yeo, D. Snyder,** and D. A. Paley. Tip-vortex localization for cross-stream position control of a multi-hole probe relative to a stationary wing in a free-jet wind tunnel. In *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA 2017-1484, Grapevine, Texas, 2017.
58. **D. Yeo** and D. A. Paley. The AUSS FIREfly: A distributed sensing and co-ordination platform for first-year engineering education. In *55th Aerospace Sciences Meeting, AIAA SciTech Forum*, number AIAA 2017-0512, Grapevine, Texas, 2017.
57. **W. Craig, D. Yeo,** and D. A. Paley. Dynamics of a Rotor-Pendulum With a Small, Stiff Propeller in Wind. In *Proc. 2016 ASME Dynamic Systems and Control Conf.*, pages 1–10, Minneapolis, Minnesota, 12 October 2016.
56. **F. Zhang, P. Washington,** and D. A. Paley. A flexible, reaction-wheel-driven fish robot: Flow sensing and flow-relative control. In *Proc. American Control Conf.*, pages 1221–1226, Boston, Massachusetts, July 2016.
55. **F. D. Lagor, A. Davis,** K. Ide, and D. A. Paley. Non-Gaussian estimation of a two-vortex flow using a Lagrangian sensor guided by output feedback control. In *Proc. American Control Conf.*, pages 1030–1035, Boston, Massachusetts, July 2016.
54. **B. Barkley** and D. A. Paley. Cooperative Bayesian target detection on a real road network using aerial vehicles. In *Proc. Int. Conf. Unmanned Aircraft Systems*, Arlington, Virginia, June 2016.
53. H. Lei, M. A. Sharif, D. A. Paley, M. J. McHenry, and X. Tan. Performance improvement of IPMC flow sensors with a biologically inspired cupula struc-

- ture. In Y. Bar-Cohen, editor, *Electroactive Polymer Actuators and Devices (EAPAD) XVIII*, volume 9798 of *Proc. SPIE*, page 979873, 2016.
52. **D. Yeo**, N. Sydney, and D. A. Paley. Onboard flow sensing for rotary-wing UAV pitch control in wind. In *Proc. AIAA Guidance, Navigation and Control Conf.*, number AIAA 2016-1386, San Diego, California, 2016.
  51. **D. Shishika** and D. A. Paley. Lyapunov stability analysis of a mosquito-inspired swarm model. In *Proc. 54th IEEE Conf. Decision and Control*, pages 482–488, Osaka, Japan, December 2015.
  50. **F. D. Lagor**, K. Ide, and D. A. Paley. Touring invariant-set boundaries of a two-vortex system using streamline control. In *Proc. 54th IEEE Conf. Decision and Control*, pages 2217–2222, Osaka, Japan, December 2015.
  49. **F. Zhang**, **F. D. Lagor**, **D. Yeo**, **P. Washington**, and D. A. Paley. Distributed flow sensing using Bayesian estimation for a flexible fish robot. In *Proc. ASME Dynamic Systems and Control Conf.*, number DSCC2015-9732, pages 1–10, Columbus, Ohio, October 2015.
  48. **D. Shishika**, J. K. Yim, and D. A. Paley. Bio-inspired pursuit with autonomous hovercraft using Lyapunov-based control. In *Proc. American Control Conf.*, pages 3107–3113, Chicago, Illinois, July 2015.
  47. **C. G. Hooi**, **F. D. Lagor**, and D. A. Paley. Flow sensing for height estimation and control of a rotor in ground effect: Modeling and experimental results. In *Proc. American Helicopter Society Forum 71*, Virginia Beach, Virginia, 5–7 May 2015.
  46. **C. G. Hooi**, **F. D. Lagor**, and D. A. Paley. Flow sensing, estimation and feedback control for rotorcraft landing in ground effect. In *Proc. IEEE Aerospace Conference*, pages 1–8, Big Sky, Montana, March 2015.
  45. **D. Yeo**, **N. Sydney**, D. A. Paley, and D. Sofge. Onboard flow sensing for downwash detection and avoidance with a small quadrotor helicopter. In *Proc. AIAA Guidance, Navigation and Control Conf.*, number AIAA 2015-1769, pages 1–11, Orlando, Florida, January 2015.
  44. **D. Yeo**, E. Shrestha, D. A. Paley, and E. Atkins. Experimental development of a rotorcraft UAV downwash model for real-time disturbance localization and avoidance. In *Proc. AIAA Atmospheric Flight Mechanics Conf.*, number AIAA 2015-1685, pages 1–14, Orlando, Florida, January 2015.
  43. **N. Sydney**, **B. Smyth**, and D. A. Paley. Dynamic control of autonomous quadrotor flight in an estimated wind field. In *Proc. IEEE Conf. Decision and Control*, pages 3609–3616, Florence, Italy, December 2013.
  42. **T. Severson** and D. A. Paley. Distributed multi-target search and track assignment using consensus-based coordination. In *Proc. IEEE SENSORS*, number 7504, pages 1474–1477, Baltimore, Maryland, November 2013.
  41. **L. DeVries** and D. A. Paley. Wake estimation and dynamic control for autonomous aircraft in formation flight. In *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA-2013-4705, Boston, Massachusetts, August 2013.

40. **F. D. Lagor, L. DeVries, K. Waychoff,** and D. A. Paley. Bio-inspired flow sensing and control for autonomous underwater navigation using distributed pressure measurements. In *Proc. 18th Int. Symp. Unmanned Untethered Submersible Tech.*, Portsmouth, New Hampshire, August 2013.
39. **L. DeVries** and D. A. Paley. Observability-based optimization for flow sensing and control of an underwater vehicle in a uniform flowfield. In *Proc. American Control Conf.*, pages 1388–1393, Washington, District of Columbia, June 2013. Invited session on “Vehicle control and estimation in the undersea environment”.
38. **N. Sydney** and D. A. Paley. Optimal sampling of nonstationary spatiotemporal fields using a mobile sensory network. In *Proc. 3rd IFAC Workshop on Distributed Estimation and Control in Networked Systems*, Santa Barbara, California, September 2012.
37. **L. DeVries** and D. A. Paley. Dynamic altitude control for motion coordination in an estimated shear flow. In *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA-2012-4696, Minneapolis, Minnesota, August 2012.
36. **L. DeVries, S. Majumdar,** and D. A. Paley. Observability-based optimization of coordinated sampling trajectories for flowfield estimation. In *Proc. Int. Conf. Unmanned Aircraft Systems*, Philadelphia, Pennsylvania, June 2012.
35. **T. Severson** and D. A. Paley. Distributed optimization for radar mission coordination. In *Proc. American Control Conf.*, pages 5102–5107, Montreal, Canada, June 2012.
34. **S. Butail, A. Chicoli,** and D. A. Paley. Putting the fish in the fish tank: Immersive VR for animal behavior experiments. In *Proc. Int. Conf. Robotics and Automation*, pages 5018–5023, Saint Paul, Minnesota, May 2012.
33. **R. Mellish** and D. A. Paley. Motion coordination of planar rigid bodies. In *Proc. IEEE Conf. Decision and Control*, pages 4897–4902, Orlando, Florida, December 2011.
32. **N. Sydney** and D. A. Paley. Multi-vehicle control and optimization for spatiotemporal sampling. In *Proc. IEEE Conf. Decision and Control*, pages 5607–5612, Orlando, Florida, December 2011. Invited session on “Consensus algorithms, cooperative control, and distributed optimization”.
31. **S. Butail, N. C. Manoukis, D. Moussa, A. S. Yaro, A. Dao, C. Traoré, J. Ribeiro, T. Lehmann,** and D. A. Paley. 3D tracking of mating events in wild swarms of the malaria mosquito *Anopheles gambiae*. In *Proc. 33rd Int. Conf. IEEE Engineering in Medicine and Biology Society*, pages 720–723, Boston, Massachusetts, August 2011.
30. **S. Sherman,** D. A. Paley, and N. Wereley. Massively parallel simulations of chain formation and restructuring dynamics in a magnetorheological fluid. In *Proc. ASME Conf. Smart Materials, Adaptive Structures and Intelligent Systems*, number SMASIS2011-5188, Scottsdale, Arizona, September 2011.

29. **C. Peterson** and D. A. Paley. Distributed estimation for motion coordination in an unknown spatiotemporal flowfield. In *Proc. AIAA Guidance, Navigation, and Control Conf.*, number AIAA-2011-6481, Portland, Oregon, August 2011.
28. **L. DeVries** and D. A. Paley. Multi-vehicle control in a strong flowfield with application to hurricane sampling. In *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA-2011-6478, Portland, Oregon, August 2011.
27. **S. Napora** and D. A. Paley. Observer-based feedback control for stabilization of collective motion. In *Proc. American Control Conf.*, pages 3996–4001, San Francisco, California, June 2011.
26. *N. Mahmoudian* and D. A. Paley. Synchronization on the N-torus with noisy measurements. In *Proc. American Control Conf.*, pages 4014–4019, San Francisco, California, June 2011.
25. **N. Sydney, S. Napora**, and D. A. Paley. A multi-vehicle testbed for underwater motion coordination. In *Proc. Performance Metrics for Intelligent Systems Workshop, Invited paper*, Baltimore, Maryland, September 2010.
24. **R. Mellish** and D. A. Paley. Backstepping control design for motion coordination of self-propelled vehicles. In *Proc. IEEE Conf. Decision and Control*, pages 5468–5473, Atlanta, Georgia, December 2010.
23. **C. Peterson** and D. A. Paley. Multi-vehicle coordination of autonomous vehicles in an unknown flowfield. In *Proc. AIAA Conf. Guidance, Navigation, and Control*, number AIAA-2010-7585, Toronto, Canada, August 2010.
22. D. A. Paley and A. K. Baharani. Critical damping in a kinetic interaction network. In *Proc. American Control Conf.*, pages 4628–4633, Baltimore, Maryland, July 2010.
21. **S. Butail** and D. A. Paley. 3D reconstruction of fish schooling kinematics from underwater video. In *Proc. IEEE Int. Conf. on Robotics and Automation*, pages 2438–2443, Anchorage, Alaska, May 2010.
20. **S. Hernandez** and D. A. Paley. Three-dimensional motion coordination in a time-invariant flowfield. In *Proc. Combined 48th IEEE Conf. on Decision and Control and 28th Chinese Control Conf.*, pages 7043–7048, Shanghai, China, 2009.
19. **S. Butail** and D. A. Paley. Vision-based estimation of three-dimensional position and pose of multiple underwater vehicles. In *Proc. IEEE/RSJ Int. Conf. Intelligent Robots and Systems*, pages 2477–2482, St. Louis, Missouri, 2009.
18. L. Techy, D. A. Paley, and C. A. Woolsey. UAV coordination on convex curves in wind: An environmental sampling application. In *Proc. 2009 European Control Conf.*, pages 4967–4972, Budapest, Hungary, August 2009.
17. **C. Peterson** and D. A. Paley. Cooperative control of unmanned vehicles in a time-varying flowfield. In *Proc. AIAA Guidance, Navigation, and Control Conf.*, number AIAA-2009-6117, Chicago, Illinois, August 2009. Invited session on “UAV Flight in Complex Atmospheric Conditions”.
16. D. A. Paley, L. Techy, and C. A. Woolsey. Coordinated perimeter patrol with minimum-time alert response. In *Proc. AIAA Guidance, Navigation, and Con-*

*trol Conf.*, number AIAA-2009-6210, Chicago, Illinois, August 2009. Invited session on “UAV Cooperative Control Technologies for Integrated Defense”.

15. **S. Hernandez** and D. A. Paley. Stabilization of collective motion in a time-invariant flow field on a rotating sphere. In *Proc. American Control Conf.*, pages 623–628, St. Louis, Missouri, June 2009.
14. D. A. Paley and **D. S. Warshawsky**. Reduced-order dynamic modeling and stabilizing control of a micro-helicopter. In *Proc. 47th AIAA Aerospace Sciences Meeting*, number AIAA-2009-1350, Orlando, Florida, January 2009. (9 pages).
13. D. A. Paley. Cooperative control of an autonomous sampling network in an external flow field. In *Proc. 47th IEEE Conf. Decision and Control*, pages 3095–3100, Cancun, Mexico, December 2008.
12. D. A. Paley. Stabilization of collective motion in a uniform and constant flow field. In *Proc. AIAA Guidance, Navigation and Control Conf. and Exhibit*, number AIAA-2008-7173, Honolulu, Hawaii, August 2008. (8 pages).
11. D. A. Paley, N. E. Leonard, R. Sepulchre, and I. D. Couzin. Spatial models of bistability in biological collectives. In *Proc. 46th IEEE Conf. Decision and Control*, pages 4851–4856, New Orleans, Louisiana, December 2007.
10. D. A. Paley, N. E. Leonard, and R. Sepulchre. Collective motion of self-propelled particles: Stabilizing symmetric formations on closed curves. In *Proc. 45th IEEE Conf. Decision and Control*, pages 5067–5072, San Diego, California, December 2006.
9. R. Sepulchre, D. A. Paley, and N. E. Leonard. Group coordination and cooperative control of steered particles in the plane. In K. Y. Pettersen, J. T. Gravdahl, and H. Nijmeijer, editors, *Group Coordination and Cooperative Control*, number 336 in Lecture Notes in Control and Information Sciences, pages 217–232. Springer, 2006.
8. D. A. Paley, N. E. Leonard, and R. Sepulchre. Oscillator models and collective motion: Splay state stabilization of self-propelled particles. In *Proc. Joint 44th IEEE Conf. Decision and Control and European Control Conf.*, pages 3935–3940, Seville, Spain, December 2005.
7. J. Jeanne, N. E. Leonard, and D. Paley. Collective motion of ring-coupled planar particles. In *Proc. Joint 44th IEEE Conf. Decision and Control and European Control Conf.*, pages 3929–3934, Seville, Spain, December 2005.
6. P. Bhatta, E. Fiorelli, F. Lekien, N. E. Leonard, D. A. Paley, F. Zhang, R. Bachmayer, R. E. Davis, D.M. Fratantoni, and R. Sepulchre. Coordination of an underwater glider fleet for adaptive ocean sampling. In *Proc. Int. Workshop on Underwater Robotics for Sustainable Management of Marine Ecosystems and Environmental Monitoring*, pages 61–69, Genoa, Italy, November 2005.
5. R. Sepulchre, D. Paley, and N. E. Leonard. Graph Laplacian and Lyapunov design of collective planar motions. In *Proc. Int. Symp. Nonlinear Theory and its Applications*, pages 217–232, Bruges, Belgium, October 2005.

4. D. Paley, N. E. Leonard, and R. Sepulchre. Collective motion: Bistability and trajectory tracking. In *Proc. 43rd IEEE Conf. Decision and Control*, pages 1932–1937, Paradise Island, Bahamas, December 2004.
3. R. Sepulchre, D. Paley, and N. Leonard. Stabilization of collective motion of self-propelled particles. In *Proc. 16th Int. Symp. Mathematical Theory of Networks and Systems (electronic)*, Leuven, Belgium, July 2004. (10 pages).
2. E. Fiorelli, N. E. Leonard, P. Bhatta, D. Paley, R. Bachmayer, and D. M. Fratantoni. Multi-AUV control and adaptive sampling in Monterey Bay. In *Proc. IEEE Autonomous Underwater Vehicles 2004: Workshop on Multiple AUV Operations*, pages 134–147, Sebasco Estates, Maine, June 2004.
1. R. Bachmayer, N. Leonard, J. Graver, E. Fiorelli, P. Bhatta, and D. Paley. Underwater gliders: Recent developments and future applications. In *Proc. IEEE Symp. Underwater Technology*, pages 195–200, Tapei, Taiwan, April 2004.

## II.E. Conferences, Workshops, and Talks

### II.E.2. Invited Talks

54. Multi-vehicle control and autonomy for swarming quadrotors. University of Colorado Boulder, Boulder, Colorado, 7 March 2019.
53. Multi-vehicle control and autonomy for swarming quadrotors. The Johns Hopkins Applied Research Laboratory, Laurel, Maryland, 16 January 2019.
52. Locomotion dynamics and control of bioinspired soft robots. *Mechanical and Aerospace Engineering Seminar*, Tandon School of Engineering, New York University, New York, New York, 30 November 2018.
51. Bifurcations in dynamical control systems for aerospace applications. *Applied Dynamics Seminar*, Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, Maryland, 18 October 2018.
50. Locomotion dynamics and control of bioinspired soft robots. *Mechanical and Aerospace Engineering Seminar*, Ira A. Fulton Schools of Engineering, Arizona State University, Tempe, Arizona, 15 May 2018.
49. Locomotion dynamics and control in bioinspired soft robots. *IAI Colloquium*, Institute for Systems Research, University of Maryland, College Park, Maryland, 4 October 2017.
48. Bio-inspired propulsion, sensing and control for a novel underwater vehicle. *Marine Propulsion & Design: Inspirations from Nature TechSurge*, Marine Technological Society, Norfolk, Virginia, 19 July 2017.
47. Dynamics and control of legged locomotion in bioinspired soft robots. *Robotics Institute Seminar*, Carnegie Mellon University, Pittsburgh, Pennsylvania, 13 July 2017.
46. Autonomous underwater vehicle research in the Collective Dynamics and Control Laboratory. *NSF REU Bioinspired Robotics Seminar*, University of Maryland, College Park, Maryland, 5 July 2017.
45. Autonomous underwater vehicle research in the Collective Dynamics and Control Laboratory. *Innovation Lab Seminar*, Northrup Grumman Corporation, Annapolis, Maryland, 21 March 2017.

44. Data-driven modeling of collective behavior in animal groups. *Statistical Physics Seminar Series*, University of Maryland, College Park, Maryland, 28 February 2017.
43. Autonomy underwater: Ocean sampling by autonomous underwater vehicles. *U.S. Frontiers of Engineering Symposium*, National Academy of Engineering, Irvine, California, 19 September 2016.
42. Social and ecological factors influencing collective behavior in fish. *Physics Colloquium*, Gettysburg College, Gettysburg, Pennsylvania, 15 April 2016.
41. Research in the Collective Dynamics and Control Laboratory. *Lockheed Martin Logistics Innovation Conference*, hosted by the University of Maryland, College Park, Maryland, 5 November 2015.
40. Bio-inspired propulsion, sensing, and control for a novel underwater vehicle. *Science of Autonomy Program Review*, Office of Naval Research, Arlington, Virginia, 13 August 2015.
39. Bio-inspired flow sensing and control for a fish-inspired underwater vehicle. *Department of Electrical Engineering Seminar Series*, Michigan State University, East Lansing, Michigan, 26 March 2015.
38. Unmanned autonomous systems research in the Collective Dynamics and Control Laboratory. *Intelligent Robotics Laboratory*, Lockheed Martin Advanced Technologies Laboratories, Cherry Hill, New Jersey, 11 March 2015.
37. Distributed sensing and feedback control of autonomous aerospace vehicles. *College of Engineering Invited Seminar*, The Pennsylvania State University, State College, Pennsylvania, 16 February 2015.
36. Bio-inspired flow sensing, control, and actuation for autonomous underwater vehicles. *Department of Mechanical & Aerospace Engineering Seminar Series*, George Washington University, Washington DC, 5 November 2014.
35. Distributed estimation and control for bio-inspired (soft) robotics. *Symposium on Autonomy*, Center for Energetic Concepts Development, Department of Mechanical Engineering, University of Maryland, College of Park, Maryland, 15 May 2014.
34. Motion coordination and information transmission in bio-groups. *Research Day*, Neuroscience and Cognitive Science Program, University of Maryland, College Park, Maryland, 18 April 2014.
33. Collective dynamics and control in engineered and biological groups. *Workshop on the Fundamentals of Research Administration*, Office of Research Administration, University of Maryland, College Park, Maryland, 17 February 2014.
32. Bio-inspired flow sensing and control for autonomous underwater vehicles. *Center for Control, Dynamical Systems and Computations Seminar Series*, College of Engineering, University of California Santa Barbara, Santa Barbara, California, 14 February 2014.

31. Motion coordination and information transmission in bio-groups. *Conference on Active Processes in Living and Nonliving Matter*, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, 13 February 2014.
30. Bio-inspired flow sensing and control for autonomous underwater vehicles. *Intelligent Automation, Inc. Colloquia Series*, Institute for Systems Research, University of Maryland, College Park, Maryland, 5 February 2014.
29. Motion coordination and information transmission in bio-groups. *Coordinated Control: Models and Mechanisms from Collective Animal Behavior*, Tutorial Session, 52nd IEEE Conf. Decision and Control, Florence, Italy, December 2013.
28. Multi-vehicle control and optimization for spatiotemporal sampling. *Aerospace Control and Guidance Systems Committee Meeting*, Annapolis, Maryland, 17 October 2013.
27. Multi-vehicle estimation and control for the optimization of spatiotemporal sampling. *Aerospace Engineering Graduate Seminar Series*, Department of Aerospace Engineering, University of Michigan, 28 February 2013.
26. Multi-vehicle estimation and control for the optimization of spatiotemporal sampling. Mechanical Engineering & Mechanics Department, Drexel University, 15 February 2013.
25. Motion coordination and information transmission in bio-groups: From mating mosquitoes to frightened fish. *Workshop on kinetic description of social dynamics: From consensus to flocking*, NSF Research Network in Mathematical Sciences, Center for Scientific Computation and Mathematical Modeling, University of Maryland, 5 November 2012.
24. Multi-vehicle control and optimization for spatiotemporal sampling. *Booz Allen Hamilton Distinguished Colloquium Series in Electrical and Computer Engineering*, University of Maryland, 26 October 2012.
23. Multi-vehicle control and optimization for spatiotemporal sampling. *NEXTOR Research Seminar*, University of Maryland, 25 June 2012.
22. Multi-vehicle control and optimization for spatiotemporal sampling. *Decision and Controls Laboratory Seminar Speaker Series*, Georgia Institute of Technology, Atlanta, Georgia, 6 April 2012.
21. Dynamics of collective behavior in bio-groups. *Frontiers in Mathematical Biology: Young Investigators Conference*, Center for Scientific Computation and Mathematical Modeling, University of Maryland, College Park, Maryland, 29 February 2012.
20. Autonomous motion coordination of unmanned Naval platforms in a dynamic flowfield. *ONR Unmanned Systems Review*, Panama City, Florida, 1 February 2012.
19. Motion coordination in a dynamic flowfield: From biological experiments to robotic applications. *General Robotics, Automation, Sensing and Perception (GRASP) Seminar*, University of Pennsylvania, Philadelphia, Pennsylvania, 28 October 2011.



18. Autonomous motion coordination of unmanned Naval platforms in a dynamic flowfield. *ONR Science of Autonomy Workshop*, Arlington, Virginia, 6 April 2011.
17. Dynamics and control of collective behavior in biological and engineered groups. *Applied Dynamics Seminar*, University of Maryland, College Park, Maryland, 10 February 2011.
16. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *NSF Workshop on New Directions in Dynamical Systems Inspired by Biological, Energy, Environmental and Information Sciences*, NSF CMMI Research and Innovation Conference, Atlanta, Georgia, 4 January 2011.
15. Motion coordination of autonomous Naval platforms in dynamic flowfields. *Systems Engineering Seminar*, U.S. Naval Academy, Annapolis, Maryland, 1 November 2010.
14. Cooperative control of unmanned vehicles for coordinated sampling in a dynamic flowfield. *Meteorology and Physical Oceanography Department Seminar*, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida, 18 Aug 2010.
13. Autonomous motion coordination of unmanned Naval platforms in a dynamic flowfield. *ONR Science of Autonomy Workshop*, Naval Research Lab, Washington DC, 3 June 2010.
12. Autonomous motion coordination of unmanned Naval platforms in a dynamic flowfield. *ONR Joint Review of Unmanned Systems Technology Review*, Panama City, Florida, 27 January 2010.
11. Autonomous motion coordination of unmanned vehicles in a flowfield. *Institute of Vibration Engineering Research*, Nanjing University of Aeronautics and Astronautics, 16 December 2009.
10. Autonomous motion coordination in a spatiotemporal flowfield. *Laboratory for Computational Sensing and Robotics*, The Johns Hopkins University, 4 November 2009.
9. Observing networks: Motion coordination and information transmission. *Collective Animal Behavior Seminar*, Princeton University, Princeton, New Jersey, 4 June 2009.
8. Fish-inspired strategies for information transmission and motion coordination. *International Workshop on Bio-Inspired Sensing and Actuation Technologies for Civil and Mechanical Systems*, National Center for Research on Earthquake Engineering, Taipei, Taiwan, 15 April 2009.
7. Collective dynamics and control. *Global Engagement Department Seminar*, The Johns Hopkins Applied Research Laboratory, Laurel, Maryland, 25 March 2009.
6. UAV control for collective motion in a dynamic environment. *Control Design and Analysis Branch Seminar*, Air Vehicles Directorate, Air Force Research Lab, Wright Patterson Air Force Base, Ohio, 5 November 2008.

5. Cooperative control of autonomous vehicles for environmental sampling. *Bio-dynamics Seminar*, Department of Aeronautics and Astronautics, University of Washington, Seattle, Washington, 7 March 2008.
4. Adaptive sampling with underwater gliders: Trajectory optimization, feedback stabilization, and operational implementation. *Ocean Dynamics and Prediction Seminar*, Naval Research Lab, Code 7320, Stennis Space Center, Mississippi, 11 December 2007.
3. Cooperative control of a UUV fleet: Adaptive ocean sampling with underwater gliders fleet. Maritime Applied Physics Corporation, 7 November 2007.
2. Cooperative control of a sensor network: Adaptive sampling with autonomous underwater vehicles. *Signals and Systems Seminar*, Bradley Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, Virginia, 19 October 2007.
1. Cooperative control of collective motion for ocean sampling with autonomous vehicles. *Horn Point Laboratory Special Seminar*, University of Maryland Center for Environmental Science, Cambridge, Maryland, 20 September 2007.

#### II.E.5. Refereed Abstracts

23. N. N. Goldberg, X. Huang, C. Majidi, A. Novelia, O. M. O'Reilly, D. A. Paley, and W. Scott. Modeling locomotion in soft robots using planar discrete elastic rods. Accepted for presentation at *IMECE 2019*.
22. **K. Bhatu, T. Brosh, J. Bukhari, A. Del Colliano, A. Edwards, K. Jain, S. Katragadda, Z. Lacey, A. Modi, I. Moss, D. A. Paley, K. Rawal, R. Singh, Q. Wei, and A. Wolek.** The UMD Autonomous Micro Air Vehicle Team. Submitted.
21. **D. Gomez** and D. A. Paley. DMD-based estimation of the unsteady flow field around an actuated airfoil. Presented at *SIAM Conference on Dynamical Systems*, Invited minisymposium on “Data-Driven Methods for Flow Sensing, Estimation, and Control”, May 2019.
20. **D. Goswami** and D. A. Paley. Koopman-based control: bilinearization, controllability and optimal control of control-affine nonlinear systems. Presented at *SIAM Conference on Dynamical Systems*, Invited minisymposium on “Control Techniques based on Koopman Operator Theory”, May 2019.
19. **F. D. Lagor** and D. A. Paley. DMD-based estimation of the flow field behind a thin airfoil at high angles of attack by assimilating distributed pressure measurements. Presented at the *SIAM Conf. Control and its Applications*, Invited session on “Data Assimilation and Large-scale Estimation for Fluid Dynamics Problems”, July 2017.
18. **H. Nguewou** and D. A. Paley. Synchronization of RLC oscillators. Presented at the *APS March Meeting*, Session on “Robophysics”, March 2017.
17. D. A. Paley. Flow sensing and control for aerospace vehicles. Presented at *SIAM Conference on Control and Its Applications*, Paris, France, 8 August 2015.

16. **F. D. Lagor** and D. A. Paley. Multivehicle motion planning in the presence of ocean eddies. Presented at *SIAM Conference on Applications of Dynamical Systems*, May 2015.
15. **A. Chicoli** and D. A. Paley. Modeling the effect of group size on rheotactic behaviors. Presented at the *2015 Society for Integrative & Comparative Biology Annual Meeting*, January 2015.
14. **N. Sydney**, D. A. Paley, and D. Sofge. Physics-inspired robotic motion planning for cooperative Bayesian target detection. Presented at *Robotics Science and Systems 2014*, Workshop on Distributed Control and Estimation for Robotic Vehicle Networks, July 2014.
13. **A. Chicoli** and D. A. Paley. It's contagious: Modeling information transmission in collective groups. Presented at *Collective Intelligence 2014*, June 2014.
12. **D. Shishika**, N. C. Manoukis, S. Butail, and D. A. Paley. The dynamics of malarial mosquitoes in wild mating swarms. Presented at *17th U.S. National Congress on Theoretical & Applied Mechanics*, invited session on "Animal Dynamics", June 2014.
11. D. A. Paley, **L. DeVries**, and **N. Sydney**. Distributed control and optimization for spatiotemporal sampling. Presented at *SIAM Conference on Applications of Dynamical Systems*, 23 May 2013.
10. **L. DeVries** and D. A. Paley. Bio-inspired sensing and control of an underwater vehicle in a Karman vortex street. Presented at *SIAM Conference on Applications of Dynamical Systems*, 19 May 2013.
9. **A. Chicoli**, M. Baeder, and D. A. Paley. Collective anti-predator behavior due to individual-based rules and social information transmission. Presented at *Society for Integrative and Comparative Biology Annual Meeting*, January 2013.
8. **A. Chicoli** and D. A. Paley. A dynamic model for information transmission via visual and hydrodynamic sensing in fish schools. Int. Conf. on Flow Sensing in Air and Water, Bonn, Germany, 18 July 2011.
7. **L. DeVries**, **A. Maki**, D. Koch, S. Majumdar, and D. A. Paley. Improving hurricane forecasts using unmanned aircraft: Motion coordination in a strong flowfield. *SIAM Conference on Applications of Dynamical Systems*, Snowbird, Utah, 23 May 2011.
6. D. A. Paley and **N. Sydney**. Multi-vehicle control and optimization for spatiotemporal sampling. Invited session on "Motion Coordination of Robotic Networks for the Observation of Natural Phenomena," *SIAM Conference on Control and Its Applications*, Baltimore, Maryland, 26 July 2011.
5. D. A. Paley and **S. Butail**. Reconstruction and analysis of individual dynamics in fish schools and mosquito swarms. *SIAM Conference on Applications of Dynamical Systems*, Snowbird, Utah, 23 May 2011.
4. N. C. Manoukis, **S. Butail**, D. A. Paley, A. S. Yaro, M. Diallo, S. F. Traoré, A. Dao, J. M. C. Ribeiro, and T. Lehmann. Quantifying and analyzing dance of *Anopheles gambiae* in mating swarms. American Society of Tropical Medicine and Hygiene Annual Meeting, 3 November 2010.

3. N. C. Manoukis, **S. Butail**, D. A. Paley, A. S. Yaro, M. Diallo, S. F. Traoré, A. Dao, J. M. C. Ribeiro, and T. Lehmann. Quantifying and analyzing the mosquito dance in mating swarms. *Biology of Mosquito Vectors*, Johns Hopkins Malaria Research Institute, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, 8 June 2010.
2. D. A. Paley. Coupled oscillator models for analysis and control of interaction networks. *SIAM Conf. on Applications of Dynamical Systems*, session on “Collective Phenomena”, Snowbird, Utah, 17 May 2009.
1. D. A. Paley. Recent progress toward a cooperative control framework for planetary-scale sampling in strong and variable currents. *18th Int. Symp. on Mathematical Theory of Networks and Systems*, invited session on “Control of Complex Networks and Environmental Applications”, 28 July 2008.

#### II.E.10. Non-Refereed Abstracts

14. *F. Zhang* and D. A. Paley. Flow sensing and moment control of a soft bioinspired underwater robot. Submitted.
13. **L. DeVries** and D. A. Paley. Observability-based optimization of controlled sampling formations for flowfield estimation. AMS Spring Eastern Sectional Meeting, Data Assimilation Session, March 2014.
12. N. C. Manoukis, S. Butail, **D. Shishika**, D. A. Paley, and J. M. C. Ribeiro. 3d video analysis of male *Anopheles gambiae* mating behaviour in the field: Challenges and opportunities. 4th Research Co-ordination Meeting of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture on Biology of Male Mosquitoes in Relation to Genetic Control Programmes, Juazeiro, Bahia Brazil, March 2013.
11. **L. DeVries**, D. Koch, S. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *2012 NSF Engineering Research and Innovation Conf.*, Boston, Massachusetts, 9 July 2012.
10. J. Coleman, **S. Butail**, D. A. Paley, and S. Coombs. The spatiotemporal dynamics of rheotaxis in stream-dwelling fish under different flow and sensory conditions. Presented at the *10th Int. Conf. Neuroethology*, August 2012.
9. **A. Chicoli**, S. Coombs, and D. A. Paley. What’s flow got to do with it? Effects of flow on schooling and startle response in fish. Presented at the *10th Int. Conf. Neuroethology*, August 2012.
8. **N. Sydney** and D. A. Paley. Multi-vehicle control and optimization for spatiotemporal sampling. Presented at the *Ocean Sciences Meeting*, February 2012.
7. D. Koch, **L. DeVries**, **A. Maki**, D. A. Paley, and S. Majumdar. Observing system simulation experiments for coordinated unmanned aircraft in hurricanes. Presented at the *16th Conf. on Integrated Observing and Assimilation Systems for Atmosphere, Oceans, and Land Surface*, 22 January 2012.
6. **L. DeVries**, D. Koch, **A. Maki**, S. Majumdar, and D. A. Paley. New algorithms for targeting coordinated observations of hurricanes using multiple unmanned

aircraft. Presented at the *16th Symp. on Integrated Observing and Assimilation Systems for Atmosphere, Oceans, and Land Surface*, 22 January 2012.

5. **A. Chicoli, Y. Lun, S. Butail**, S. Coombs, and D. A. Paley. Making waves: Quantitative analysis of information transmission in schooling fish. Presented at the *Ann. Meeting Soc. for Integrative and Comparative Biology*, 4 January 2012.
4. **J. Lun, A. Chicoli, S. Butail**, S. Coombs, and D. A. Paley. Escape response probability of giant danios to select visual looming stimuli. *Soc. for Neuroscience Annual Meeting*, Washington, DC, 15 November 2011.
3. D. A. Koch, **A. Maki, L. DeVries**, D. A. Paley, and S. J. Majumdar. Observing system simulation experiments for unmanned aircraft in an idealized hurricane model framework. *91st Amer. Meteor. Soc. Ann. Meeting*, Seattle, Washington, 23 January 2011.
2. **A. Chicoli, Y. Lun, S. Butail**, S. Coombs, and D. A. Paley. Motion coordination for information transmission in schooling fish: Determining threat-detection sensitivity and response bias. *2011 NSF Engineering Research and Innovation Conf.*, Atlanta, Georgia, 5 January 2011.
1. **L. DeVries, A. Maki**, D. Koch, S. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *2011 NSF Engineering Research and Innovation Conf.*, Atlanta, Georgia, 5 January 2011.

#### II.E.11. Non-Refereed Posters

11. **F. Zhang** and D. A. Paley. Flow sensing and feedback control of a fish-inspired underwater vehicle. *30th Anniversary Celebration of the Institute for Systems Research*, University of Maryland, College Park, Maryland, 8 May 2015.
10. **D. Shishika** and D. A. Paley. Motion coordination in mosquito mating swarms. *30th Anniversary Celebration of the Institute for Systems Research*, University of Maryland, College Park, Maryland, 8 May 2015.
9. **F. D. Lagor** and D. A. Paley. Motion planning for ocean sampling in the presence of vortices. *11th Annual Symposium & 10th Anniversary Celebration of the Burgers Program for Fluid Dynamics*, University of Maryland, College Park, Maryland, 13 November 2014.
8. D. A. Paley, **N. Sydney**, and D. Sofge. Physics-inspired motion planning for Bayesian target detection with quadrotors. *3rd Annual Karles Invitational Conf.*, Naval Research Laboratory, Washington, DC, 13 January 2014.
7. **L. DeVries** and D. A. Paley. Autonomous underwater vehicle control using bio-inspired flow sensor arrays. Workshop on Biologically Inspired Based Strategies for Hybrid and Multi-Modal Locomotion, IEEE/RSJ International Conference on Intelligent Robots and Systems, 3 November 2013.
6. **L. DeVries**, D. Koch, S. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *2012 NSF Engineering Research and Innovation Conf.*, Boston, Massachusetts, 9 July 2012.

5. **J. Lun, A. Chicoli, S. Butail**, S. Coombs, and D. A. Paley. Escape response probability of giant danios to select visual looming stimuli. *Soc. for Neuroscience Annual Meeting*, Washington, DC, 15 November 2011.
4. D. A. Koch, **A. Maki, L. DeVries**, D. A. Paley, and S. J. Majumdar. Observing system simulation experiments for unmanned aircraft in an idealized hurricane model framework. *91st Amer. Meteor. Soc. Ann. Meeting*, Seattle, Washington, 23 January 2011.
3. **A. Chicoli, Y. Lun, S. Butail**, S. Coombs, and D. A. Paley. Motion coordination for information transmission in schooling fish: Determining threat-detection sensitivity and response bias. *2011 NSF Engineering Research and Innovation Conf.*, Atlanta, Georgia, 5 January 2011.
2. **L. DeVries, A. Maki**, D. Koch, S. Majumdar, and D. A. Paley. Targeting observations of tropical cyclones using unmanned aircraft: Motion coordination in a strong flowfield. *2011 NSF Engineering Research and Innovation Conf.*, Atlanta, Georgia, 5 January 2011.
1. N. C. Manoukis, **S. Butail**, D. A. Paley, A. S. Yaro, M. Diallo, S. F. Traoré, A. Dao, J. M. C. Ribeiro, and T. Lehmann. Quantifying and analyzing the mosquito dance in mating swarms. *2010 Research Advances in Malaria Conf.*, Johns Hopkins Malaria Research Institute, Baltimore, Maryland, 7 June 2010.

## II.H. Completed Creative Works

### II.H.5. Inventions

- Glider Coordinated Control System: Software framework for automatic control of multiple underwater vehicles. Joint invention with Naomi E. Leonard (Princeton University) and Fumin Zhang (Georgia Tech.) University of Maryland Intellectual Property Disclosure Number IS-2009-002.
- Multi-hole probe system for small UAS flow measurements: Flow measurement system that uses a unique probe geometry and calibration technique for low airspeeds. Joint Invention with Derrick Yeo (U. Maryland) and Ella Atkins (U. Michigan) University of Maryland Intellectual Property Disclosure Number PS-2016-015.
- Information-based Cooperative Mapping and Target Search. Joint Invention with Artur Wolek and Sheng Cheng (U. Maryland) University of Maryland Intellectual Property Disclosure Number IS-2019-062.

## II.J. Sponsored Research and Programs administered by the Office of Research Administration

*Total research funding: \$8,815,408 (\$7,643,602 external funding as PI)*

### II.J.1. Grants

- National Science Foundation, Planning Grant: Engineering Research Center for Adaptive Small-systems for data Analytic Pain Management (ERC-ASAP), \$100,000, 09/18–08/19, co-PI. (Share: %0)
- Air Force Office of Scientific Research, Uncertain, Data-Driven Observer-based Feedback Control of Unmanned Aerospace Systems, \$395,838, 03/18–02/21, PI. (Share: %100)

- National Geographic Graduate Research Fellowship, \$150,000, 04/17–07/20, PI (Share: %100)
- Office of Naval Research, SEA-STAR: Soft Echinoderm-Inspired Appendages for Strong Tactile Amphibious Robots, \$2,000,000, 01/17–12/20, PI. Co-PIs: Carmel Majidi, Robert Woord. (Share: %100)
- Army, University of Maryland Vertical Lift Research Center of Excellence, \$7,710,000, 08/16–08/21, co-PI. Principal Investigator: Inder Chopra. (Share: %5)
- Army Research Office & Office of Naval Research (jointly sponsored), 2nd UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics, \$20,000, 07/16–12/16, PI. (Share: %100)
- Army Research Office, Nonlinear Dynamics and Distributed Control for Soft Robot Locomotion, \$360,000, 05/16–04/19, PI. Co-PIs: Carmel Majidi, Oliver O'Reilly. (Share: %100)
- University of Maryland, First-Year Innovation & Research Experience Stream: Autonomous Unmanned Systems, \$225,000, 01/16–12/18, PI. Research Educator: Derrick Yeo. (Share: %100)
- Office of Naval Research, Bio-inspired Underwater Sensing and Control with Mechanosensitive Hairs, \$700,000, 05/15–04/18, PI. Co-investigators: Xiaobo Tan, Matt McHenry. (Share: %100)
- National Science Foundation, Motion Guidance for Ocean Sampling by Underwater Vehicles using Autonomous Control and Oceanographic Models with Forecast Uncertainty, \$504,600, 09/14–08/17, PI. Co-investigator: Kayo Ide. (Share: %50)
- Army Research Office & Office of Naval Research (jointly sponsored), UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics, \$27,700, 07/14–12/14, PI. Co-investigator: Norman Wereley. (Share: %50)
- Office of Naval Research, PECASE: Bio-inspired Propulsion, Sensing and Control for a Novel Underwater Vehicle, \$1,000,000, 04/14–05/19, PI. (Share: %100)
- Air Force Office of Scientific Research, Optimized Routing of Intelligent, Mobile Sensors for Dynamic, Data-Driven Sampling, \$600,000, 03/13–03/16, PI. (Share: %100)
- Office of Naval Research, Distributed Spatiotemporal Optimization for Radar Mission Coordination using Cooperative Control, \$95,000, 04/12–09/13, PI. (Share: %100)
- National Science Foundation, Research Experiences for Undergraduates Site: Training and Research Experiences in Nonlinear Dynamics, \$116,961, 02/12–02/15, co-I. Principal Investigator: Michelle Girvan. (Share: %0)
- Office of Naval Research, Bio-inspired Flow Sensing and Control for Autonomous Underwater Vehicles, \$625,000, 01/12–12/14, PI. Co-investigators: Sean Humbert, Xiaobo Tan, and Sheryl Coombs. (Share: %50)

- Army, University of Maryland Vertical Lift Research Center of Excellence, \$6,940,000, 08/11–08/16, co-PI. Principal Investigator: Inder Chopra. (Share: %6)
- National Science Foundation, Research Experiences for Undergraduates Site: Research Opportunities in Miniature Robotics, \$122,071, 07/11–08/15, co-I. Principal Investigator: Sarah Bergbreiter. (Share: %0)
- Maryland Robotics Center (ISR Seed Grant), Development of a Testbed for Heterogeneous Autonomous Cooperative Robotics, \$75,000, 02/11–02/12, co-PI. Principal investigator: Nuno Martins. (Share: %33)
- Mathworks, Multipurpose Hands On Systems Laboratory, \$75,000, 05/10–05/11, co-I. Principal investigator: Bill Levine. (Share: %0)
- National Science Foundation, CAREER: Dynamics and Control of Motion Coordination for Information Transmission in Groups, \$400,000, 04/10–03/15, PI. (Share: %100)
- National Science Foundation, Targeting Observations of Tropical Cyclones using Cooperative Control of Unmanned Aircraft, \$275,000, 09/09–08/13, PI. (Share: %100)
- Office of Naval Research, Autonomous Motion Coordination of Unmanned Naval Platforms in a Dynamic Flowfield, \$600,000, 08/09–07/12, PI. (Share: %100)
- Minta Martin Fund (Clark School), Cooperative Control of Autonomous Vehicle Swarms in a Dynamic Environment, \$60,000, 09/08–08/09, PI. (Share: %100)

#### II.J.2. Contracts

- Heron Systems, Inc. (Defense Advanced Research Projects Agency subcontract), Cooperative Detection and Tracking in an Uncertain Environment with Autonomous Quadrotors, \$93,528, 08/18–02/19, PI. (Share: %50)
- Heron Systems, Inc. (National Aeronautics and Space Administration SBIR Phase II) A Modular Swarm Optimization Framework Enabling Multi-Vehicle Cooperative Path Planning, \$100,000, 06/16–05/17, PI. (Share: %100)
- Army, Synthetic Collective Unmanned Underwater Laboratory, \$300,000, 09/09–08/10, PI. (Share: %100)
- DeepQuest, Inc. (Office of Naval Research SBIR Phase I), Optical Flow and Electrorception for Underwater Motion Co-ordination and Homing, \$75,000, 06/09–01/10, PI. Co-investigator: Sean Humbert. (Share: %50)

#### II.K. Gifts, and Funded Research not administered by ORA

##### II.K.1. Gifts

- Office of Naval Research Sabbatical Fellowship, 2013–2014
- The Link Foundation Graduate Student Fellowship, 2013–2014
- L-3 Graduate Student Fellowship, 2015–2016

#### II.L. Centers for Research, Scholarship, and Creative Activities



### II.L.3. Symposia Organized

- UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics, Maryland Robotics Center, 11–12 September 2014.
- 2nd UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics, Maryland Robotics Center, 3 October 2016.

### II.P. Research Fellowships, Prizes and Awards

- Henry Prentiss Becton Prize for Excellence in Engineering and Applied Science, Yale University, 1997
- Draper Fellowship, Massachusetts Institute of Technology, 2002–2004 (declined)
- National Defense Science and Engineering Graduate Fellowship, 2002–2004
- Associated Member of Pew Program in Biocomplexity, Princeton University, 2002–2005
- Gordon Y. S. Wu Fellowship, Princeton University, 2002–2006
- Graduate Research Fellowship, National Science Foundation, 2004–2007
- Best Paper in Session, IEEE Conference on Decision and Control, 2006
- Harold W. Dodds Honorific Fellowship, Princeton University, 2006–2007
- Faculty Early Career Development (CAREER) Award, National Science Foundation, 2010
- Associate Fellow (highest grade below fellow), AIAA, 2010
- Senior Member (highest grade below fellow), IEEE, 2011
- Outstanding Reviewer, IEEE Journal of Oceanic Engineering Editorial Board, 2012
- Presidential Early Career Award for Scientists and Engineers (PECASE), Department of Defense, 2012
- Sabbatical Fellow, Office of Naval Research, 2013–2014
- Engineer of the Year, AIAA National Capital Section, 2015
- Selected Speaker at the U.S. Frontiers of Engineering Symposium, National Academy of Engineering, 2016
- Fellow, UMD ADVANCE Leadership Fellows Program, 2019–2020

## III. Teaching, Extension, Mentoring and Advising

### III.A. Courses Taught

- ENAE 301: Dynamics of Aerospace Systems (Fa08, Fa09, Fa10, Fa11, Fa12, Fa14, Fa15). Introduction to particle and rigid body dynamics with primary emphasis on Newtonian methods. Course evaluations: Fa08 = 3.65/3.38 (32 students); Fa09 = 3.76/3.17 (88 students); Fa10 = 3.39/2.57 (97 students); Fa11 = 3.57/3.63 (106 students); Fa12 = 3.65/3.56 (113 students); Fa14 = 3.80/3.51 (102 students); Fa15 = 3.76/3.65 (114 students); Fa16 = 3.89/3.57 (107 students); Fa17 = 3.79/3.58 (117 students); Fa18 = 3.85/3.69 (160 students)

- ENAE 403: Aircraft Flight Dynamics (Fa12). Study of motion of aircraft, equations of motion, aerodynamic force representation, longitudinal and lateral motions, response to controls and to atmospheric disturbances, handling qualities criteria and other figures of merit. Course evaluations: Fa12 = 3.58/3.10 (53 students).
- ENAE743: Applied Nonlinear Control of Aerospace Systems (Sp08, Sp09, Sp10, Sp12, Sp16). The mathematics and methods of nonlinear systems analysis and nonlinear control design. Course evaluations: Sp08 = 3.79/3.57 (8 students); Sp09 = 3.90/3.70 (11 students); Sp10 = 3.88/3.75 (5 students); Sp12 = 3.85/3.70 (12 students); Sp16 = 3.5/3.4 (16 students); Sp18 = 3.64/3.55 (16 students)
- ENAE 646 (formerly) 788G: Advanced Dynamics of Aerospace Systems (Sp11, Sp13, Sp15, Sp17). The principles and methods for formulating and analyzing mathematical models of aerospace systems using Newtonian, Lagrangian, and Hamiltonian formulations of particle and rigid body dynamics. Course evaluations: Sp11 = 3.50/3.50 (21 students); Sp13 = 3.61/3.14 (20 students); Sp15 = 3.60/3.60 (7 students); Sp17=3.88/3.88 (13 students); Sp19 3.75/3.63 (12 students)

### III.B. Teaching Innovations

#### III.B.3. Textbooks

1. N. J. Kasdin and D. A. Paley. *Engineering dynamics: A comprehensive introduction*. Princeton University Press, 2011. [Review] [Errata].

#### III.B.6. Course or Curriculum Development

- ENAE 301: Dynamics of Aerospace Systems. I co-authored the textbook for this course (Princeton University Press, 2011). The course emphasizes rigorous mathematical notation that enables of particle and rigid-body motion to extend from two dimensions to three, and provides a solid background for upper-level electives in aircraft/spacecraft flight dynamics.
- ENAE 743: Applied Nonlinear Control of Aerospace Systems. My version of the course includes applications of dynamical systems theory, Lyapunov theory, input-output stability, passivity theory, frequency-domain analysis, and nonlinear feedback, with aerospace examples ranging from rigid spacecraft to autonomous aircraft.
- ENAE 646 (formerly 788G): Advanced Dynamics of Aerospace Systems. This is a graduate level course on aerospace-vehicle dynamics that I developed from scratch, including Newtonian, Lagrangian, and Hamiltonian formulations of particle and rigid body dynamics. I also strongly emphasize nonlinear dynamics, geometric mechanics, and symmetry.
- ENAE 464: Aerospace Engineering Laboratory. Developed two-week hands-on laboratory for senior aerospace engineering students on the topics of state feedback control, output feedback control, and system identification using the rotary pendulum as an example.
- FIRE 164/264: FIRE Autonomous Unmanned Systems. Two-semester sequence for undergraduate students in the First-Year Innovation & Research

Experience (FIRE) stream on basic research challenges in the area of autonomous unmanned systems.

### III.C. Advising: Research

#### III.C.1. Undergraduate

*Advisor (graduated):*

1. Adam Reese (2007–2008) ENAE Honors Research Topic “System identification of an automatic depth controller on a small unmanned submarine.” Presented at 2008 AIAA Region I-MA Student Conference.
2. Stephanie Petillo (2007–2008) ENAE Honors Research Topic “Evaluation of the coordinated sampling performance of underwater gliders in strong and variable currents: A simulated case study in the Chesapeake Bay.” Presented at 2008 AIAA Region I-MA Student Conference.
3. Seth Napora (2007–2009) ENAE Honors Research Topic “Onboard feedback control for autonomous navigation of an unmanned submarine.” Presented at 2009 AIAA Region I-MA Student Conference.
4. Sarah Beal (2007–2009) ENAE Honors Research Topic “Image processing for autonomous coordination of an underwater vehicle fleet.” Presented at 2009 AIAA Region I-MA Student Conference.
5. Nitin Sydney (2009) ENAE Elective Research Topic “A micro-UUV testbed for bio-inspired motion coordination.” Won student paper award at the 2009 International Symposium of Unmanned Untethered Submersible Technology.
6. Kamala Shetty (2008–2010) ENAE Honors Research Topic “Fish-inspired strategies for motion coordination and information transmission.” Presented at 2010 AIAA Region I-MA Student Conference.
7. David Warshawsky (2008–2010) UMD Honors Research Topic “Multi-vehicle coordination using motion-capture-based feedback.” Presented at the 2009 AIAA Aerospace Sciences Meeting.
8. Awais Raza (2009–2010) ENAE Honors Research Topic “Supervisory control of a micro air vehicle swarm using an iPhone or iPod Touch.” Presented at 2010 AIAA Region I-MA Student Conference.
9. Steve Sherman (2010–2011) ENAE Honors Research Topic “Massively parallel simulations of chain formation and restructuring dynamics in a magnetorheological fluid.” Presented at the 2011 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (co-advised with Prof. Norman Wereley).
10. Dan Langis (2010–2011) ENAE Honors Research Topic “Experimental validation of cooperative control laws using a micro-helicopter testbed.” Presented at 2011 AIAA Region I-MA Student Conference.
11. Colin Parker (2010–2011) ENAE Elective Research Topic “A multi-vehicle testbed based on the sea perch robotics platform.” Received Student Paper Award at the 2011 International Symposium of Unmanned Untethered Submersible Technology.

12. Alexander Leishman (2010–2011) ENAE Honors Research Topic “Experimental validation of wind estimation using a micro-helicopter.” Received 3rd Place Prize, 2011 AIAA Region I-MA Student Conference; 2010 Barry Goldwater Scholarship winner.
13. Jennifer Lun, (2010–2012) Neuroscience Elective Research Topic “Escape response probability of giant danios to select visual looming stimuli.” Presented at the 2011 Society for Neuroscience Annual Meeting.
14. Patrick Mohl, Patrick Nolan, and William Ouyang (2011–2012) Independent Research Topic “Feedback control applied to multi-vehicle cooperative leaf collecting.” Received 2nd Place Prize, 2012 AIAA Region I-MA Student Conference, Team Competition.
15. Angela Maki (2011–2012) ENAE Honors Research Topic “Development of a virtual autopilot for an unmanned aerial vehicle with applications to hurricane sampling.” Presented at 2012 AIAA Region I-MA Student Conference.
16. Joshua Brulé (2012) TREND REU Program “A model of vortex streets for sensing and feedback control of a robotic submarine.” Presented at the 2012 MERIT & TREND Fair.
17. Brian Powers (2012–2013) ENAE Honors Research Topic “System identification and control of a fixed-wing MAV using motion-capture based feedback control.” Presented at the 2013 AIAA Region I-MA Student Conference.
18. Hongyi Xia (2011–2013) Miniature Robotics REU Program and ENAE Honors Research Topic “Experimental validation of Karman vortex flow past a fish-inspired robot.” Presented at the 2013 AIAA Region I-MA Student Conference.
19. Esther Jang (MIT) and Roberto Villalba (Cornell) (2013) Miniature Robotics REU Program “RSSI-Based rendezvous on the Tiny Terrestrial Robotic Platform (TinyTeRP).” Presented at the Council on Undergraduate Research’s 2013 Conference of Research Experiences for Undergraduates Student Scholarship.
20. Tony Sang (Concordia) (2013) TREND REU Program “Stimulating startle response in group behavior.” Presented at the 2013 MERIT & TREND Fair.
21. Cody Karcher (2013–2014) ENAE Honors Research, “Development of a prototype underwater test platform for the low Reynolds number regime.” Presented at the 2014 AIAA Region I-MA Student Conference.
22. Cory Frontin (2013–2014) ENAE Honors Research, “Linearized longitudinal flight dynamics of a flapping wing micro-aerial vehicle.” Presented at the 2014 AIAA Region I-MA Student Conference.
23. Raymond Bounds (2012–2014) ENAE Honors Research, “Space Perch: A human-robot interaction testbed for communication-constrained environments.” Presented at the 2014 AIAA Region I-MA Student Conference.
24. William Ouyang (2012–2014), ENAE Honors Research, “Cooperative control for autonomous traffic management.” Presented at the 2014 AIAA Region I-MA Student Conference.

25. Joe Seiss (2013–2014), ENAE Independent Research, “Gravity-defying dynamics of a heavy gyroscope on an extended arm”
26. Justin Yim (UPenn) (2014), Miniature Robotics REU Program, “Lyapunov-based mosquito-inspired pursuit with autonomous hovercraft.” Submitted to the 2015 American Control Conference.
27. Storm Weiner (UC Berkeley) (2014), TREND REU Program, “Guiding sensor arrays for Lagrangian data assimilation in a point vortex flow.” Presented at the 2014 TREND Fair.
28. Amy Davis (Covenant College) (2015), TREND REU Program, “Stability and bifurcation analysis of the planar two-point vortex system.” Presented at the 2015 TREND Fair.
29. Nathan Lauer (AE/CS 2016), AEROS Research Program, “Tip-vortex localization for cross-stream position control of a multi-hole probe relative to a stationary wing in a free-jet wind tunnel.”
30. Sarah Withee (U. Colorado Boulder 2018) Microrobotics REU Program, “designing efficient periodic gaits for a soft starfish-inspired robot”
31. Simran Chawla (ECE 2015), ASPIRE Research Program, “Remotely operated underwater vehicle”
32. Bernadine Passe (AE 2017), ENAE Honors Research, “Experimental validation of the blade-flapping dynamics of a small, stiff propeller in wind”
33. Michael Kreinar (AE 2017), ENAE Honors Research, “Experimental validation of a small, lightweight wind-velocity probe from at-sea trials with an RC helicopter in the airwake of a ship”
34. Patrick Washington (AE 2017, co-advised with N. Wereley), 2016 AERO Scholar recipient, ENAE Honors Research “Artificial muscles for underwater robotics: Comparing pneumatic to hydraulic actuation”
35. Emma Thackray (Mount Holyoke College 2017), TREND REU Program
36. David Snyder (AE 2018), 2016 ASPIRE Research Program, ENAE Honors Research “A modified Goman-Khrabrov framework for control design of airfoils at high angle of attack”
37. Katerina Sherman (AE 2018), ENAE Honors Research “experimental demonstration of competing swarms of autonomous vehicles: Intruders versus guardians”
38. Austin Mahowald (AE 2018), AMAV Team Research “State-machine guidance and occupancy-grid navigation for an autonomous quadrotor”
39. Saimouli Katragadda (AE 2018), AMAV Team Research “Vision-based guidance for an autonomous quadrotor in a GPS-denied environment”
40. Johnathan Morley (AE 2018), AMAV Team Research “LIDAR-based obstacle detection for autonomous micro air vehicles”
41. Jena Shubham (IIT Kharagpur 2018), S.N. Bose Scholars Program “Development of an off-board control architecture for an autonomous quadcopter”
42. Shyline Santana (U. Puerto Rico 2018), TREND REU Program “Global bifurcation in a simple pendulum with nonlinear damping”

43. Anthony Thompson (UC-Berkeley 2018), Robotics REU Program “Creating a test bed for the electromagnetic formation flight of satellites”
44. JT Lewis (AE 2019), ENAE Honors Research “Modeling quadrotor response to a wind gust: Linear system identification for improvement of flight control”
45. Ray Garatsa (AE 2019), “Dynamics and control of pressure-driven microfluidic components”
46. Mukund Patnaik (AE 2019), ENAE Honors Research “Development of an artificial swim bladder for a soft robotic fish”
47. Aniket Goel (AE 2019), ENAE Honors Research “Autonomous coordinated formation flight of an outdoor quadcopter swarm”
- Advisor (in progress):*
48. Justin Lidard (AE 2020), ASPIRE Research Program, “State feedback control for lift maximization of an unsteady airfoil”
49. Theresa Enyeart (UT San Antonio 2019), Robotics REU Program “3D printing a soft hydraulic bending actuator”
50. Rachel Slover (U. North Carolina 2019), TREND REU Program “Understanding the Behavior of Single and Two-Vortex Systems Through Mathematical Modeling”
51. Charles Flanagan (AE 2020), ENAE Honors Research Ongoing
52. Shivam Soni, (AE 2020), ENAE Honors Research Ongoing
53. Jonathan Bosnich (U. Colorado), Robotics REU Program

### III.C.2. Master’s

*Advisor (graduated):*

1. Sonia Hernandez (2008–2009), M.S. Thesis “Three-dimensional motion coordination in a time-varying flowfield” [Advisor]
2. Seth Napora (2009–2011), M.S. Thesis “Observer-based feedback control for stabilization of collective motion” [Advisor]
3. Rochelle Mellish (2009-2011), M.S. Thesis “Backstepping control design for the coordinated motion of vehicles in a flowfield” [Advisor]
4. Tom Runge (2012), M.S. Non-thesis “A Lyapunov control law for reference orbit tracking in earth-orbit spacecraft formations” [Advisor]
5. Levi DeVries (2013), M.S. Ongoing Ph.D. student [Advisor]
6. Nitin Sydney (2013), M.S. Ongoing Ph.D. student [Advisor]
7. Chin Gian Hooi (2013–2015), M.S. Thesis Research, “Height estimation and control of a rotorcraft in ground effect using multiple pressure probes.” Received the AHS Vertical Flight Foundation Scholarship. Placement: Rockwell Collins. [Advisor]
8. Lia Sacks (2014) M.S. Non-thesis “Dynamics of fuel slosh and its effects on NASA missions” [Advisor]
9. Diago Shishika (2015), M.S. Ongoing Ph.D. student [Advisor]
10. Frank Lagor (2015), M.S. Ongoing Ph.D. student [Advisor]

11. Brett Barkley (2015–2017), M.S. Thesis “Multi-target detection, tracking, and data association on road networks using unmanned aerial vehicles” [Advisor]
12. Estefany Carrillo (2016–2017, ECE), M.S. Thesis “A system methodology for fault detection and fault restoration in distributed electric power systems” [Co-Advisor]
13. Patrick Nolan (2016, ENPM), M.S. Independent Study “Augmented path-planning technique for UAS applied to precision agriculture” [Advisor]
14. Brian Free (2015–2017), M.S. Ongoing Ph.D. student [Advisor]
15. Adarsh Jagan (2018, ENPM), M.S. Independent Study “Vision-aided guidance, navigation, and control for an autonomous micro air vehicle” [Advisor]
16. Jerrar Bukhari (2019, ENPM), M.S. Independent Study “Trajectory estimation and control for fixed wing drone package delivery” [Advisor]
17. Daniel Gomez (2019), M.S. Thesis “Flowfield estimation and vortex stabilization near an actuated airfoil” [Advisor]
18. Travis Burch (2019), M.S. Thesis “Dynamics and control of an elastic rod in air and water” [Advisor]
19. Jordan Boehm (2019), M.S. Thesis “Modeling, estimation, and control of actuator dynamics for remotely operated underwater vehicles” [Advisor]
20. Paul Ghanem (2019, MSSE), M.S. Thesis “Synchronized swimming and formation control for fish-inspired underwater vehicles” [Advisor]
21. Jinseong Lee (2019), M.S. Scholarly Paper “State-feedback control of an internal rotor for propelling and steering a flexible fish-inspired underwater vehicle” [Advisor]
- Advisor (in progress):*
22. Timothy Kurtiak (2018–present), M.S. Non-thesis [Advisor]
- Committee:*
23. Peter Gardner (2008) M.S. Thesis “A study of selected aspects of electromagnetic formation flight” [Committee]
24. Massimiliano Di Capua (2008) M.S. Thesis “Augmented reality for space applications” [Committee]
25. David Billingsley (2010) M.S. Thesis “The design, fabrication, and flight testing of an academic research platform for high resolution terrain imaging” [Committee]
26. Adam Mirvis (2010) M.S. Thesis “A dynamics-based fidelity assessment of partial gravity gait simulation using underwater body-segment ballasting” [Committee]
27. Dustin Alinger (2013) M.S. Thesis “System analysis and design for the Resonant Inductive Near-field Generation System (RINGS)” [Committee]
28. Nicholas Kostreski (2012) M.S. Thesis “Automated kinematic extraction of wing and body motions of free flying Diptera” [Committee]
29. Andrew Kehlenbeck (2014) M.S. Thesis “Aggressive control development of a microquadrotor UAV” [Committee]

30. William Dean (2015) M.S. Thesis “Wind frame state estimation and gust rejection using bio-inspired flow sensors” [Committee]
31. Matt Solomon (2016) M.S. Thesis “Development of a real-time hierarchical 3D path planning algorithm for unmanned aerial vehicles” [Committee]
32. Edward Levine (2016) M.S. Thesis “The effects of tidal forces on the minimum energy configurations of the full three-body problem” [Committee]
33. Utsav Saxena (2017) M.S. Thesis Research “Gramian-aware closed loop flight control design for energy harvesting through modulating disturbance sensitivity: Theory and experiment” [Committee]
34. Joshua Shaffer (2019) M.S. Thesis Research ongoing [Committee]
35. Senthil Arul (TBD, MSSE) M.S. Thesis Research ongoing [Committee]

### III.C.3. Doctoral

#### *Advisor (graduated):*

1. Sachit Butail (2007–2012), Ph.D. Dissertation “Motion reconstruction of animal groups: From schooling fish to swarming mosquitoes” Placement: faculty Northern Illinois University [Advisor]
2. Cameron Peterson (2008–2012), Ph.D. Dissertation “Motion coordination of multiple autonomous vehicles in spatiotemporal flowfields” Placement: faculty Brigham Young University [Advisor]
3. Tracie Severson (2010–2013), Ph.D. Dissertation “Distributed optimization of resource allocation for search and track assignment with multifunction radars” Placement: faculty U.S. Naval Academy [Advisor]
4. Levi DeVries (2010–2014), Ph.D. Dissertation “Observability-based Sampling and Estimation of Flowfields Using Multi-sensor Systems.” Received the Link Ph.D. Fellowship Program in Ocean Engineering and Instrumentation. Placement: faculty U.S. Naval Academy [Advisor]
5. Nitin Sydney (2010–2015), Ph.D. Dissertation Research, “Rotorcraft flight dynamics and control in wind for autonomous sampling of spatiotemporal processes.” Placement: The Mitre Corporation. [Advisor]
6. Amanda Chicoli (2010–2016; NACS), Ph.D. Dissertation Research, “Social and ecological factors influencing collective behavior in giant danio.” Received the UMD Ann G. Wylie Dissertation Fellowship. Placement: The Carnegie Institute for Science [Advisor]
7. Frank Lagor (2012–2017), Ph.D. Dissertation “path planning, flow estimation, and dynamic control for underwater vehicles” [Advisor]
8. Daigo Shishika (2012–2017), Ph.D. Dissertation “mosquito-inspired swarming and pursuit for autonomous rotorcraft” [Advisor]
9. Brian Free (2019), Ph.D. Dissertation “Bioinspired sensing and control for underwater pursuit” [Advisor]
10. Will Craig (2019), Ph.D. Dissertation “Dynamics and control of a quadrotor in unsteady wind” [Advisor]

#### *Advisor (in progress):*



11. Debdipta Goswami (2016-present, ENEE), Ph.D. Dissertation Research in progress [Advisor]
  12. Erin Fowler (2018–present), Ph.D. Dissertation Research in progress [Advisor]
  13. Sheng Cheng (2018–present, ENEE), Ph.D. Research ongoing [Advisor]
  14. Sheng Cheng (2018–present, ENEE), Ph.D. Research ongoing [Advisor]
  15. Animesh Shastry (2019–present), Ph.D. Research ongoing [Advisor]
- Committee:*
16. Shane Jacobs (2009) Ph.D. Dissertation “Pressure-constrained, reduced-DOF, interconnected parallel manipulators with applications to space suit design” [Committee]
  17. Min Mao (2010), Ph.D. Dissertation “Adaptive magnetorheological sliding seat system for ground vehicles” [Committee]
  18. Kevin Galloway (2011; ENEE), Ph.D. Dissertation “Cyclic pursuit: Symmetry, reduction and nonlinear dynamics” [Committee]
  19. Chen Friedman (2013), Ph.D. Dissertation “Accurate SLAM with application for aerial path planning” [Committee]
  20. Kedar Dimble (2013) Ph.D. Dissertation “Electrollocation-based obstacle avoidance and autonomous navigation in underwater environments” [Committee]
  21. Ryan Robinson (2014), Ph.D. Dissertation “Pneumatic Artificial Muscle Actuators for Compliant Robotic Manipulators” [Committee]
  22. Robert Vocke (2014), Ph.D. Dissertation “Morphing Mechanisms and Actuators for Rotorcraft Performance Enhancement” [Committee]
  23. Greg Gremillion (2014), Ph.D. Dissertation “Bio-inspired Disturbance Rejection with Ocellar and Distributed Acceleration Sensing for Micro-Air Vehicles” [Committee]
  24. Matias Delgadino (2016, AMSC), Ph.D. Dissertation “Mathematical analysis of self-organization models arising in population dynamics” [Committee]
  25. Badri Ranganathan (2017), Ph.D. Dissertation “Bioinspired robust underwater behaviors using fluid flow sensing” [Committee]
  26. Ramin Bighamian (2017, ENME), Ph.D. Dissertation Research “Systems-level modeling and validation of cardiovascular system responses to fluid and vasopressor infusion for automated critical care” [Committee]
  27. Joseph Galante (2018), Ph.D. Dissertation Research “Analysis of the stochastic stability and asymptotically stationary statistics for a class of nonlinear attitude estimation algorithms” [Committee]
  28. Yimeng Dong (2018, ENME), Ph.D. Dissertation “Content modification attacks on networked robotic systems” [Committee]
  29. Field Manar (2018), Ph.D. Dissertation “Measurements and modeling of the unsteady flow around a thin wing” [Committee]
  30. Tom Pillsbury (2018), Ph.D. Dissertation “Soft robotic appendages using pneumatic artificial muscles” [Committee]

31. Julie Mallon (TBD, BISI), Ph.D. Dissertation Research in progress [Committee]
32. Martin Molina Fructuoso (TBD, AMSC), Ph.D. Dissertation Research in progress [Committee]
33. Brandon Alexander (TBD, AMSC), Ph.D. Research in progress [Committee]
34. Shilei Han (TBD), Ph.D. Research in progress [Committee]
35. David Russell (TBD, AMSC), Ph.D. Research in progress [Committee]
36. Xiaonan Huang (TBD, ME, Carnegie Mellon), Ph.D. Research in progress [Committee]

#### III.C.4. Post-doctoral

1. Nina Mahmoudian (2010) Placement: faculty Michigan Tech. [Advisor]
2. Derrick Yeo (2013–2016) Placement: non-tenure-track faculty University of Maryland [Advisor]
3. Feitian Zhang (2014–2016) Placement: faculty George Mason University [Advisor]
4. Will Scott (2018–present)
5. Artur Wolek (2018–present)

#### III.C.5. Other Directed Research

- Advisor, ESTEEM Research Mentoring Program, Center for Minorities, Clark School of Engineering, 2008–2012
- Partner, Martin Luther King Middle School, Germantown, Maryland; worked with Patrick Stevens, Environmental Science Teacher as part of the Trout in the Classroom Program, 2010–2014
- Advisor, Science, Mathematics, Computer Science Magnet Program, Montgomery Blair High School, Silver Spring, Maryland, 2012, 2016
- Advisor, Science and Technology Program, Eleanor Roosevelt High School, Greenbelt, Maryland, 2015–2016
- Advisor, Science, Math, Computer Science House, Poolesville High School, Poolesville, Maryland, 2017, 2019

### III.D. Mentorship

#### III.D.1. Junior Faculty

- Anya Jones (ENAE Assistant Professor) [Committee]
- Christine Hartzell (ENAE Assistant Professor) [Committee]

#### III.D.2. Other

- Mentor, Inventis: Academy of Engineering Leadership, Clark School of Engineering, University of Maryland, 2007–2009
- Design Review Panelist, Robotics@Maryland Autonomous Underwater Vehicle Team, 2007–2009; 1st Place Winner, Association for Unmanned Vehicle Systems International and Office of Naval Research 11th Annual International Autonomous Underwater Vehicle Competition, 2008.

- Mentor, Maryland Space Grant Program, 2009
- Mentor, DAAD RISE in North America, 2009
- Advisor, Student Paper Award, International Symposium of Unmanned Untethered Submersible Technology, 2009 and 2011
- Mentor, Keystone Academy, Clark School of Engineering, University of Maryland, 2010–2012
- Advisor, SER-Quest Program, Center for Minorities, Clark School of Engineering, 2010–2011
- Advisor, Student Paper 3rd Place Award, AIAA Region I-MA Student Conference, 2011
- Advisor, Student Paper 2nd Place Award in Team Competition, AIAA Region I-MA Student Conference, 2012
- Advisor, Team MAV: Directionally Operating Nautical Copter, 2nd place, ENAE 100 Undergraduate Research Project Competition, Department of Aerospace Engineering, University of Maryland, 2012.
- Advisor, TREND National Science Foundation REU Summer Research Program, 2012–present
- Advisor, Miniature Robotics National Science Foundation REU Summer Research Program, 2012–present
- Advisor, Louis Stokes Alliance for Minority Participation Program, Center for Minorities, Clark School of Engineering, University of Maryland, 2012–2013
- Advisor, CDCL Dolphin, 1st Place Winner, American Helicopter Society’s 2nd Annual Micro Air Vehicle Student Challenge, 2014
- Faculty Leader, Autonomous Unmanned Systems Stream, First-Year Innovation & Research Experience, University of Maryland 2016–2018.
- Advisor, Autonomous Micro Aerial Vehicle (AMAV) Team, 2015–present; 1st Place Winner, Vertical Flight Society MAV Student Challenge, 2019.

### III.E. Advising: Other than Research Direction

#### III.E.1. Undergraduate

- Academic advisor for 15–20 students per year

### III.F. Professional and Extension Education

#### III.F.3. Workshops

- Organizer, Women in Engineering LEAD Academy in Aerospace Engineering, Clark School of Engineering: “Introduction to Control Theory,” 8 July 2010.
- Facilitator, Spring STEM Expo, Center for Minorities, Clark School of Engineering: “Going Deep Underwater!: Explore Underwater with a Sea Perch Remotely Operated Vehicle,” 5 March 2011.
- Facilitator, Spring STEM Expo, Center for Minorities, Clark School of Engineering, 14 April 2012.

- Organizer, Women in Engineering LEAD Academy in Aerospace Engineering, Clark School of Engineering: “Robots and Roaches: Engineering applications and bio-inspired designs,” 26 July 2012.
- Organizer, Women in Engineering LEAD Academy in Aerospace Engineering, Clark School of Engineering: “Fluids are Fun!,” 24 July 2015.
- Organizer, Women in Aeronautics and Astronautics (WIAA), Department of Aerospace Engineering, outreach event with “Girls Who Code” club from Don Bosco Cristo Rey High School in Takoma Park, Maryland, 14 September 2016.
- Organizer, Adat Shalom Synagogue, “How to be a Mensch: MenschMaker,” 7 January 2018.
- Organizer, Adat Shalom Synagogue, “Zayin Maker,” 3 February 2019.
- Organizer, Travilah Elementary School, “Destination Imagination Workshop,” 9 February 2019.

#### III.F.4. Guest Lectures

- ENAE 464: Aerospace Engineering Laboratory, 1–2 week module with lectures and lab experiments on feedback control systems: 2012S, 2013S, 2015S, 2016S.

#### III.I. Teaching Awards

- Luigi Crocco Award for Teaching Excellence, Department of Mechanical and Aerospace Engineering, Princeton University, 2004, 2006
- Willis H. Young Jr. Faculty Fellowship, Department of Aerospace Engineering, University of Maryland, 2013–2016
- E. Robert Kent Teaching Award for Junior Faculty, Clark School of Engineering, University of Maryland, 2014
- Robert M. Sanner Broken Propeller Award, Department of Aerospace Engineering, University of Maryland, 2016, 2017, 2018

### IV. Service and Outreach

#### IV.A. Editorships, Editorial Boards, and Reviewing Activities

##### IV.A.2. Editorial Boards

- Associate Editor, AIAA Journal of Guidance, Control, and Dynamics, 2013–present
- Associate Editor, IEEE Transactions on Control of Network Systems, 2014–2017
- Guest Editor, Bioinspiration & Biomimetics, Special Issue on Bioinspired Soft Robotics, 2016

##### IV.A.3. Reviewing Activities for Journals and Presses

AIAA Journal of Guidance, Control, and Dynamics, Automatica, Autonomous Robots, IEEE Control Systems Magazine, IEEE Journal of Oceanic Engineering (Outstanding Reviewer of 2012), IEEE Robotics and Automation Magazine, IEEE

Transactions on Aerospace and Electronic Systems, IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, IEEE Transactions on Instrumentation and Measurement, IEEE Transactions on Robotics, IET Control Theory & Applications, and International Journal of Advanced Robotic Systems, International Journal of Robust and Nonlinear Control, International Journal of Robotics Research, Journal of Aerospace Computing, Journal of Atmospheric and Oceanic Technology, Information, and Communication, Journal of Marine Systems Journal of Nonlinear Science, Journal of Theoretical Biology, Ocean Dynamics Ocean Engineering, Physical Review E, Scientific Reports, SIAM Journal on Applied Dynamical Systems, Systems and Control Letters

#### IV.A.4. Reviewing Activities for Agencies and Foundations

Air Force Office of Scientific Research, Army Research Office, National Aeronautics and Space Administration, National Science Foundation, National Institutes of Health, Office of Naval Research, Natural Sciences and Engineering Research Council of Canada, Norwegian Research Council

#### IV.A.5. Reviewing Activities for Conferences

AIAA Guidance, Navigation, and Control Conference, American Control Conference, IEEE Conference on Decision and Control, IEEE International Conference on Robotics and Automation, IEEE Multi-conference on Systems and Control, IEEE/RSJ International Conference on Intelligent Robots and Systems, IFAC World Congress, International Conference on Dynamics of Continuous, Discrete and Impulsive Systems, Robotics: Science and Systems Conference

### IV.B. Committees, Professional & Campus Service

#### IV.B.1. Campus Service – Department

- Member, Undergraduate Committee, 2007–2016
- Member, Guidance, Navigation, and Control Graduate Prize Committee, 2008
- Member, Merit Review Committee, 2008–2012
- Member, Staff Search Committee, 2009
- Member, Faculty Search Committee, 2009–2010
- Member, Faculty Search Committee, 2011–2012
- Member, Faculty Mentor Committee, 2011–2017
- Member, Faculty Search Committee, 2012–2013
- Member, Faculty Search Committee, 2014–2015
- Chair, Faculty Search Committee, 2015–2016
- Member, Graduate Committee, 2016–present
- Member, Committee for Diversity and Inclusion, 2018–present
- Chair, Faculty Mentor Committee, 2019–present

#### IV.B.2. Campus Service – College

- Faculty Advisory Committee, Maryland Robotics Center, 2010–2014
- Seminar Committee, Maryland Robotics Center, 2010–2013
- Coordinator, Clark School Junior Faculty Monthly Luncheon, 2010–2012

- Seminar Coordinator, Maryland Robotics Center, 2014–2017
- Member, University of Southern Maryland Building Working Group, 2014–2017
- Leader, Unmanned Vehicles Thrust Area, Maryland Robotics Center, 2014–2017
- Member, UAS Research Committee for UAS Test Site, 2015–2017
- Member, Engineering Freshmen Application Review Committee, 2015–2016
- Member, Education Program Committee, Institute for Systems Research, 2017–present
- Member, Executive Committee, Maryland Robotics Center, 2017–present
- Member, Kent Teaching Award for Junior Faculty Selection Committee, 2017, 2018
- Member, IDEA Factory Space Planning Committee, Maryland Robotics Center, 2018–present
- Member, IDEA Factory Business Model Committee, 2019–present

#### IV.B.3. Campus Service – University

- Tenured Faculty Representative, University Senate, 2015–2018
- Selection Committee for the Graduate Summer Research Fellowship, University Graduate School, 2019–present

#### IV.B.5. Campus Service – Other

- Volunteer, Faculty Staff Move-In Program, 2008

#### IV.B.8. Leadership Roles in Meetings and Conferences

- Session co-chair, 2006 IEEE Conference on Decision and Control (Swarms and Collective Behavior)
- Session chair, 2008 IEEE Conference on Decision and Control (Multi-agent Motion Planning)
- Session co-chair, 2009 American Control Conference (Cooperative control)
- Session co-chair, 2010 American Control Conference (Multi-vehicle systems)
- Session chair, 2010 Northeast Control Conference (Optimization)
- Session chair, 2010 AIAA Guidance, Navigation, and Control Conference (Flapping wing MAV dynamics and control)
- Technical area co-chair, 2011 AIAA Guidance, Navigation, and Control Conference (Multi-vehicle control)
- Mini-symposium organizer, 2011 SIAM Conference on Applications of Dynamical Systems (Reconstruction and analysis of individual dynamics in bio-groups)
- Session chair, 2011 AIAA Guidance, Navigation, and Control Conference (Multi-vehicle control I and II)
- Session co-chair, 2011 IEEE Conference on Decision and Control (Cooperative control)

- Session chair, 2012 International Conference on Unmanned Aircraft Systems (UAV Applications II)
- Technical area chair, 2012 AIAA Guidance, Navigation, and Control Conference (Multi-vehicle control)
- Session chair, 2012 AIAA Guidance, Navigation, and Control Conference (Multi-vehicle control II and III)
- Program Committee member, 2012 International Symposium on Distributed Autonomous Robotic Systems
- Session chair, 2012 International Symposium on Distributed Autonomous Robotic Systems (Modular Robots II)
- Session co-chair, 2012 IEEE Conference on Decision and Control (Autonomous Systems)
- Mini-symposium organizer, 2013 SIAM Conference on Applications of Dynamical Systems (Data-driven adaptive sampling of dynamic spatial processes)
- Session chair, 2013 AIAA Guidance, Navigation, and Control Conference (Control of Multiple Autonomous Aircraft I and II)
- Session chair, 2013 IEEE Conference Decision and Control (Autonomous Robots)
- Session co-chair, 2013 IEEE Conference Decision and Control (Coordinated Control: Models and Mechanisms from Collective Animal Behavior)
- Associate Editor, 2013 American Control Conference
- Associate Editor, 2014 American Control Conference
- Session chair of faculty presentations, 2014 Symposium on Autonomy, Center for Energetic Concepts Development, Department of Mechanical Engineering, University of Maryland, College of Park, Maryland
- Organizer and Chair, 2014 UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics
- Mini-symposium organizer, 2015 SIAM Conference on Applications of Dynamical Systems (Guided approaches to ocean data assimilation incorporating uncertainty and observability)
- Session chair, 2015 IEEE Conference on Decision and Control (Agent-based Systems)
- Program Committee member, 2016 International Symposium on Distributed Autonomous Robotic Systems
- Organizer, Invited session on Dynamics and Control of Soft Robot Systems, Society of Engineering Science 53rd Annual Meeting, October 2016.
- Session chair, 2016 International Conference on Unmanned Aerial Systems (Path Planning)
- Organizer and Chair, 2016 UMD Workshop on Distributed Sensing, Actuation, and Control for Bio-inspired Soft Robotics
- Session co-chair, 2018 IEEE Conference on Control Technology and Applications (Robotics)

- Program Committee member, 2019 Robotics For Good Symposium
- Member, Program Committee, IEEE Conference on Decision and Control, December 2019

#### IV.B.9. Other Non-University Committees, Memberships, Panels, etc.

- Panelist, NSF Workshop on New Directions in Dynamical Systems Inspired by Biological, Energy, Environmental and Information Sciences, Preceding the 2011 NSF CMMI Research and Innovation Conference, Atlanta, Georgia
- Member, AIAA Guidance, Navigation, and Control Technical Committee, 2008-2013
- Member, IEEE Control Systems Society, Aerospace Controls Technical Committee, 2013–2017
- Panelist, Research on the Hill, “The future has arrived: Research and policy implications of autonomous systems,” Russell Senate Office Building, Washington, D.C., 16 July 2015
- Panelist, White Symposium on Engineering Innovation, “Collective animal behavior and control of robotic networks,” A. James Clark School of Engineering, University of Maryland, 9 November 2015.
- Member, Faculty Mentor Committee, New York University Polytechnic Institute, 2018–present
- Panelist, Future Autonomy Education Panel, ONR Science of Autonomy Program Review, 9 August 2018.

### IV.C. External Service and Consulting

#### IV.C.2. International Activities

- Participant, 2009 International Workshop on Bio-Inspired Sensing and Bio-Inspired Actuation Technology, National Center for Research on Earthquake Engineering, Taipei, Taiwan
- Visiting scholar, Institute of Vibration Engineering Research, Nanjing University of Aeronautics and Astronautics, China, 15–17 December 2009.

#### IV.C.5. Consultancies (to local, state and federal agencies; companies; organizations)

- Consultant, Primordial, Inc. 2013–2014
- Consultant, Heron Systems, Inc. 2015

### IV.D. Non-Research Presentations

#### IV.D.1. Outreach Presentations

1. Spring into the Future Seminar, Center for Minorities, Clark School of Engineering: “Why the world needs more engineers, what do engineers like me do, and how to build a better catapult,” 16 June 2008.
2. Up, Up, and Away Seminar, Center for Minorities, Clark School of Engineering: “Why the world needs more engineers, what do engineers like me do, and how to build a better catapult,” 9 July 2008.



3. Discovering Engineering Seminar, Undergraduate Recruitment and Special Programs, Clark School of Engineering: “Why the world needs more engineers, what do engineers like me do, and how to build a better catapult,” 7 August 2008.
4. Up, Up, and Away Seminar, Center for Minorities, Clark School of Engineering: “Why the world needs more engineers, what do engineers like me do, and how to build a better catapult,” 8 July 2009.
5. Exploring Engineering Seminar, Women in Engineering, Clark School of Engineering: “Research opportunities in Aerospace Engineering at the University of Maryland,” 17 July 2009.
6. Discovering Engineering Seminar, Undergraduate Recruitment and Special Programs, Clark School of Engineering: “Research opportunities in Aerospace Engineering at the University of Maryland,” 7 August 2009.
7. Seminar speaker, UNIV100 The Student in the University, Clark School of Engineering: “Research opportunities in Aerospace Engineering at the University of Maryland,” 21 October 2009.
8. Discovering Engineering Seminar, Undergraduate Recruitment and Special Programs, Clark School of Engineering: “Research opportunities in Aerospace Engineering at the University of Maryland,” 30 July 2010.
9. Career Day Speaker, Garrett Park Elementary School, Kensington, Maryland: “Aerospace Engineering is Awesome,” 11 May 2012.
10. Career Day Speaker, Garrett Park Elementary School, Kensington, Maryland: “Aerospace Engineering is Awesome,” 5 June 2015.

#### IV.E. Media Contributions

##### IV.E.2. TV/Radio

- WYPR On The Record, “Technology Inspired by Nature,” 5 March 2018.
- CBS News, “Fish School UMD Researchers on Sub Coordination,” 5 May 2010.
- Fox News, “Univ. of Md. Research of Unmanned Submarines Could Help Defense Department,” 5 May 2010.
- Prince George’s County Community Television, “Robots & Cockroaches,” 26 July 2012.

##### IV.E.4. Digital Media

- Daily Record, “Robots making move in Maryland’s medical field,” 6 August 2019.
- School of Engineering News Item, “Inspired by Nature: Autonomous Underwater Robotics,” 22 June 2018.
- Clark School of Engineering Media Day, “Synchronized Swimming for Submarines: Clark School Engineer
- Studies Schooling Fish to Improve Motion Coordination in Unmanned Vehicle Teams,” 5 May 2010.

- Clark School of Engineering Media Day, “A Dip in a Completely Different Kind of Pool: High School Students Get Rare Access to Neutral Buoyancy Facility in College Park,” 7 July 2010.
- Newsletter of the National Academy of Engineering, “Photos from University of Maryland workshop for high school students, who built their own underwater vehicles and launched them,” 18 July 2010.
- Newsletter of the National Academy of Engineering, “How do engineers rescue those subs at the bottom of the University of Maryland Neutral Buoyancy Facility?” 8 August 2010.
- National Science Foundation, “Innovators: Programming unmanned aircraft to cooperate in daring hurricane missions,” 13 October 2011.
- Cruiser News, Consortium for Robotics and Unmanned Systems Education and Research, “Doctoral Dissertation Defense: Motion Coordination of Multiple Autonomous Vehicles in a Spatiotemporal Flowfield,” Issue 15, May 2012.
- Bowling Green State University, “Fish Sense,” 3 June 2013.
- White House Press Release, “President Obama Honors Outstanding Early-Career Scientists,” 23 December 2013.
- In The Capital, “UMD Professors Receive Presidential Award for Science and Engineering Research,” 2 January 2014.
- ASEE First Bell, “Two University Of Maryland Professors To Be Honored By President Obama,” 3 January 2014.
- ONR in the News, “White House Lauds ONR-funded Researchers for Early Success,” 13 January 2014.
- The Diamondback, “Robot fish on campus,” 17 April 2014.

#### IV.E.5. Print Media

- The PG Sentinel, “Program exposes students to aerospace engineering,” 18 July 2010.
- EM, The Magazine of the Clark School of Engineering, “We, Robots,” Spring 2011.
- Baltimore Sun, “Robotic fish feels the flow,” 6 April 2014.
- System Solutions, a publication of the Institute for Systems Research at the University of Maryland, “Paley, Bergbreiter win PECASE Awards,” 24 September 2014.