

## Craig A. Woolsey

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### Contact Information:

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### Research Interests:

Dr. Woolsey's research interests include nonlinear control theory for mechanical systems, particularly energy-based control methods, and applications to ocean and atmospheric vehicles. Woolsey co-directs the Nonlinear Systems Laboratory ([www.nsl.aoe.vt.edu](http://www.nsl.aoe.vt.edu)), with colleagues Dr. Mazen Farhood and Dr. Cornel Sultan. Woolsey is also the co-director, with Dr. Kevin Kochersberger, of the Virginia Tech site in the Center for Autonomous Air Mobility and Sensing ([caams.center](http://caams.center)).

### Education:

Ph.D. in Mechanical & Aerospace Engineering, Princeton University, January 2001.  
M.A. in Mechanical & Aerospace Engineering, Princeton University, June 1997.  
B.M.E., Georgia Institute of Technology, March 1995. (Highest Honor, Cooperative Employment Plan)

### Professional Experience:

Sep. 2014 – present	Professor Aerospace & Ocean Engineering Department Virginia Tech, Blacksburg, VA
Sep. 2008 – Aug. 2014	Associate Professor & Assistant Department Head for Graduate Studies Aerospace & Ocean Engineering Department Virginia Tech, Blacksburg, VA
Sep. 2006 – Aug. 2008	Associate Professor Aerospace & Ocean Engineering Department Virginia Tech, Blacksburg, VA
Jan. 2001 – Aug. 2006	Assistant Professor Aerospace & Ocean Engineering Department Virginia Tech, Blacksburg, VA
July 1995 – Dec. 2000	Graduate Research Assistant and Assistant in Instruction Mechanical & Aerospace Engineering Department Princeton University, Princeton, NJ
June 1991 - Sep. 1994	Student Employee, Cooperative Plan Office of Scientific and Weapons Research (Directorate of Intelligence) & Office of Logistics (Directorate of Administration), Central Intelligence Agency, Washington, D.C. (Clearance Level: Top Secret, Sensitive Compartmented Information)

## Professional Affiliations:

American Institute of Aeronautics and Astronautics (AIAA), Associate Fellow

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

International Federation of Automatic Control (IFAC), Member

Association for Unmanned Vehicle Systems International (AUVSI), Ridge & Valley Chapter, Member & Treasurer

## Professional & University Service:

Associate Editor, *AIAA J. Guidance, Control, and Dynamics* (2023 – present)

AIAA Atmospheric Flight Mechanics TC Member (2017 – present; Vice-chair, 2021 – 2023; Chair, 2021 – present)

IEEE CSS TC on Manufacturing Automation and Robotic Control (2017 – present)

IFAC TC on Marine Systems: TC 7.2 (2017 – present)

AUVSI Ridge & Valley Chapter (Treasurer, 2022 – present; President, 2019 – 2021; Secretary, 2016 – 2018)

VT University Promotion & Tenure Committee, College of Engineering (CoE) Representative (2016 – 2019)

VT AOE Diversity, Equity, & Inclusion Committee (2022 – present; Co-Chair, 2022 – 2023)

VT AOE Promotion & Tenure Committee (2014 – 2023; Chair, 2022 – 2023)

VT AOE Undergraduate Curriculum Committee (2012 – 2022)

VT AOE Dynamics, Control, & Estimation Group (2006 – present; Chair, 2006 – 2022)

Director, Virginia Center for Autonomous Systems (2006 – 2014)

VT AOE Assistant Department Head for Graduate Studies (2008 – 2014)

VT AOE Graduate Committee (Member, 2006 – 2019; Chair, 2007 – 2014)

Faculty Advisor, VT AUVSI Student Chapter (2018 – present)

Faculty Co-Advisor, VT Autonomous Underwater Vehicle Team (2002 – 2013)

Faculty Co-Advisor, VT Student Chapter of AIAA (2003 – 2008)

VT ADVANCE Advisory Board (2003 – 2008)

Chair, VT AOE Student Opportunities Committee (2003 – 2007)

Presbyterian Campus Ministry (Board, 2001 – 2007; Endowment Committee, 2007 – present)

Conference Organizing Service:

- General Chair: *15<sup>th</sup> IFAC Conf. Control Appl. in Marine Systems, Robotics and Vehicles: CAMS 2024*

- Organizing Committee: *18<sup>th</sup> Intl. Symposium on Mathematical Theory of Networks & Systems* (2008)

- Organizing Committee: *AUVSI Ridge & Valley Chapter Fall Symposium* (2016 -- present)

Conference Program and/or Associate Editor Service:

- *14th IFAC Conf. Control Appl. in Marine Systems, Robotics and Vehicles: CAMS 2022* (Lyngby, Denmark, 2022)

- *American Control Conf.* (2006-2009, 2013-14, 2021, 2023)

- *1<sup>st</sup> IFAC Workshop on Guidance & Control of Underwater Vehicles* (Newport, South Wales, U.K., 2003)

Reviewer for numerous journals and conferences. Special recognition:

- Excellent Reviewer (2015, 2017, 2022): *AIAA J. Guidance, Control, & Dynamics*

- Excellence in Review (2012): *IEEE J. Oceanic Engineering*

## Honors & Awards:

AIAA SciTech Forum Atmospheric Flight Mechanics Best Student Paper Award (Gahan et al, 2023)

AIAA SciTech Forum Atmospheric Flight Mechanics Best Student Paper Award (Hopwood et al, 2022)

AIAA SciTech Forum Atmospheric Flight Mechanics Best Paper Award (McClelland & Woolsey, 2019)

National Academy of Sciences, Engineering and Medicine (NAS) Committee to Assess the Risks of Unmanned Aircraft Systems (UAS) Integration (2017-2018)

Virginia Tech College of Engineering Dean's Award for Excellence in Research (2017)

Virginia Tech Student Engineers Council Undergraduate Research Advisor of the Year (2015)

Virginia Tech Master Online Instructor (2013)  
 Virginia Tech College of Engineering Certificate of Teaching Excellence (2013)  
 SAE Ralph R. Teetor Educational Award (2008)  
 NSF Faculty Early Career Development (CAREER) Award (2002—2007)  
 ONR Young Investigator Program Award (2002—2005)  
 NASA Institute for Advance Concepts Fellow (2004-2005)  
 Virginia Tech College of Engineering Faculty Fellow (2003 – 2006)  
 Virginia Tech College of Engineering Dean’s Award: Outstanding New Assistant Professor (2003)  
 NDSE (Department of Defense) Graduate Fellowship (1995–1998)  
 NSF Graduate Fellowship (deferred) (1995)  
 Guggenheim Fellowship (Princeton University) (1995)  
 Georgia Tech President’s Scholar (1990 – 1995)  
 Tau Beta Pi Senior Engineering Cup (Georgia Tech) (1995)  
 College of Engineering Award (Georgia Tech) (1994)  
 CIA Exceptional Performance Award (1993)

## **Publications:<sup>1</sup>**

### Journal publications (peer-reviewed):

- [1] “Disturbance observer based extended Kalman filter,” Y.-C. Chen\* and C. A. Woolsey. (In review.)
- [2] “Hermite-based, one-step, variational and Galerkin time integrators for mechanical systems,” H. Sharma, M. Patil, and C. A. Woolsey. (In review.)
- [3] “A study of the wind sensing performance of pusher and puller hexacopter small unmanned aircraft,” J. González -Rocha, P. Sharma, E. Atkins, and C. A. Woolsey. *AIAA J. Aircraft* (To appear.)
- [4] “A structure-inspired disturbance observer for mechanical systems,” Y.-C. Chen\* and C. A. Woolsey. *IEEE Trans. Control Systems Technology* (To appear.)
- [5] "A free surface corrected lumped parameter model for near-surface horizontal maneuvers of underwater vehicles in waves," W. Lambert, L. Miller, S. Brizzolara, and C. A. Woolsey, *Ocean Engineering* (To appear.)
- [6] “Flight-test system identification techniques and applications for small, low-cost, fixed-wing aircraft,” B. M. Simmons\*, J. L. Gresham\*, and C. A. Woolsey, *AIAA J. Aircraft* (To appear.)
- [7] "Nonlinear dynamic modeling for aircraft with unknown mass properties using flight data," B. M. Simmons\*, J. L. Gresham\*, and C. A. Woolsey. *AIAA J. Aircraft* (To appear.)
- [8] “Spin aerodynamic modeling for a fixed-wing aircraft using flight data,” J. L. Gresham\*, B. M. Simmons\*, J. W. Hopwood\*, and C. A. Woolsey. *AIAA J. Aircraft* (To appear.) [[10.2514/1.C036835](#)]
- [9] "Remote uncorrelated pilot input excitation assessment for unmanned aircraft aerodynamic modeling," J. L. Gresham\*, B. M. Simmons\*, J.-M. W. Fahmi\*, J. W. Hopwood\*, and C. A. Woolsey. *AIAA J. Aircraft* (To appear.) [[10.2514/1.C036942](#)]
- [10] “Robust stall spin flight path control with flight test validation,” J. Hopwood\*, J. Gresham\*, and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* [[10.2514/1.G007016](#)]
- [11] “The effect of a linear free surface boundary condition on the steady-state wave-making of shallowly submerged underwater vehicles,” W. Lambert, S. Brizzolara, and C. A. Woolsey, *J. Marine Science and Engineering* [[10.3390/jmse11050981](#)]

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<sup>1</sup>The superscript \* in an author list denotes a postdoctoral, graduate, undergraduate, or high school research assistant or a visiting scholar advised or co-advised by C. Woolsey.

- [12] “Virginia Tech advanced towing carriage,” C. Gilbert, M. Javaherian, C. Woolsey, and M. Shephard, *Part M: Journal of Engineering for the Maritime Environment* [[10.1177/14750902231166958](https://doi.org/10.1177/14750902231166958)]
- [13] “Experimental validation of port-Hamiltonian based control of fixed wing unmanned aircraft,” J.-M. Fahmi\*, J. Gresham\*, and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* [[10.2514/1.G007018](https://doi.org/10.2514/1.G007018)]
- [14] “Time delay mitigation in aerial telerobotic operations using heterogeneous stereo vision systems,” N. Sakib\*, K. C. Gahan\*, and C. A. Woolsey *AIAA J. Aerospace Information Systems* **20**(9), pp. 526-545, 2023. [[10.2514/1.I011204](https://doi.org/10.2514/1.I011204)]
- [15] “A maneuvering model for an underwater vehicle near a free surface—Part III: Simulation and control under waves,” F. Valentinis, T. Battista\*, and C. A. Woolsey. *IEEE J. Oceanic Engineering*, **48**(3), pp. 752-777, 2023. [[10.1109/JOE.2023.3234811](https://doi.org/10.1109/JOE.2023.3234811)]
- [16] “A maneuvering model for an underwater vehicle near a free surface - Part II: Incorporation of the free surface memory,” T. Battista\*, F. Valentinis, and C. A. Woolsey. *IEEE J. Oceanic Engineering*, **48**(3), pp. 740-751, 2023. [[10.1109/JOE.2022.3229919](https://doi.org/10.1109/JOE.2022.3229919)]
- [17] “Aero-propulsive modeling for propeller aircraft using flight data,” B. Simmons\*, J. Gresham\*, and C. A. Woolsey. *AIAA J. Aircraft* **60**(1), pp. 81-96, 2023. [[10.2514/1.C036773](https://doi.org/10.2514/1.C036773)]
- [18] “Bridge inspection component registration for damage evolution,” E. Bianchi, N. Sakib\*, M. Hebdon, and C. A. Woolsey. *J. Structural Health Monitoring*. **22**(1), pp. 472-495, January 2023. [[10.1177/14759217221083647](https://doi.org/10.1177/14759217221083647)]
- [19] “Performance assessment of energy-preserving, adaptive time-step variational integrators,” H. Sharma, J. Borggaard, M. Patil, and C. A. Woolsey. *Comm. Nonlinear Science and Numerical Simulation* . **114**, November 2022 [[10.1016/j.cnsns.2022.106646](https://doi.org/10.1016/j.cnsns.2022.106646)]
- [20] “Lift enhancement by a flapped trailing edge at low Reynolds number: A frequency response approach,” H. Shehata\*, M. Y. Zakaria, M. Hajj, and C. A. Woolsey. *J. Fluids and Structures*. **110**, April 2022. [[10.1016/j.jfluidstructs.2022.103518](https://doi.org/10.1016/j.jfluidstructs.2022.103518)]
- [21] “On closed-loop vibrational control of underactuated mechanical systems,” S. Tahmasian and C. A. Woolsey. *Nonlinear Dynamics*. **108**, pp. 329–347, January 2022. [[10.1007/s11071-022-07214-y](https://doi.org/10.1007/s11071-022-07214-y)]
- [22] “Port-Hamiltonian flight control of a fixed-wing aircraft,” J.-M. Fahmi\* and C. A. Woolsey. *IEEE Trans. Control Systems Technology* **30**(1), pp. 408-415, January 2022. [[10.1109/TCST.2021.3059928](https://doi.org/10.1109/TCST.2021.3059928)]
- [23] “Parameter computation for a Lagrangian mechanical system model of a submerged vessel moving near a free surface,” S. Jung\*, S. Brizzolara, and C. A. Woolsey. *Ocean Engineering*, **230**, June 2021. [[10.1016/j.oceaneng.2021.108988](https://doi.org/10.1016/j.oceaneng.2021.108988)]
- [24] “Scheduled imaging of multiple threat aircraft using a modified traveling salesman problem,” C. Kang\* and C. A. Woolsey *AIAA J. Aerospace Information Systems*, **18**(7), pp. 476-486, 2021 [[10.2514/1.I010871](https://doi.org/10.2514/1.I010871)]
- [25] “Development of a peripheral-central vision system for small UAS tracking,” C. Kang\*, H. Chaudhry, C. A. Woolsey, and K. Kochersberger. *AIAA J. Aerospace Information Systems*, **18**(9), pp. 645-658, 2021. [[10.2514/1.I010909](https://doi.org/10.2514/1.I010909)]
- [26] “An approach for computing parameters for a Lagrangian nonlinear maneuvering and seakeeping model of submerged vessel motion,” S. Jung\*, S. Brizzolara, and C. A. Woolsey. *IEEE J. Oceanic Engineering*, **46**(3), pp. 749 – 764, 2021. [[10.1109/JOE.2021.3052657](https://doi.org/10.1109/JOE.2021.3052657)]
- [27] “Model-based path prediction for fixed-wing unmanned aircraft using pose estimates,” C. Kang\* and C. A. Woolsey. *Aerospace Science and Technology* **105**, October 2020, 106030 [[10.1016/j.ast.2020.106030](https://doi.org/10.1016/j.ast.2020.106030)]
- [28] “A review of structure-preserving numerical methods for engineering applications,” H. Sharma\*, M. Patil, and C. A. Woolsey. *Computer Methods in Applied Mechanics and Engineering* **366**, July 2020, 113067 [[10.1016/j.cma.2020.113067](https://doi.org/10.1016/j.cma.2020.113067)]
- [29] “Effects of two modeling assumptions on wind reconstruction from longitudinal aircraft motion,” H. McClelland\* and C. A. Woolsey *AIAA J. Guidance, Control, and Dynamics* **43**(6), pp. 1069-1081, June 2020 [[10.2514/1.G004224](https://doi.org/10.2514/1.G004224)]
- [30] “Wind profiling in the lower atmosphere from wind-induced perturbations to multirotor UAS,” J. González-Rocha\*, S. F. J. De Wekker, S. D. Ross, and C. A. Woolsey *Sensors*, 2020. [[10.3390/s20051341](https://doi.org/10.3390/s20051341)]
- [31] “A maneuvering model for an underwater vehicle near a free surface - Part I: Motion without memory effects,” T. Battista\*, F. Valentinis, and C. Woolsey. *IEEE J. Oceanic Engineering* **45**(1), pp. 212-226, January 2020. [[10.1109/JOE.2018.2871650](https://doi.org/10.1109/JOE.2018.2871650)]

- [32] "Nonlinear model identification methodology for small, fixed-wing, unmanned aircraft," B. Simmons\*, H. G. McClelland\*, and C. A. Woolsey. *AIAA J. Aircraft* **56**(3), pp. 1056-1067, May-June 2019. [[10.2514/1.C035160](#)]
- [33] "A method for detecting atmospheric Lagrangian coherent structures using a single fixed wing unmanned aircraft system," P. Nolan, H. G. McClelland\*, C. A. Woolsey, S. D. Ross, *Sensors*, 2019. [[10.3390/s19071607](#)]
- [34] "Sensing wind from quadrotor motion," J. González-Rocha\*, C. A. Woolsey, C. Sultan, and S. F. J. De Wekker. *AIAA J. Guidance, Control, and Dynamics* **42**(4), pp. 836-852, April 2019. [[10.2514/1.G003542](#)]
- [35] "Nonlinear control of a subscale submarine in emergency ascent," F. Valentinis and C. A. Woolsey. *Ocean Engineering* **171**, pp. 646-662, January 2019. [[10.1016/j.oceaneng.2018.11.029](#)]
- [36] "Workspace modeling and path planning for truss structure inspection by small UAS," A. Das\* and C. A. Woolsey. *AIAA J. Aerospace Information Systems* **16**(1), pp. 37-51, January 2019. [[10.2514/1.I010634](#)]
- [37] "Energy-preserving variational integrators for forced Lagrangian systems," H. Sharma\*, M. Patil, and C. A. Woolsey. *Communications in Nonlinear Science and Numerical Simulation* **64**, pp. 159-177, November 2018. [[10.1016/j.cnsns.2018.04.015](#)]
- [38] "On averaging and input optimization of high-frequency mechanical control systems," S. Tahmasian\*, D. W. Allen\*, and C. A. Woolsey. *J. Vibration and Control* **24**(5), pp. 937-955, May 2018. [[10.1177/1077546316655706](#)]
- [39] "Flight control of biomimetic air vehicles using vibrational control and averaging," S. Tahmasian\* and C. A. Woolsey. *J. Nonlinear Science* **27**(4), pp. 1193–1214, August 2017. [[10.1007/s00332-016-9334-5](#)]
- [40] "A comparison of three approaches to atmospheric source localization," H. M. Abdelghaffar, C. A. Woolsey, and H. A. Rakha, *AIAA J. Aerospace Information Systems*, **14**(1), pp. 40-52, January 2017. [[10.2514/1.I010440](#)]
- [41] "Optimal paths in still air for a sailplane with a quadratic glide polar," A. Wolek\* and C. A. Woolsey. *Technical Soaring* **40**(2), pp. 9-23, April-June 2016.
- [42] "Time-optimal path planning for a kinematic car with variable speed," A. Wolek\*, E. M. Cliff, and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **39**(10), pp. 2374-2390, 2016. [[10.2514/1.G001317](#)]
- [43] "Fuel/time optimal relative trajectories for a satellite near a perturbed, elliptical orbit," A. Rogers\*, C. A. Woolsey, J. Black, and R. McGwier. *AIAA J. Spacecraft and Rockets* **53**(5), pp. 811-821, 2016. [[10.2514/1.A33365](#)]
- [44] "Energy-optimal paths for a glider with speed and load factor controls," A. Wolek\*, E. M. Cliff, and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **39**(2), pp. 397-408, February 2016. [[10.2514/1.G001345](#)]
- [45] "Geometric control approach to longitudinal stability of flapping flight," H. Taha, C. A. Woolsey, and M. Hajj. *AIAA J. Guidance, Control, and Dynamics* **39**(2), pp. 214-226, February 2016. [[10.2514/1.G001345](#)]
- [46] "Exploring the oceans of Europa with biologically-inspired underwater vehicles," D. W. Allen\*, M. C. Jones\*, L. S. McCue, W. B. Moore, M. Philen, and C. A. Woolsey. *J. the British Interplanetary Society* **68**, pp. 251-264, August 2015.
- [47] "Geometric control of a flapping plate," H. E. Taha and C.A. Woolsey. *J. Vibration and Control* **21**(11):2124–2133, August 2015. [[10.1177/1077546313506924](#)]
- [48] "A control design method for underactuated mechanical systems using high frequency inputs," S. Tahmasian\* and C. A. Woolsey. *ASME J. Dynamic Systems, Measurement, and Control* **137**(7), July 2015. [[10.1115/1.4029627](#)]
- [49] "Feasible Dubins paths in the presence of unknown, unsteady velocity disturbances," A. Wolek\* and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **38**(4), pp. 782-786, April 2015. [[10.2514/1.G000629](#)]
- [50] "The need for higher-order averaging in the stability analysis of hovering, flapping-wing flight", H. Taha, S. Tahmasian\*, C. A. Woolsey, A. Nayfeh, and M. Hajj. *Bioinspiration and Biomimetics* **10**(1), February 2015. (Paper selected as one of the *Bioinspiration & Biomimetics* "Highlights" for 2015.) [[10.1088/1748-3190/10/1/016002](#)]
- [51] "Integration and testing of a surface plasmon resonance sensor with a small unmanned aerial vehicle," M. Palframan\*, H. Gruszewski, D. Schmale, III, and C. A. Woolsey. *J. Unmanned Vehicle Systems* **2**, pp. 103–118, October 2014. [[10.1139/juvs-2013-0019](#)]
- [52] "Dynamics of underwater gliders in currents," S. Fan\* and C. A. Woolsey. *Ocean Engineering* **84**, pp. 249–258, July 2014. [[10.1016/j.oceaneng.2014.03.024](#)]

- [53] "Stabilization of flapping-wing micro-air vehicles in gust environments," M. Bhatia, M. Patil, C. A. Woolsey, B. Stanford and P. Beran. *AIAA J. Guidance, Control, and Dynamics* **37**(2):592-607, March 2014. [[10.2514/1.59875](#)]
- [54] "An efficient motion control system for underwater gliders," N. Mahmoudian\* and C. Woolsey. *Nonlinear Engineering: Modeling and Application*. Vol. 2, pp. 63-77, 2013. [[10.1515/nleng-2012-0011](#)]
- [55] "Elements of underwater glider performance and stability," S. Fan\* and C. Woolsey. *Marine Technology Society Journal*, **47**(3), pp. 81-98, May/June 2013. [[10.1515/nleng-2012-0011](#)]
- [56] "Modeling, identification, and control of an unmanned surface vehicle," C. Sonnenburg\* and C. A. Woolsey. *J. Field Robotics*, **30**(3), pp. 371-398, May/June 2013. [[10.1002/rob.21452](#)]
- [57] "Vehicle motion in currents," P. Thomasson and C. A. Woolsey. *IEEE J. Oceanic Engineering*, **38**(2), pp. 226-242, April 2013. [[10.1109/JOE.2013.2238054](#)]
- [58] "Unmanned aerial vehicle coordination on closed convex paths in wind" L. Techy\*, D. Paley, and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics*, **33**(6), pp. 1946-1951, November-December 2010. [[10.2514/1.47655](#)]
- [59] "Backstepping for synchronization of nonlinear dynamical systems," K. Listmann, J. Adamy, and C. A. Woolsey. *Automatisierungstechnik*, pp. 425-434, August 2010.
- [60] "Coordinated aerobiological sampling of a plant pathogen in the lower atmosphere using two autonomous unmanned aerial vehicles," L. Techy\*, D. Schmale, III, and C. A. Woolsey. *J. Field Robotics* **27**(3), pp. 335-343, May/June 2010. [[10.1002/rob.20335](#)]
- [61] "Fast estimation for range identification in the presence of unknown motion parameters," L. Ma\*, C. Cao, N. Hovakimyan, C. Woolsey, and W. Dixon. *IMA J. Applied Mathematics*, **75**(2), pp. 165-189, February 2010. [[10.1093/imat/hxq008](#)]
- [62] "Approximate analytical turning conditions for underwater gliders and implications for path planning," N. Mahmoudian\*, J. Geisbert\*, and C. Woolsey. *IEEE J. Oceanic Engineering* **35**(1), pp. 131-143, January 2010. [[10.1109/JOE.2009.2039655](#)]
- [63] "Minimum-time path planning for unmanned aerial vehicles in steady uniform winds," L. Techy\* and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics*, **32**(6), pp. 1736-1746, November-December 2009. [[10.2514/1.44580](#)]
- [64] "Cross-track control of a slender, underactuated AUV using potential shaping," C. A. Woolsey and L. Techy\*. *Ocean Engineering: Special Issue on AUVs* **36**, pp. 82-91, January 2009. [[10.1016/j.oceaneng.2008.07.010](#)]
- [65] "Planar flow model identification for improved navigation of small AUVs," J. Petrich, C. A. Woolsey, and D. J. Stilwell. *Ocean Engineering: Special Issue on AUVs*. **36**, pp. 119-131, January 2009. [[10.1016/j.oceaneng.2008.10.002](#)]
- [66] "Global directional control of a slender AUV," H.-Y. Kim\* and C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **30**(1), pp. 255-259, January-February 2007. [[10.1016/j.oceaneng.2008.07.010](#)]
- [67] "Exploring Titan with autonomous, buoyancy-driven gliders," M. Morrow\*, C. A. Woolsey, and G. Hagerman. *J. the British Interplanetary Society* **59**(1), pp. 27-34, January 2006.
- [68] "Backstepping control of an SMA-actuated robotic arm," M. H. Elahinia, J. Koo, M. Ahmadian, and C. A. Woolsey. *J. Vibration and Control* **11**(3), pp. 407-429, March 2005. [[10.1177/1077546305051201](#)]
- [69] "Reduced Hamiltonian dynamics for a rigid body/mass particle system," C. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **28**(1), pp. 131-138, January-February 2005. [[10.2514/1.5409](#)]
- [70] "Controlled Lagrangian systems with gyroscopic forcing and dissipation," C. Woolsey, C. K. Reddy\*, A. M. Bloch, D. E. Chang, N. E. Leonard, J. E. Marsden. *European J. Control (Special Issue on Lagrangian and Hamiltonian Methods for Nonlinear Control)* **10**(5), pp. 478-496, Dec. 2004. [[10.3166/ejc.10.478-496](#)]
- [71] "Stabilizing underwater vehicle motion using internal rotors," C. Woolsey and N. E. Leonard. *Automatica*, **38**(12), pp. 2053-2062, December 2002. [[10.1016/S0005-1098\(02\)00136-X](#)]
- [72] "The equivalence of controlled Lagrangian and controlled Hamiltonian systems," D. E. Chang, A. M. Bloch, N. E. Leonard, J. E. Marsden, and C. Woolsey *Control, Optimisation, and Calculus of Variations (Special Issue Dedicated to J. L. Lions)* **8**, pp. 393-422, June 2002. [[10.1051/cocv:2002045](#)]
- [73] "Transfer functions for acoustic emission transducers using laser interferometry," L. J. Jacobs and C. Woolsey, *J. the Acoustical Society of America*, **94** (6), pp. 3506-3508, December 1993. [[10.1121/1.407205](#)]



#### Book chapters and other journal publications:

- [74] “Model-based path planning,” A. Wolek and C. A. Woolsey, *Sensing and Control for Autonomous Vehicles: Applications to Land, Water and Air Vehicles*, T. I. Fossen, K. Y. Pettersen, and H. Nijmeijer, Eds., Springer: Lecture Notes in Control and Information Sciences, pp. 183-206, 2017. [[10.1007/978-3-319-55372-6\\_9](https://doi.org/10.1007/978-3-319-55372-6_9)]
- [75] “Design and modeling of a two-stage towed sensor platform: A passively and actively stabilized towfish for experimental ocean science,” E. M. Schuch\*, A. C. Linklater\*, and C. A. Woolsey. *Sea Technology* **47**(7), pp. 20-23, July 2006. [[10.1109/OCEANS.2005.1640001](https://doi.org/10.1109/OCEANS.2005.1640001)]
- [76] “Book Review: *Marine Control Systems: Guidance, Navigation, and Control of Ships, Rigs, and Underwater Vehicles* by T. I. Fossen,” C. A. Woolsey. *AIAA J. Guidance, Control, and Dynamics* **28**(3), pp. 574-575, May-June 2005. [[10.2514/1.17190](https://doi.org/10.2514/1.17190)]

#### Technical Reports<sup>2</sup>

- [1] “Design and Testing of a Pneumatically Propelled Underwater Glider for Shallow Water,” A. Wolek\*, T. Gode\*, C. A. Woolsey, J. Quenzer and K. A. Morgansen. VaCAS Technical Report No. VaCAS-2015-01.
- [2] “Exploration of Under-ice Regions with Ocean Profiling Agents (EUROPA),” D. W. Allen\*, M. Jones\*, L. McCue, C. A. Woolsey, and W. B. Moore. VaCAS Technical Report No. VaCAS-2013-01.
- [3] “Vehicle Dynamics in Currents,” C. Woolsey. VaCAS Technical Report No. VaCAS-2011-01.
- [4] “Dynamics and Control of Underwater Gliders II: Motion Planning and Control,” N. Mahmoudian\* and C. Woolsey. VaCAS Technical Report No. VaCAS-2010-02.
- [5] “Control-Oriented Planar Motion Modeling of Unmanned Surface Vehicles,” C. Sonnenburg\*, A. Gadre, D. Horner, S. Krageland, A. Marcus, D. J. Stilwell, and C. A. Woolsey. VaCAS Technical Report No. VaCAS-2010-01.
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- [44] “Uncertainty in wind estimates, Part 1: Analysis using generalized polynomial chaos,” K. C. Gahan\*, J. Hopwood\* and C. A. Woolsey, *AIAA SciTech Forum 2024*, Orlando, FL, January 2024. [Invited. In review.]
- [45] “Uncertainty in wind estimates, Part 2:  $H_\infty$  filtering using generalized polynomial chaos,” K. C. Gahan\*, J. Hopwood\* and C. A. Woolsey, *AIAA SciTech Forum 2024*, Orlando, FL, January 2024. [Invited. In review.]

- [46] "Analysis of model-free and model-based algorithms and architectures for wind estimation using fixed-wing aircraft," M. Halefom\*, Z. Ahmed\*, N. Sakib\*, and C. A. Woolsey, *AIAA SciTech Forum 2024*, Orlando, FL, January 2024. [Invited. In review.]
- [47] "The invariant extended Kalman filter for wind estimation using a small fixed-wing UAV in horizontal-plane flight," A. Ahmed\* and C. A. Woolsey, *AIAA SciTech Forum 2024*, Orlando, FL, January 2024. [Invited. In review.]
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- [50] "Intelligent wind estimation for chemical source localization," J. Cooper, J. Hopwood\*, C. Woolsey, S. De Wekker, and M. DeVore, *Proc. Vertical Flight Society*, Miami, FL, May 2023.
- [51] "Wind estimation using a fixed-wing model-based  $H_\infty$  filter," K. C. Gahan\*, J. Hopwood\*, and C. A. Woolsey, *AIAA SciTech Forum 2023*, National Harbor, MD, January 2023. [[10.2514/6.2023-2252](#)] **Award:** 2023 AIAA Atmospheric Flight Mechanics Best Student Paper
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- [88] "Measuring atmospheric winds from quadrotor motion," J. González-Rocha\*, C. A. Woolsey, C. Sultan, N. Rose, and S. F. J. De Wekker, *AIAA SciTech Forum 2017*, Grapevine, TX, January 2017. [[10.2514/6.2017-1189](#)]
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- [95] "Testing a pneumatic underwater glider and acoustic ranging system in shallow water," A. Wolek\*, T. Gode\*, C. A. Woolsey, J. Quenzer, K. A. Morgansen. *Proc. MTS/IEEE OCEANS 2015*, Washington, DC, October 2015. [[10.23919/OCEANS.2015.7401980](#)]
- [96] "Design and demonstration of a flexible matrix composite actuated flap in a UAV," E. B. Doepke, M. Heim\*, K. Pyne\*, A. Bialy\*, M. Burns\*, G. Mohan\*, N. Beaty\*, C. MacNeal\*, C. Weit\*, C. Kevorkian\*, C. A. Woolsey, and M. Philen, *ASME 2015 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS)*, September 2015.
- [97] "A geometric control approach for the longitudinal flight stability of hovering insects/FWMAVs," H. Taha, C. A. Woolsey, and M. Hajj, *SciTech 2015*, Orlando FL, January 2015. [[10.2514/6.2015-1552](#)]
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- [101] "Flight testing of a subscale aeroservoelastic aircraft," J. Oullette, M. Patil, and C. A. Woolsey, *SciTech 2014*, National Harbor, MD, January 2014. (Best Paper Award for Atmospheric Flight Mechanics.) [[10.2514/6.2014-0032](#)]
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- [128] “Identification of a low-complexity flow field model for AUV applications,” J. Petrich\*, C. A. Woolsey, and D. J. Stilwell. *Proc. MTS/IEEE OCEANS 2005*, September 19-23, 2005, Washington, DC [[10.1109/OCEANS.2005.1639984](#)]
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- [135] “Assessing conceptual knowledge in an engineering course: Four case studies,” M. Allen, W. Devenport, J. Wang, and C. Woolsey. AIAA Paper 2003-949, *Proc. 41<sup>st</sup> AIAA Aerospace Sciences Meeting*. [[10.2514/6.2003-949](#)]

Ph.D. Dissertation: *Energy Shaping and Dissipation: Underwater Vehicle Stabilization Using Internal Rotors*, Craig Woolsey, Princeton University, December 2000. (Doctoral Advisor: Naomi Leonard)

#### Externally Sponsored Research:

**Summary of External Research Funding**

Number of Projects	Total Amount	Woolsey Component
57	\$22,594,603	\$8,209,460

Projects directed by C. Woolsey (reverse chronological order by end date)

- [1] **Proposal Title:** AF21B-T003 Restricted SWAP-C Air Direction Sensing to Enable Single Vehicle Chemical Reactive Tracking: Phase II  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** April 19, 2023 –April 18, 2025  
**Sponsor:** Barron Associates, Inc. (AFRL)  
**Amount:** \$225,000  
**Woolsey Component:** \$225,000 (100%)
- [2] **Proposal Title:** Bayesian localization of multiple atmospheric contaminant sources  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** January 1, 2022 – June 30, 2023  
**Sponsor:** C2IAS

**Amount:** \$46,234  
**Woolsey Component:** \$46,234 (100%)

- [3] **Proposal Title:** AF21B-T003 Restricted SWAP-C Air Direction Sensing to Enable Single Vehicle Chemical Reactive Tracking: Phase I  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** January 30, 2022 –October 20, 2022  
**Sponsor:** Barron Associates, Inc. (AFRL)  
**Amount:** \$30,000  
**Woolsey Component:** \$30,000 (100%)
- [4] **Proposal Title:** Wind Sensing From UAVs  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** October 21, 2021 to January 31, 2022  
**Sponsor:** NIA (NASA LaRC flowthrough)  
**Amount:** \$13,074  
**Woolsey Component:** \$13,074 (100%)
- [5] **Proposal Title:** Classification Scheme for Multirotor Aircraft  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** February 1, 2021 to July 31, 2021  
**Sponsor:** Perspecta Labs (CCDC Armaments Center)  
**Amount:** \$70,000  
**Woolsey Component:** \$70,000 (100%)
- [6] **Proposal Title:** Real-time Weather Awareness for Enhanced UTM Safety Assurance  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** August 1, 2020 to July 31, 2024  
**Sponsor:** NASA (via Oklahoma State University)  
**Amount:** \$600,000  
**Woolsey Component:** \$600,000 (100%)
- [7] **Proposal Title:** eSPAARO UAS Project for USAF TPS/AF  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** August 16, 2019 to August 15, 2021  
**Sponsor:** USAF Test Pilot School  
**Amount:** \$220,000  
**Woolsey Component:** \$220,000 (100%)
- [8] **Proposal Title:** FW-HTF: First Person View and Augmented Reality for Airborne Embodied Intelligent Cognitive Assistants  
**Principal Investigator:** J. Gabbard, M. Hebdon, P. Tokekar, and C. Woolsey (Lead)  
**Period of Performance:** September 1, 2018 to August 31, ~~2021~~ 2022 (No-cost extension)  
**Sponsor:** National Science Foundation  
**Amount:** \$1,500,000  
**Woolsey Component:** \$375,000 (25%)
- [9] **Proposal Title:** Submarine Motion in Waves  
**Principal Investigator:** E. Paterson and C. Woolsey (Lead)  
**Period of Performance:** July 1, 2016 to June 30, ~~2019~~ 2020 (No-cost extension)  
**Sponsor:** Office of Naval Research  
**Amount:** \$395,584  
**Woolsey Component:** \$197,792 (50%)
- [10] **Proposal Title:** Collaborative Research: Unsteady Hydrodynamics and Geometric Control of Pisciform Locomotion  
**Principal Investigator:** M. Hajj and C. Woolsey (Lead)  
**Period of Performance:** September 1, 2016 to August 31, ~~2019~~ 2020 (No-cost extension)

**Sponsor:** National Science Foundation  
**Amount:** \$270,000  
**Woolsey Component:** \$135,000 (50%)

- [11] **Proposal Title:** I/UCRC: Center for UAS Phase II Site: Virginia Tech  
**Principal Investigator:** K. Kochersberger and C. Woolsey (Lead)  
**Period of Performance:** March 1, 2017 to February 2022  
**Sponsor:** National Science Foundation  
**Amount:** \$500,000  
**Woolsey Component\*:** \$250,000 (50%)  
**Note:** Virginia Tech Site within an existing NSF I/UCRC established by BYU and CU-Boulder. This Phase II site supersedes a Phase I site which ended with the original Phase I grant to BYU and CU-Boulder. Funds from NSF are supplemented by membership fees from industry/government members of the C-UAS. Industry membership fees of \$44,000/Year per member support a varying roster of investigators and projects. **Member fee contributions through 2020 total \$1.7M.** Funding totals above account only for direct NSF sponsorship.
- [12] **Proposal Title:** I/UCRC: Center for UAS Phase I Site  
**Principal Investigator:** K. Kochersberger and C. Woolsey (Lead)  
**Period of Performance:** September 1, 2015 to August 31, ~~2020~~ 2018  
**Sponsor:** National Science Foundation  
**Amount:** ~~\$324,996~~ \$130,000  
**Woolsey Component\*:** ~~\$162,498~~ \$65,000 (50%)  
**Note:** Phase I industry membership fees of \$40,000/Year per member supported a varying roster of investigators and projects. Member fee contributions range from \$200,000 to \$300,000 annually, but funding totals reported here **do not account for member-sponsored research tasks.**
- [13] **Proposal Title:** Planning Grant: I/UCRC Center for UAS Site Addition  
**Principal Investigator:** K. Kochersberger and C. Woolsey (Lead)  
**Period of Performance:** February 10, 2015 to February 29, 2016  
**Sponsor:** National Science Foundation  
**Amount:** \$10,000  
**Woolsey Component:** \$5000 (50%)
- [14] **Proposal Title:** Motion Prediction & Control for Submarines in High Sea States: The Virginia Tech Component of an International Collaboration  
**Principal Investigator:** L. McCue-Weil, E. Paterson, and C. Woolsey (Lead)  
**Period of Performance:** June 1, 2014 to May 31, 2017  
**Sponsor:** Office of Naval Research  
**Amount:** \$590,229  
**Woolsey Component:** \$200,668 (34%)  
**Note:** Project coordinated with investigators at DSTO and Queensland University of Technology
- [15] **Proposal Title:** Hybrid UA/UV: Support for Barron Associates  
**Principal Investigator:** E. Paterson, D. Stilwell, and C. Woolsey (Lead)  
**Period of Performance:** July 1, 2016 to January 31, 2017  
**Sponsor:** Barron Associates (Office of Naval Research SBIR Flow-through)  
**Amount:** \$24,000  
**Woolsey Component:** \$8,000 (34%)
- [16] **Proposal Title:** Bioloocomotion Analysis and Design Using Geometric Control and Averaging Methods  
**Principal Investigator:** M. Hajj and C. Woolsey (Lead)  
**Period of Performance:** September 1, 2014 to August 31, 2016  
**Sponsor:** National Science Foundation  
**Amount:** \$350,000  
**Woolsey Component:** \$175,000 (50%)
- [17] **Proposal Title:** Underwater Gliders in Significant Currents  
**Principal Investigator:** C. Woolsey

**Period of Performance:** December 26, 2012 to October 31, 2014  
**Sponsor:** Office of Naval Research  
**Amount:** \$194,975

- [18] **Proposal Title:** Ultra-Efficient Transport Aircraft  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** August 10, 2012 to August 9, 2014  
**Sponsor:** National Institute of Aerospace  
**Amount:** \$71,837  
**Note:** Project coordinated with Mr. M. D. Guynn (NASA Langley Research Center)
- [19] **Proposal Title:** Autonomous Systems Technology, Economics, & Policy Survey  
**Principal Investigator:** T. Campbell, J. Greene, J. Shand, and C. Woolsey (Lead)  
**Period of Performance:** October 1, 2013 to May 14, 2014  
**Sponsor:** Virginia Department of Aviation  
**Amount:** \$139,798  
**Woolsey Component:** \$90,958 (65%)
- [20] **Proposal Title:** Additional Support for Impact/Sikorsky ASPEC Program  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** January 1, 2013 to July 31, 2013  
**Sponsor:** Sikorsky, formerly Impact Technologies (NUWC-Newport flowthrough)  
**Amount:** \$56,657  
**Woolsey Component:** \$19,263 (34%)
- [21] **Proposal Title:** Support for “A Propulsion-Enabled Control System for Precise Submarine Maneuvering”  
**Principal Investigators:** W. Neu, D. Stilwell, and C. Woolsey (Lead)  
**Period of Performance:** April 1, 2011 to January 30, 2013  
**Sponsor:** Impact Technologies (NUWC-Newport flowthrough)  
**Amount:** \$180,000  
**Woolsey Component:** \$60,000 (33%)
- [22] **Proposal Title:** Efficient Motion Control for Undersea Gliders: Experimental Implementation and Assessment  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** January 1, 2011 to December 31, 2012  
**Sponsor:** Office of Naval Research  
**Amount:** \$209,929  
**Note:** Project coordinated with Dr. K. Morgansen (U. Washington)
- [23] **Proposal Title:** Marine and Hydrokinetic Technology: Support for THOR, LLC  
**Principal Investigators:** C. Woolsey  
**Period of Performance:** January 1, 2011 to December 31, 2011  
**Sponsor:** Turner Hunt Ocean Renewable (DOE flowthrough)  
**Amount:** \$60,213
- [24] **Proposal Title:** Efficient Motion Control for Undersea Gliders: Implementation and Assessment Using *Seaglider*  
**Principal Investigators:** E. Cliff and C. Woolsey (Lead)  
**Period of Performance:** September 1, 2009 to December 31, 2010  
**Sponsor:** Office of Naval Research  
**Amount:** \$55,039  
**Woolsey Component:** \$27,520 (50%)  
**Note:** Project coordinated with Dr. K. Morgansen (U. Washington)
- [25] **Proposal Title:** UAV Flying Qualities Criteria Development and Evaluation  
**Principal Investigators:** W. Durham and C. Woolsey (Lead)  
**Period of Performance:** July 1, 2008 to September 30, 2010  
**Sponsor:** Naval Air Warfare Center (NAVAIR)

**Amount:** \$166,450  
**Woolsey Component:** \$83,225 (50%)

- [26] **Proposal Title:** Evidence Based Approach to Improved Small UAV Reliability  
**Principal Investigators:** J. Marchman and C. Woolsey (Lead)  
**Period of Performance:** July 1, 2008 to December 10, 2009  
**Sponsor:** Naval Air Warfare Center (NAVAIR)  
**Amount:** \$134,673  
**Woolsey Component:** \$67,337 (50%)
- [27] **Proposal Title:** Motion Planning for Underwater Gliders  
**Principal Investigators:** E. Cliff and C. Woolsey (Lead)  
**Period of Performance:** October 1, 2007 to September 30, 2009  
**Sponsor:** Office of Naval Research  
**Amount:** \$213,044  
**Woolsey Component:** \$174,696 (82%)
- [28] **Proposal Title:** In-Flight Data Collection Using a N~ASK Transponder  
**Principal Investigators:** C. Woolsey  
**Period of Performance:** January 1, 2009 to August 15, 2009  
**Sponsor:** N~ASK, Inc.  
**Amount:** \$33,928  
**Woolsey Component:** \$33,928 (100%)
- [29] **Proposal Title:** Internally actuated lateral-directional maneuvering for a blended wing-body underwater glider  
**Principal Investigators:** C. Woolsey  
**Period of Performance:** May 15, 2005 to December 31, 2007  
**Sponsor:** Office of Naval Research  
**Amount:** \$259,688  
**Woolsey Component:** \$259,688 (100%)
- [30] **Proposal Title:** CAREER: Internal shape control for ocean and atmospheric vehicles (NSF Faculty Early Career Development Award)  
**Principal Investigators:** C. Woolsey  
**Period of Performance:** May 1, 2002 to April 30, 2007  
**Sponsor:** National Science Foundation  
**Amount:** \$381,000  
**Woolsey Component:** \$381,000 (100%)
- [31] **Proposal Title:** Fleet applications of AUVs: A technology development roadmap  
**Principal Investigators:** W. Neu, D. Stilwell, and C. Woolsey (Lead)  
**Period of Performance:** May 15, 2006 to December 31, 2006  
**Sponsor:** Office of Naval Research  
**Amount:** \$27,694  
**Woolsey Component:** \$9416 (34%)
- [32] **Proposal Title:** Heterogeneous teams of autonomous vehicles: Advanced sensing and control  
**Principal Investigators:** D. Hong, N. Hovakimyan, M. Johnson, C. Reinholtz, D. Stilwell, A. Wicks, C. Woolsey (Lead), C. Wyatt  
**Period of Performance:** July 1, 2005 to June 30, 2006  
**Sponsor:** Office of Naval Research  
**Amount:** \$1,050,000  
**Woolsey Component:** \$180,712 (17%)  
**Note:** Project coordinated with investigators at Naval Postgraduate School
- [33] **Proposal Title:** Collaborative Research: A two-stage towing system for swath-mapping ocean turbulence  
**Principal Investigator:** C. Woolsey  
**Period of Performance:** August 16, 2002 to August 15, 2005



**Sponsor:** National Science Foundation  
**Amount:** \$217,936  
**Woolsey Component:** \$217,936 (100%)  
**Note:** Project coordinated with Dr. A. Gargett (Old Dominion U.)

- [34] **Proposal Title:** Real-time flow-field estimation for cooperative autonomous underwater vehicle mission planning (Supplement to YIP Award to support collaboration with a U.S. Navy laboratory.)  
**Principal Investigators:** C. Woolsey  
**Period of Performance:** June 1, 2004 to June 30, 2005  
**Sponsor:** Office of Naval Research  
**Amount:** \$50,000  
**Woolsey Component:** \$50,000 (100%)
- [35] **Proposal Title:** Low velocity attitude control for underwater vehicles using internal actuators (ONR Young Investigator Program Award)  
**Principal Investigators:**  
**Period of Performance:** May 1, 2002 to April 30, 2005  
**Sponsor:** Office of Naval Research  
**Amount:** \$300,000  
**Woolsey Component:** \$300,000 (100%)
- [36] **Proposal Title:** A self-sustaining, boundary-layer-adapted system for terrain exploration and environmental sampling  
**Principal Investigators:** G. Hagerman, C. Woolsey (Lead)  
**Period of Performance:** October 1, 2004 to March 31, 2005  
**Sponsor:** NASA Institute for Advanced Concepts  
**Amount:** \$69,513  
**Woolsey Component:** \$47,424 (66%)

Projects directed by collaborators (reverse chronological order by end date)

- [37] **Proposal Title:** I/UCRC: Center for Autonomous Air Mobility and Sensing: Virginia Tech  
**Principal Investigator:** K. Kochersberger (Lead) and C. Woolsey  
**Period of Performance:** March 2022 to February 2027  
**Sponsor:** National Science Foundation  
**Amount:** \$506,628  
**Woolsey Component\*:** \$253,314 (50%)  
**Note:** Virginia Tech Site within a 6-university NSF Phase I I/UCRC. Funds from NSF are supplemented by membership fees from industry/government members of the C-UAS. Industry membership fees of \$50,000/Year per member support a varying roster of investigators and projects. The funding amounts shown above account only for direct NSF sponsorship.
- [38] **Proposal Title:** Identification and validation of a Lagrangian nonlinear maneuvering and seakeeping model  
**Principal Investigator:** S. Brizzolara (PI) and C. Woolsey  
**Period of Performance:** June 1, 2020 to May 31, 2023  
**Sponsor:** Office of Naval Research  
**Amount:** \$577,637  
**Woolsey Component:** \$288,818 (50%)
- [39] **Proposal Title:** Omniscient Planning and Control Environment for the Naval Enterprise  
**Principal Investigator:** D. Stilwell (PI), E. Paterson, M. Farhood, and C. Woolsey  
**Period of Performance:** June 25, 2018 to ~~September 30, 2020~~ December 31, 2022 (No-cost extension)  
**Sponsor:** Office of Naval Research  
**Amount:** \$3,000,000  
**Woolsey Component:** \$750,000 (25%)
- [40] **Proposal Title:** Advanced towing carriage and instrumentation for the study of small vessels in waves  
**Principal Investigator:** C. Gilbert (PI) and C. Woolsey

**Period of Performance:** June 15, 2018 to June 14, 2019  
**Sponsor:** Office of Naval Research  
**Amount:** \$620,057  
**Woolsey Component:** \$310,028 (50%)

- [41] **Proposal Title:** Structure-preserving numerical methods for engineering applications  
**Principal Investigators:** M. Patil (Lead) and C. Woolsey  
**Period of Performance:** July 1, 2018 to July 31, 2020  
**Sponsor:** Office of Naval Research  
**Amount:** \$220,059  
**Woolsey Component:** \$110,030 (50%)
- [42] **Proposal Title:** Hazards SEES: Uncovering the hidden skeleton of environmental flows: Advanced Lagrangian methods for hazards prediction, mitigation and response\*  
**Principal Investigator:** S. Ross (Sub-Award PI), D. Schmale, III (Key Person), and C. Woolsey (Key Person)  
**Period of Performance:** September 1, 2015 to August 31, 2019  
**Sponsor:** National Science Foundation  
**Amount:** \$514,192  
**Woolsey Component:** \$128,117 (25%)  
**\*Note:** Virginia Tech component of \$3M award to Thomas Peacock (PI) and Co-PI's Pierre Lermusiaux, Shane Ross, Irina Rypina, and Shawn Shadden
- [43] **Proposal Title:** Virginia Tech Airworthiness Center  
**Principal Investigators:** R. Canfield (PI) M. Farhood, K. Lowe, L. McCue, C. Sultan, and C. Woolsey  
**Period of Performance:** January 15, 2015 to June 2, 2016  
**Sponsor:** NAVAIR  
**Amount:** \$519,950  
**Woolsey Component:** \$83,192 (16%)
- [44] **Proposal Title:** UAS in the NAS  
**Principal Investigators:** R. Mooney (PI) and C. Woolsey  
**Period of Performance:** January 15, 2015 to December 31, 2015  
**Sponsor:** Northrop Grumman – Information Systems  
**Amount:** \$95,000  
**Woolsey Component:** \$47,500 (50%)
- [45] **Proposal Title:** THOR: Tactical Hazardous Operations Robot (Phase 1)  
**Principal Investigators:** D. Hong and C. Woolsey  
**Period of Performance:** October 1, 2012 to December 21, 2013  
**Sponsor:** DARPA  
**Amount:** \$2,999,968  
**Woolsey Component:** \$60,000 (2%)
- [46] **Proposal Title:** AFRL-VT Collaborative Center On Multidisciplinary Analysis And Design Of Future Aerospace Vehicles  
**Principal Investigators:** R. Batra, R. Canfield, M. Hajj, R. Kapania (Lead), W. Mason, M. Patil, D. Tafti, L. Watson, and C. Woolsey  
**Period of Performance:** December 22, 2008 to December 21, 2013  
**Sponsor:** Air Force Research Laboratory, WPAFB  
**Amount:** \$1,595,028  
**Woolsey Component:** \$79,751 (5%)
- [47] **Proposal Title:** Exploration of Under-ice Regions with Ocean Profiling Agents (EUROPA)  
**Principal Investigators:** L. McCue (Lead) and C. Woolsey  
**Period of Performance:** August 15, 2012 to August 14, 2013  
**Sponsor:** National Institute for Aerospace (NIAC flowthrough)  
**Amount:** \$53,977  
**Woolsey Component:** \$21,590 (40%)

**Note:** Project coordinated with investigators at Naval Postgraduate School

- [48] **Proposal Title:** Sensing and Autonomy for Riverine Vessels  
**Principal Investigators:** D. Stilwell (Lead) and C. Woolsey  
**Period of Performance:** January 1, 2012 to September 30, 2012  
**Sponsor:** Office of Naval Research  
**Amount:** \$119,493  
**Woolsey Component:** \$29,873 (25%)  
**Note:** Project coordinated with investigators at Naval Postgraduate School
- [49] **Proposal Title:** Sensing and Autonomy for Riverine Vessels  
**Principal Investigators:** M. Patil (Lead) and C. Woolsey  
**Period of Performance:** June 1, 2011 to December 31, 2011  
**Sponsor:** Office of Naval Research  
**Amount:** \$60,000  
**Woolsey Component:** \$27,000 (45%)
- [50] **Proposal Title:** A Hardware Testbed for Distributed Learning, Estimation and Approximation Theory with Sensor Vehicle Networks  
**Principal Investigators:** A. Kurdila (Lead), A. Leonessa, D. Stilwell, C. Woolsey  
**Period of Performance:** June 15, 2010 to June 14, 2011  
**Sponsor:** Army Research Office  
**Amount:** \$441,970  
**Woolsey Component:** \$110,493 (25%)
- [51] **Proposal Title:** Enhanced Riverine Drifter  
**Principal Investigators:** P. Diplas, D. Stilwell (Lead), and C. Woolsey  
**Period of Performance:** July 1, 2010 to April 30, 2011  
**Sponsor:** Barron Associates (ONR flowthrough)  
**Amount:** \$49,966  
**Woolsey Component:** \$16,655 (25%)
- [52] **Proposal Title:** Autonomous USV Navigation in Riverine Environments  
**Principal Investigators:** D. Stilwell (Lead) and C. Woolsey  
**Period of Performance:** September 1, 2009 to December 31, 2010  
**Sponsor:** Office of Naval Research  
**Amount:** \$259,969  
**Woolsey Component:** \$129,985 (50%)  
**Note:** Project coordinated with investigators at Naval Postgraduate School
- [53] **Proposal Title:** Experimental Scale Underwater Glider  
**Principal Investigators:** L. McCue-Weil (Lead) and C. Woolsey  
**Period of Performance:** May 6, 2010 to September 30, 2010  
**Sponsor:** University of Michigan (Naval Engineering Education Consortium)  
**Amount:** \$69,348  
**Woolsey Component:** \$34,674 (50%)
- [54] **Proposal Title:** USV Autonomy in Riverine Environments  
**Principal Investigators:** D. Stilwell (Lead) and C. Woolsey  
**Period of Performance:** May 1, 2008 to December 31, 2009  
**Sponsor:** Office of Naval Research  
**Amount:** \$381,757  
**Woolsey Component:** \$190,879 (50%)  
**Note:** Project coordinated with investigators at Naval Postgraduate School
- [55] **Proposal Title:** Design and Prototype Development of a Flight Vehicle for Large Event Surveillance  
**Principal Investigators:** J. Marchman (Lead) and C. Woolsey  
**Period of Performance:** August 1, 2007 to October 31, 2009

**Sponsor:** Virginia Space Grant Consortium (flow-through from NAVAIR)

**Amount:** \$143,533

**Woolsey Component:** \$71,767 (50%)

[56] **Proposal Title:** Coordinated sensing and control for surveillance and tracking by heterogeneous autonomous vehicle teams.

**Principal Investigators:** N. Hovakimyan, A. Kurdila, M. Roan, C. Reinholtz, D. Stilwell (Lead), A. Wicks, C. Woolsey, C. Wyatt

**Period of Performance:** October 1, 2006 to September 30, 2007

**Sponsor:** Office of Naval Research

**Amount:** \$1,417,500

**Woolsey Component:** \$226,000 (16%)

**Note:** Project coordinated with investigators at Naval Postgraduate School

[57] **Proposal Title:** Adaptive sampling in dynamic environments using AUVs

**Principal Investigators:** D. Stilwell (Lead), C. Woolsey

**Period of Performance:** May 30, 2005 to May 29, 2006

**Sponsor:** Office of Naval Research

**Amount:** \$479,750

**Woolsey Component:** \$86,969 (18%)

**Note:** Project coordinated with investigators at Tulane University

### **Courses Taught:<sup>3</sup>**

AOE 3034: System Dynamics and Control

AOE 3104: Aircraft Performance

AOE 3134: Air Vehicle Dynamics

AOE 3234: Ocean Vehicle Dynamics

AOE 4004: State-Space Control

AOE 4224/5224G: Atmospheric & Ocean Vehicle Model Identification

AOE 4804: Special Topics in Dynamics, Control, and Estimation: Ethics and Autonomy

AOE 4984 (Special Topics): Navigation and Guidance

AOE 5774: Nonlinear Systems Theory

AOE 6744: Linear Control Theory

AOE 5984 (Special Topics): Real-time Control (Co-taught with Prof. Chris Hall)

AOE 6984 (Special Topics): Geometric Control Theory (Co-taught with Prof. Andy Kurdila)

### **Advising:**

#### Post-Doctoral Scholars

##### Current:

None

##### Complete:

Dr. Ahmed Hussein

Co-advised with Dr. M. Hajj

Dr. Hye-Young Kim

Co-advised with Dr. C. Hall

Dr. C. Konda Reddy

Co-advised with Dr. N. Hovakimyan

Dr. Lili Ma

Co-advised with Dr. N. Hovakimyan

Dr. Sevak Tahmasian

Sole Advisor

#### Graduate Scholars (Ph.D. Candidates)

##### Current:

Zakia Ahmed (Ph.D. M.E. expected 2024)

Sole Advisor

Chris Gahan (Ph.D. A.E., expected 2024)

Sole Advisor

Mekonen Halefom (Ph.D. A.E., expected 2023)

Sole Advisor

Jeremy Hopwood (Ph.D. A.E., expected 2024)

Sole Advisor

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<sup>3</sup> The teaching requirement in Virginia Tech's Department of Aerospace & Ocean Engineering is 3 courses per year.

Nazmus Sakib (Ph.D. A.E. expected 2023)  
Ian Willebeck-LeMair (Ph.D. A.E. expected 2027)  
Mohamed Zakaria (Ph.D. A.E. expected 2025)

Sole Advisor  
Sole Advisor  
Co-Advisor (with Dr. S. Ross)

Complete:

Ying-Chun Chen (Ph.D., 2023)  
Ben Simmons (Ph.D. A.E., 2023)  
Jean-Michel Fahmi (Ph.D. A.E., 2022)  
James Gresham (Ph.D. A.E., 2022)  
Emmanuel Skamangas (Ph.D. A.E., 2021)  
Javier González-Rocha (Ph.D. A.E., 2020)  
Seyong Jung (Ph.D. A.E., 2020)  
Changkoo Kang (Ph.D. A.E., 2020)  
Harsh Sharma (Ph.D. A.E., 2020)  
Hisham Shehata (Ph.D. E.S.M., 2020)  
Hunter McClelland (Ph.D. A.E., 2019)  
Tom Battista (Ph.D. A.E., 2018)  
Jacob Bean (Ph.D. A.E., 2018)  
David Allen (Ph.D. A.E., 2016)  
Andrew Rogers (Ph.D. A.E., 2016)  
Sevak Tahmasian (Ph.D. E.S.M., 2015)  
Artur Wolek (Ph.D. A.E., 2015)  
Brad Atkins (Ph.D. A.E., 2014)  
Christian Sonnenburg (Ph.D. A.E., 2012)  
Chris Cotting (Ph.D. A.E., 2010)  
Robert Kraus (Ph.D. A.E., 2010)  
Amanda Young Dippold (Ph.D. A.E., 2009)  
Nina Mahmoudian (Ph.D. A.E., 2009)  
Laszlo Techy (Ph.D. A.E., 2009)  
Chevva Konda Reddy (Ph.D. E.S.M., 2005)

Sole Advisor  
Primary Advisor (with Dr. E. Morelli)  
Sole Advisor  
Sole Advisor  
Secondary Advisor (with Dr. J. Black)  
Primary Advisor (with Dr. C. Sultan)  
Primary Advisor (with Dr. S. Brizzolara)  
Sole Advisor  
Secondary Advisor (with Dr. M. Patil)  
Secondary Advisor (with Dr. M. Hajj)  
Sole Advisor  
Primary Advisor (with Dr. F. Valentinis)  
Secondary Advisor (with Dr. C. Fuller)  
Sole Advisor  
Primary Advisor (with Dr. R. McGwier)  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Primary Advisor (with Dr. D. Stilwell)  
Primary Advisor (with Dr. W. Durham)  
Primary Advisor (with Dr. E. Cliff)  
Secondary Advisor (with Dr. N. Hovakimyan)  
Sole Advisor  
Primary Advisor (with Dr. D. Schmale, III)  
Primary Advisor (with Dr. A. Nayfeh)

Graduate Scholars (M.S. Candidates, Thesis Option)

Current:

Genevieve Petsopoulos (M.S. A.E., expected 2024)

Primary Advisor (with Dr. K. Crandall)

Complete:

Ryan Fisher (M.S. A.E., 2022)  
Kendy Edmonds (M.S. A.E., 2021)  
Khanh Nguyen (M.S. A.E., 2021)  
Kushal Patel (M.S. E.C.E., 2021)  
Alberto Post (M.S. A.E., 2021)  
Mekonen Halefom (M.S. A.E., 2020)  
Griffin Hyde (M.S. A.E., 2019)  
Meghan Burns (M.S. A.E., 2018)  
Ben Simmons (M.S. A.E., 2018)  
Chang Koo Kang (M.S. A.E., 2017)  
Poorva Shukla (M.S. E.S.M., 2017)  
Chris Kevorkian (M.S. A.E., 2016)  
Tejaswi Gode (M.S. E.E., 2015)  
David Allen (M.S. A.E., 2014)  
Kevin Antcliff (M.S. A.E., 2014)  
Jeffrey Garnand-Royo (M.S. A.E., 2013)  
Mark Palframan (M.S. A.E., 2013)  
Justin Murtha (M.S. A.E., 2009)  
Jesse Geisbert (M.S. O.E., 2007)  
Chris Schultz (M.S. A.E., 2006)  
Amy Linklater (M.S. A.E., 2005)  
Michael Morrow (M.S. A.E., 2005)

Sole Advisor  
Primary Advisor (with Mr. John Coggin)  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Primary Advisor (with Dr. S. Choi)  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Primary Advisor (with Dr. L. McCue-Weil)  
Secondary Advisor (with Mr. Mark Guynn)  
Secondary Advisor (with Dr. R. Canfield)  
Primary Advisor (with Dr. D. Schmale)  
Sole Advisor  
Sole Advisor  
Sole Advisor  
Sole Advisor



Chris Nickell (M.S. A.E., 2005)  
Eric Schuch (M.S. A.E., 2004)

Sole Advisor  
Sole Advisor