Jack W. Langelaan PH.D.

Professor and Director of Graduate Studies, Aerospace Engineering
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Education

Stanford University, Stanford, CA
Ph.D., Department of Aeronautics and Astronautics, March 2006.
Dissertation title: State Estimation for Autonomous Flight in Cluttered Environments
Advisor: Professor Stephen Rock, Department of Aeronautics and Astronautics

University of Washington, Seattle, Washington
Master of Science in Aeronautics and Astronautics, December 1994.
Thesis title: Design Oriented Structural Analysis for Shape Optimization of Isotropic and Composite Fuselage Structures
Advisor: Professor Eli Livne, Department of Aeronautics and Astronautics

Queen's University, Kingston, Ontario.
Bachelor of Science, Engineering Physics (Mechanical Option), with Honors, May 1992.

Research and Professional Experience

2020–present: Professor, Aerospace Engineering, The Pennsylvania State University, University Park, Pennsylvania. Director of Graduate Program, 2017–present.

2012–2020: Associate Professor, Aerospace Engineering, The Pennsylvania State University, University Park, Pennsylvania. Director of Graduate Program, 2017–present.

2006–2012: Assistant Professor, Aerospace Engineering, The Pennsylvania State University, University Park, Pennsylvania.

2000–2006: Research Assistant, Aerospace Robotics Laboratory, Department of Aeronautics and Astronautics, Stanford University, Stanford, California.

1995–2000: Engineer, Bombardier Aerospace (formerly de Havilland Inc.), Downsview, Ontario Canada.

1994–1995: Research Assistant, Department of Aeronautics and Astronautics, University of Washington, Seattle, Washington.

Professional Memberships and Service

Professional Engineer, Association of Professional Engineers of Ontario since 1996.

Associate Fellow (2011), American Institute of Aeronautics and Astronautics. Member of Guidance, Navigation and Control Technical Committee (2005-2014 and 2018-present). Chair of Education sub-committee, 2007-2010.

Member, Vertical Flight Society. Member of Unmanned Vertical Flight Technical Committee, (2014-present) and eVTOL Provisional Technical Committee (2019-present)

Member, Institute for Electrical and Electronics Engineers. Session organizer and co-chair (Autonomous Vehicles), 2006 and 2007 IEEE Aerospace Conference, Big Sky, MT.

Associate Editor, Journal of Guidance, Control and Dynamics (2017-present).

Reviewer: AIAA Journal of Guidance, Control and Dynamics; International Journal of Robotics Research; IEEE Transactions on Control System Technology; IEEE Transactions on Robotics; Journal of Intelligent Robots and Systems; IEEE Conference on Decision and Control; AIAA Guidance, Navigation and Control Conference; IEEE/RSJ International Conference on Intelligent Robots and Systems; IEEE Conference on Robotics and Automation; IEEE Multi-Conference on Systems and Control; American Control Conference.

Grant Proposal Peer Review: National Science Foundation Robust Intelligence Cluster "small proposals" panel, 2009, 2008, 2007; Army Research Office, 2009, Office of Naval Research, 2010.

Conference Organization: Technical Area co-chair, 2008 AIAA Guidance, Navigation and Control Conference; Technical Area Chair, 2009, 2010, 2011, 2020 AIAA Guidance, Navigation and Control Conference; Technical co-Chair, 2012 AIAA Guidance, Navigation and Control Conference; Organizing Committee, 2010 National Academy of Engineering United States Frontiers of Engineering (USFOE) Conference.

Honors and Awards

2014: Winner of OSTIV Diploma for best paper presented at the XXXI OSTIV Congress and published in the Journal of Technical Soaring, vol. 37, no. 3, July 2013. (OSTIV is the Organization Scientifique et Technique International du Vol à Voile).

2011: Winner of a NASA Centennial Challenge. Team Leader of Pipistrel-USA.com, winner of the Green Flight Challenge. Our four seat, electric powered aircraft flew 403 passenger miles per gallon over a 195 mile course at 107 miles per hour. The prize of $1.35Million is the largest ever awarded for an achievement in aviation.

2011: Associate Fellow, American Institute of Aeronautics and Astronautics.

2010: PSEAS Outstanding Teaching Award (awarded by the Penn State Engineering Alumni Society).

2008: National Science Foundation Faculty Early Career Development Program (CAREER) award.

2006-2008: Dorothy Quiggle Professor in Engineering, The Pennsylvania State University.

2001-2004: Alyce B. and Henry J. Ramey Jr. Fellow, Stanford University.

2000: Department Fellowship, Department of Aeronautics and Astronautics, Stanford University.

Teaching

AERSP 306 (Introduction to Aeronautics): Spring 2018, Spring 2012, Spring 2010.

AERSP 397 (Aerospace Design Studio): Spring 2018

AERSP 402A (Aircraft Design, Preliminary): Fall 2020-2016, 2012-2014.

AERSP 402B (Aircraft Design, Detailed): Spring 2019-2017, 2012-2015.

AERSP 413 (Aircraft Stability and Control): Fall 2008.

AERSP 460 (Control of Aerospace Systems): Fall 2020-2018, 2012, 2010, 2009, 2007, 2006.

AERSP 497D/597D (AUV Design): Fall 2013, Spring 2014, Fall 2014

AERSP 597E (Estimation Theory): Spring 2013, Spring 2011, Spring 2008.

AERSP 597G (Theory and Application of Global Navigation Satellite Systems): Fall 2011, Spring 2009, Spring 2007.

Patents

Names in **BOLD SMALL CAPS** denote students supervised by Langelaan.

[P3] Stroman, Richard, Daniel J. Edwards, Daniel S. Newton, **JOHN J. BIRD**, Jack W. Langelaan, Vladimir Dobrokhodov, *Method for identifying optimal vehicle paths when energy is a key metric or constraint*, US Patent Application Publication 2019/0107408 A1, April 11, 2019.

[P2] Langelaan, Jacob Willem, *Powered hydrofoil board*, US Patent 9,586,659 B2, March 7, 2017.

[P1] Langelaan, Jacob Willem, *Weight-shift controlled personal hydrofoil watercraft*, US Patent 9,359,044 B2, June 7, 2016.

Invited Publications

[1] Langelaan, Jack W. and Nicholas Roy, "Enabling New Missions for Robotic Aircraft," *Science*, vol. 326, no. 5960, December 18, 2009, pp. 1642-1644, DOI: 10.1126/science.1182497

Refereed Journal Publications

Names in **BOLD SMALL CAPS** denote students supervised by Langelaan.

[J22] Yan, Sihong, **TOMAS I. OPAZO**, Jack W. Langelaan, and Jose L. Palacios, "Experimental Evaluation and Flight Simulation of Coaxial-rotor Vehicles in Icing Clouds," *Journal of the American Helicopter Society*, 65(2), April 2020. DOI: 10.4050/JAHS.65.022011

[J21] **GENG, JUNYI** and Jack W. Langelaan, "Cooperative transport of a slung load using load-leading control," *AIAA Journal of Guidance, Control, and Dynamics*, 43(7), March 2020. DOI: 10.2514/1.G004680

[J20] **BIRD, JOHN J.** and Jack W. Langelaan, "Optimal Speed Scheduling with Arrival Time Constraints for Solar Augmented Aircraft," *AIAA Journal of Guidance, Control, and Dynamics*, 43(7), May 2020. DOI: 10.2514/1.G004430

[J19] **BIRD, JOHN J.,** Scott J. Richardson, and Jack W. Langelaan, "Estimating the Vertical Structure of Weather-Induced Mission Costs for Small UAS," *Sensors* 2019, 19, 2770; DOI:10.3390/s19122770

[J18] **DEPENBUSCH, NATHAN T., JOHN J. BIRD** and Jack W. Langelaan, "The AutoSOAR Autonomous Soaring Aircraft Part 1: Autonomy Algorithms," *Journal of Field Robotics,* available online March 2018. DOI: 10.1002/rob.21782

[J17] Enciu, J., Joseph F. Horn and Jacob W. Langelaan, "Formation control of a rotorcraft multilift system," *Journal of the American Helicopter Society*, vol. 62, No. 4, October 2017.

[J16] **DEPENBUSCH, NATHAN T., JOHN J. BIRD** and Jack W. Langelaan, "The AutoSOAR Autonomous Soaring Aircraft Part 2: Hardware Implementation and Flight Results," *Journal of Field Robotics*, online October 3, 2017. DOI: 10.1002/rob.21747

[J15] **YOMCHINDA, THANAN**, Jack W. Langelaan and Joseph F. Horn, "Modified Dubins Parameterization for Aircraft Emergency Trajectory Planning," *Proceedings of the Institution of Mechanical Engineers Part G: Journal of Aerospace Engineering* 03/2016. DOI:10.1177/0954410016638869

[J14] **GRANDE, NICHOLAS, SHANE TIERNEY**, Joseph F. Horn and Jack W. Langelaan, "Safe Autorotation through Wind Shear via Backwards Reachable Sets," *Journal of the American Helicopter Society*, vol. 61, no. 2, April 2016.

[J13] Mandell, Jason G., Jack W. Langelaan, Andrew G. Webb, and Steven J. Schiff, "Volumetric brain analysis in neurosurgery: Part I. Particle filter segmentation of brain and cerebrospinal fluid growth dynamics from MRI and CT images," *Journal of Neurosurgery: Pediatrics,* vol. 15, no. 2, February 2015, pp 113-124. DOI: 10.3171/2014.9.PEDS12426

[J12] **BIRD, JOHN J.** and Jack W. Langelaan, "Spline Mapping to Maximize Energy Exploitation of Non-Uniform Thermals," *Journal of Technical Soaring*, vol. 37, no. 3, July-September 2013. Winner of 2014 OSTIV Diploma.

[J11] Langelaan, Jack W., **ANJAN CHAKRABARTY**, Aijun Deng, Kirk Miles, Vid Plevnik, Jure Tomazic, Tine Tomazic, Gregor Veble, "Green Flight Challenge: Aircraft Design and Flight Planning for Extreme Fuel Efficiency," *Journal of Aircraft*, vol. 50, no. 3, May 2013, pp 832-846. DOI: 10.2514/1.C032022

[J10] Tomažič, Tine, Vid Plevnik, Gregor Veble, Jure Tomažič, Franc Popit, Sašo Kolar, Radivoj Kikelj, Jacob W Langelaan, Kirk Miles, "Pipistrel Taurus G4: on Creation and Evolution of the Winning Aeroplane of NASA Green Flight Challenge 2011," *Strojniški vestnik-Journal of Mechanical Engineering*, vol. 57, no. 12, 2012, pp 869-878.

[J9] **CHAKRABARTY, ANJAN** and Jack W. Langelaan, "Energy-based Long-Range Path Planning for Soaring-capable UAVs," *Journal of Guidance, Control and Dynamics*, vol. 34, no. 4, 2011, pp 1002-1015.

[J8] Langelaan, Jack W., Nicholas J. Alley, and James Neidhoefer, "Wind Field Estimation for Mini- and Micro-Unmanned Aerial Vehicles," *Journal of Guidance, Control and Dynamics*, vol. 34, no. 4, 2011, pp 1016-1030.

[J7] Langelaan, Jack W., "A Gust Soaring Controller for Small Gliders," *Journal of Technical Soaring*, vol. 35, no. 2, 2011.

[J6] **MARLOW, SEAN Q.** and Jack W. Langelaan, "Local Terrain Mapping for Obstacle Avoidance using Monocular Vision," *Journal of the American Helicopter Society*, vol. 56, no. 2, April 2011.

[J5] **CORBETS, JEFFREY B.** and Jack W. Langelaan, "Real Time Trajectory Generation for Target Localization using Micro Air Vehicles," *Journal of Aerospace Computing, Information and Communications*, vol. 7, August 2010, pp 223-240. DOI: 10.2514/1.47834.

[J4] Langelaan, Jack W., "Gust Energy Extraction for Small- and Micro- Uninhabited Aerial Vehicles," *Journal of Guidance, Control and Dynamics,* vol. 32, no. 2, 2009, pp 464-473.

[J3] Langelaan, Jack W., "State Estimation for Autonomous Flight in Cluttered Environments," *Journal of Guidance, Control and Dynamics,* vol. 30, no. 5, 2007.

[J2] Langelaan, Jack, ed.: "Special Issue on Aircraft Design and Development," *Canadian Aeronautics and Space Journal* vol. 46, no. 2 June 2000.

[J1] Langelaan, Jack W. and E. Livne: "Analytic Sensitivities and Design Oriented Structural Analysis for Airplane Fuselage Shape Synthesis," *Computers and Structures*, vol. 62, no. 3, pp. 505–519, 1997.

Book Chapters

[B1] Langelaan, Jack W., "Power Generation and Energy Management," in *Encyclopedia of Aerospace Engineering: UAS*, online June 13, 2016. DOI: 10.1002/9780470686652.eae1113

Conference Publications

Names in **BOLD SMALL CAPS** denote Langelaan's students.

[C57] **GENG, JUNYI** and Jack W. Langelaan, "Mass and Center of Mass Location Estimation for a Multi-lift Slung Load," *Proceedings of the 2020 AIAA SciTech Forum*, Orlando, Florida, January 7-11, 2020. DOI: 10.2514/6.2020-2067

[C56] **BIRD, JOHN J.** and Jack W. Langelaan, "A Multi-Armed Bandit Approach to Atmospherically Aware Altitude Optimization," *Proceedings of the 2020 AIAA SciTech Forum*, Orlando, Florida, January 7-11, 2020. DOI: 10.2514/6.2020-1089

[C55] **LI, ZHENDA** and Jack W. Langelaan, "Parameterized Trajectory Planning for Dynamic Soaring," *Proceedings of the 2020 AIAA SciTech Forum*, Orlando, Florida, January 7-11, 2020. DOI: 10.2514/6.2020-0856

[C54] **OPAZO, TOMAS I.** and Jack W. Langelaan, "Longitudinal control of transition to powered flight for a parachute-dropped multirotor," *Proceedings of the 2020 AIAA SciTech Forum*, Orlando, Florida, January 7-11, 2020. DOI: 10.2514/6.2020-2072

[C53] Kinzel, Michael P., Jason K. Cornelius, Sven Schmitz, Jose L. Palacios, Jack W. Langelaan, Douglas Adams, and Ralph Lorenz, "An Investigation of the Behavior of a Coaxial Rotor in Descent and Ground Effect," *Proceedings of the 2019 AIAA SciTech Forum*, San Diego, California, January 7-11, 2019. doi: 10.2514/6.2019-1098

[C52] Yan, Sihong, David Getz, Jose L. Palacios, Michael P. Kinzel, Sven Schmitz and Jack W. Langelaan, "Design, Fabrication and Preliminary Testing of an Experimental Measurement Rig for Co-Axial Rotors," *Proceedings of the 2019 AIAA SciTech Forum*, San Diego, California, January 7-11, 2019. doi: 10.2514/6.2019-1096

[C51] **GENG, JUNYI** and Jack W. Langelaan, "Implementation And Demonstration Of Coordinated Transport Of A Slung Load By A Team Of Rotorcraft," *Proceedings of the 2019 AIAA SciTech Forum*, San Diego, California, January 7-11, 2019. doi: 10.2514/6.2019-0913

[C50] **BIRD, JOHN J.** and Jack W. Langelaan, "Optimal Speed Scheduling for Hybrid Solar Aircraft with Arrival Time Condition," *Proceedings of the 2019 AIAA SciTech Forum*, San Diego, California, January 7-11, 2019. doi: 10.2514/6.2019-1421

[C49] Yan, Sihong, **TOMAS OPAZO**, Jose Palacios, Jack W. Langelaan and Louis-David Germain, "Experimental evaluation of multi-rotor UAV operation under icing conditions," *Proceedings of the American Helicopter Society 74th Annual Forum,* Phoenix, Arizona, May 2018.

[C48] Lakhmani, Sagar, Jack W. Langelaan, and Alan Wagner, "Human-intuitable collision avoidance for autonomous and semi-autonomous aerial vehicles," *Proceedings of the American Helicopter Society 74th Annual Forum,* Phoenix, Arizona, May 2018.

[C47] McGee, Timothy G., Douglas S. Adams, Kenneth E. Hibbard, Elizabeth P. Turtle, Ralph D. Lorenz, Farzin Amzajerdian, and Jack W. Langelaan, "Guidance, Navigation, and Control for Exploration of Titan with the Dragonfly Rotorcraft Lander," *AIAA Guidance, Navigation, and Control Conference*, Kissimee, Florida, January 8-12, 2018.

[C46] **BIRD, JOHN J.** and Jack W. Langelaan, "Design Space Exploration for Hybrid Solar/Soaring Aircraft," *Proceedings of the AIAA Aviation Technology, Integration, and Operations Conference*, Denver, Colorado, June 5-7, 2017.

[C45] Langelaan, Jack W., Sven Schmitz, Jose Palacios and Ralph D. Lorenz, "Energetics of rotary-wing exploration of Titan," *IEEE Aerospace Conference*, Big Sky, Montana, March 6-10, 2017.

[C44] **GENG, JUNYI** and Jack W. Langelaan, "A Quasi Polar Local Occupancy Grid Approach for Vision-based Obstacle Avoidance," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, Grapevine, Texas, January 9-13, 2017.

[C43] **HOLMES, W. K.** and Jack W. Langelaan, "Autonomous Ship-board Landing using Monocular Vision," *Proceedings of the American Helicopter Society 72nd Annual Forum*, West Palm Beach, Florida, May 2016.

[C43] Jerath, Kshitij and Jack W. Langelaan, "Simulation framework for incorporating sensor systems in UAS conceptual design," *Proceedings of the AIAA Modeling and Simulation Technologies Conference*, San Diego, California, January 4-8, 2016.

[C42] Enciu, Jacob, Joseph F. Horn, and Jack W. Langelaan, "Formation control of a rotorcraft multi-lift system," *41st European Rotorcraft Forum*, September 1-4, 2015.

[C41] **DEPENBUSCH, NATHAN T.,** Constantino Lagoa, and Jack W Langelaan, "Random Geometric Graphs as a Model for Bounding the Endurance of Soaring Aircraft," *IEEE Conference on Decision and Control*, Los Angeles, California, December 2014.

[C40] **CHENG, KWOK** and Jack W. Langelaan, "Guided Exploration for Coordinated Autonomous Soaring Flight," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, National Harbor, Maryland, January 13-17, 2014.

[C39] **LI, ZUQUN,** Jack W. Langelaan and Joseph F. Horn, "Coordinated Transport of a Slung Load by a Team of Autonomous Rotorcraft," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, National Harbor, Maryland, January 13-17, 2014.

[C38] **MAKOVKIN, DMITRIY** and Jack W. Langelaan, "Optimal Persistent Surveillance using Coordinated Soaring," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, National Harbor, Maryland, January 13-17, 2014.

[C37] **BIRD, JOHN J.,** Jack W. Langelaan, Corey Montella, John Spletzer, Joachim Grenestedt, "Closing the Loop in Dynamic Soaring," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, National Harbor, Maryland, January 13-17, 2014.

[C36] **DAUGHERTY, SHAWN** and Jack W. Langelaan, "Improving Autonomous Soaring via Energy State Estimation and Extremum Seeking Control," *Proceedings of the AIAA Guidance, Navigation and Control Conference*, National Harbor, Maryland, January 13-17, 2014.

[C35] **DEPENBUSCH, NATHAN T.** and Jack W. Langelaan, "Minimum Risk Planning for Teams of Unmanned Air Vehicles," *Proceedings of the 2013 Infotech@Aerospace Conference*, Boston, Massachusetts, August 19-22, 2013. (invited paper).

[C34] **CHAKRABARTY, ANJAN** and Jack W. Langelaan, "UAV Flight Path Planning in Time Varying Complex Wind Fields," *American Control Conference*, Washington, DC, June 2013.

[C33] **GRANDE, NICHOLAS** and Jack W. Langelaan, "Safe Autonomous Flare and Landing during Autorotation through Wind Shear," *Proceedings of the AHS 69th Annual Forum*, Phoenix, Arizona, May 21-23, 2013.

[C32] **TRUSKIN, BENJAMIN** and Jack W. Langelaan, "Vision-based Deck State Estimation for Autonomous Ship-board Landing," *Proceedings of the AHS 69th Annual Forum*, Phoenix, Arizona, May 21-23, 2013.

[C31] Song, Y., Joseph F. Horn, **ZUQUN LI,** and Jack W. Langelaan, "Modeling, Simulation, and Non-linear Control of a Rotorcraft Multi-Lift System," *Proceedings of the AHS 69th Annual Forum*, Phoenix, Arizona, May 21-23, 2013.

[C30] **QUINDLEN, JOHN F.** and Jack W. Langelaan, "Flush Air Data Sensing for Soaring-capable UAVs," *51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition*, January 7-10, 2013. DOI: 10.2514/6.2013-1153.

[C29] **BIRD, JOHN J.** and Jack W. Langelaan, "Spline Mapping to Maximize Energy Exploitation of Non-uniform Thermals," *Proceedings of the XXXI OSTIV Congress*, Uvalde, Texas, August 8-13, 2012.

[C28] Langelaan, Jack W., J. Spletzer, C. Montella and J. Grenestedt, "Wind field estimation for autonomous dynamic soaring," *2012 IEEE International Conference on Robotics and Automation*, St. Paul, Minnesota, May 14-18, 2012.

[C26] **YOMCHINDA, THANAN,** Joseph F. Horn and Jack W. Langelaan, "Autonomous Control and Path Planning for Autorotation of Unmanned Helicopters," *American Helicopter Society 68th Annual Forum*, Fort Worth, Texas. May 1-3, 2012.

[C26] **MARLOW, SEAN Q.** and Jack W. Langelaan, "Population of a Range Bearing Map for Local Obstacle Avoidance Using Monocular Vision," *American Astronautical Society Guidance and Control Conference*, Breckenridge, Colorado, 2012.

[C25] **YOMCHINDA, THANAN**, Joseph F. Horn and Jack W. Langelaan, "Flight Path Planning for Descent-phase Helicopter Autorotation," *AIAA Guidance, Navigation and Controls Conference*, Portland, Oregon, August 7-11, 2011.

[C24] **NATHAN T. DEPENBUSCH** and Jack W. Langelaan, "Coordinated Mapping and Exploration for Autonomous Soaring," *AIAA Infotech@Aerospace Conference*, St. Louis, Missouri, March 29-31, 2011.

[C23] Jack W. Langelaan, Nicholas Alley and James Niedhoefer, "Wind Field Estimation for Small Unmanned Aerial Vehicles," *AIAA Guidance, Navigation and Controls Conference*, Toronto, Canada, August 2-5, 2010.

[C22] **DEPENBUSCH, NATHAN T.** and Jack W. Langelaan, "Receding Horizon Control for Atmospheric Energy Harvesting by Small UAVs," *AIAA Guidance, Navigation and Controls Conference*, Toronto, Canada, August 2-5, 2010.

[C21] **CHAKRABARTY, ANJAN** and Jack W. Langelaan, "Flight Path Planning for UAV Atmospheric Energy Harvesting Using Heuristic Search," *AIAA Guidance, Navigation and Controls Conference*, Toronto, Canada, August 2-5, 2010.

[C20] **MARLOW, SEAN Q.** and Jack W. Langelaan, "Dynamically Sized Occupancy Grids for Obstacle Avoidance," *AIAA Guidance, Navigation and Controls Conference*, Toronto, Canada, August 2-5, 2010.

[C19] Dean, Adam J., Jack W. Langelaan, and Sean N. Brennan, "Improvements in Terrain-Based Road Vehicle Localization by Initializing an Unscented Kalman Filter Using Particle Filters." *2010 American Control Conferenc*e, Baltimore, Maryland, June 30-July 2, 2010.

[C18] **TIERNEY, SHANE** and Jack W. Langelaan, "Autorotation Path Planning Using Backwards Reachable Sets and Optimal Control," *American Helicopter Society 66th Annual Forum*, Phoenix, Arizona, May 2010.

[C17] Jemmott, Colin W., Lee J. Culver, and Jack W. Langelaan, "Comparison of Particle Filter and Histogram Filter for Passive Sonar Localization," *Proceedings of Meetings on Acoustics*, vol. 8, issue 1, December 22, 2009. http://dx.doi.org/10.1121/1.3292596

[C16] Dean, Adam J., Jack W. Langelaan, and Sean N. Brennan, "Initializing an Unscented Kalman Filter using a Particle Filter," Dynamic Systems and Control Conference, Hollywood, California, October 2009.

[C15] **CHAKRABARTY, ANJAN** and Jack W. Langelaan, "Energy Maps for Long Range Path Planning for Small- and Micro- UAVs," *AIAA Guidance, Navigation and Controls Conference*, Chicago, Illinois, August, 2009.

[C14] **MARLOW, SEAN Q.** and Jack W. Langelaan, "Local Terrain Mapping for Obstacle Avoidance using Monocular Vision," *AHS International Specialist's Meeting on Unmanned Rotorcraft*, Scottsdale, Arizona, January 2009.

[C13] **SARFRAZ, SANA** and Jack W. Langelaan, "Autonomous Ground-Based Tracking of Migrating Raptors using Vision," *AIAA Guidance, Navigation and Controls Conference (invited paper)*, Honolulu, Hawaii, August 18-21, 2008.

[C12] Jack W. Langelaan, "Biologically Inspired Flight Techniques for Small and Micro Unmanned Aerial Vehicles," *AIAA Guidance, Navigation and Controls Conference*, Honolulu, Hawaii, August 18-21, 2008.

[C11] Jack W. Langelaan, "Tree-based Trajectory Planning to Exploit Atmospheric Energy," *American Control Conference,* Seattle, Washington, June 11-13, 2008.

[C10] **JEFFREY B. CORBETS** and Jack W. Langelaan, "Parameterized Trajectories for Target Localization using Small- and Micro- Unmanned Aerial Vehicles," *American Control Conference,* Seattle, Washington, June 11-13, 2008.

[C9] Jack W. Langelaan and Goetz Bramesfeld, "Gust Energy Extraction for Small and Micro Uninhabited Aerial Vehicles," *46th AIAA Aerospace Sciences Meeting*, Reno, Nevada, January 7-10, 2008.

[C8] Jack W. Langelaan, "Long Distance/Duration Trajectory Optimization for Small UAVs," *AIAA Guidance, Navigation and Controls Conference*, Hilton Head, South Carolina, August 20-23, 2007.

[C7] Eric W. Frew, Jack Langelaan, Maciej Stachura, "Adaptive Planning Horizon Based on Information Velocity for Vision-Based Navigation and Active Sensing," *invited to AIAA Guidance, Navigation and Controls Conference*, Hilton Head, South Carolina, August 20-23, 2007.

[C6] **JEFFREY B. CORBETS** and Jack W. Langelaan, "Parameterized Optimal Trajectory Generation for Target Localization," *invited to AIAA Guidance, Navigation and Controls Conference*, Hilton Head, South Carolina, August 20-23, 2007.

[C5] Eric Frew, Jack Langelaan and Sungmoon Joo, "Adaptive Receding Horizon Control for Vision-Based Navigation of Small Unmanned Aircraft," *invited to American Controls Conference*, Minneapolis, Minnesota, June 14-16, 2006.

[C4] Jack Langelaan and Steve Rock, "Towards Autonomous UAV Flight in Forests," *AIAA Guidance, Navigation and Control Conference*, San Francisco, California, August 15-18, 2005.

[C3] Jack Langelaan and Steve Rock, "Passive GPS-Free Navigation for Small UAVs," *IEEE Aerospace Conference*, Big Sky, Montana 2005.

[C2] Jack Langelaan and Steve Rock, "Navigation of Small UAVs Operating in Forests," *AIAA Guidance, Navigation and Control Conference*, Providence, Rhode Island, August 16-19, 2004.

[C1] Jack W. Langelaan and Leo J. J. Kok: "Damage Tolerance Modelling of Fibre/Metal Laminate Fuselage Structures," AIAA Paper 97-1400*, 38th Structures, Structural Dynamics and Materials Conference*, Kissimmee, Florida, April 7-10, 1997.

Seminars and speaking engagements

[27] "Teaching Drones to Soar," Maryland Robotics Center, University of Maryland, March 2018.

[26] "Algorithms, Implementation, and Flight Test Results of the AutoSOAR Platform," Centre for Aerial Robotics Research and Education, University of Toronto, January 2017.

[25] "Cooperative Transport of Slung Loads by Teams of Autonomous Rotorcraft," University of Michigan, January 2015.

[24] "Coordination Strategies for Autonomous Soaring," University of Toronto Institute for Aerospace Studies, October 2014.

[23] "Coordination Strategies for Autonomous Soaring," Ohio State University, October 2014.

[22] "Progress in Autonomous Soaring," Naval Research Lab, September 2014.

[21] "Risks and Opportunities: Flying Drones," Excess Casualty Claims Seminar, New York, NY, September 2014.

[20] "Extreme Flight Efficiency: The Taurus G4 and the Green Flight Challenge," Virginia Tech Department of Aerospace and Ocean Engineering, November 4, 2012.

[19] "Extreme Flight Efficiency: The Taurus G4 and the Green Flight Challenge," University of Illinois Department of Aerospace Engineering, September 26, 2012.

[18] "Extreme Flight Efficiency: The Taurus G4 and the Green Flight Challenge," Stanford University Department of Aeronautics and Astronautics, April 25, 2012.

[17] "Dawn of the Electric Age: The Taurus G4, the Green Flight Challenge and the Promise of Electric Powered Flight," NASA Ames Research Center, April 25, 2012.

[16] "The Advent of Flight's Electric Age," presentation to Collier Trophy Selection Committee, March 12, 2012.

[15] "The Advent of Green and Affordable Personal Air Travel," TEDxPSU, November 13, 2011 (http://www.youtube.com/watch?v=rA7o9eMhsjw).

[14] "Electric Flight Research Panel," member of panel discussing teaching and research issues in electric aviation, 2010 EAA AirVenture, Oshkosh, Wisconsin, July 29, 2010.

[13] "Enabling Long-duration Missions for Small UAVs," Lehigh University Department of Mechanical Engineering, April 22, 2010.

[12] "Enabling Long-duration Missions for Small UAVs," Stanford University Department of Aeronautics and Astronautics, Stanford, California, February 17, 2010.

[11] "Vision-based obstacle avoidance for small unmanned rotorcraft," AMRDEC, NASA Ames Research Center, Moffet Field, California, July 23, 2009.

[10] "Autonomous Soaring Flight for Small and Micro UAVs," Intelligent Systems Division, NASA Ames Research Center, Moffet Field, California, July 22, 2009.

[9] "Autonomous Soaring Flight for Small and Micro UAVs," University of Colorado Aerospace Engineering Sciences, October 28, 2008.

[8] "Integrated Symbolic/Continuous Trajectory Planning for Safe Landing under Restricted Flight Envelopes", NASA Ames, March 6, 2008.

[7] "Biologically Inspired Flight Techniques for Small- and Micro- Unmanned Aerial Vehicles", Stanford University Department of Aeronautics and Astronautics, March 5, 2008.

[6] "Vision Aided State Estimation for Autonomous Flight in Cluttered Environments", AFRL/VACA, Wright-Patterson AFB, November 28, 2006.

[5] "Vision Aided State Estimation for Autonomous Flight in Cluttered Environments", Department of Aerospace and Ocean Engineering, Virginia Tech, Blacksburg, VA. November 13, 2006.

[4] "Towards Autonomous UAV Flight in Forests", Department of Aerospace Engineering, Pennsylvania State University, State College, PA. November 15, 2005.

[3] "Towards Autonomous UAV Flight in Forests", MDA Space Missions, Brampton, Ontario. June 22, 2005.

[2] "Towards Autonomous UAV Flight in Forests", University of Toronto Institute for Aerospace Studies, Toronto, Ontario. June 20, 2005.

[1] "Autonomous Navigation of Small UAVs in Unknown Environments", Mechatronics Division, Department of Mechanical Engineering, University of Waterloo, Waterloo, Ontario. March 24, 2005.