

Hanspeter Schaub

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Education:

May 1998 Ph.D. in Aerospace Engineering, Texas A&M University (GPA 4.0)
August 1996 M.S. in Aerospace Engineering, Texas A&M University (GPA 4.0)
May 1994 B.S. in Aerospace Engineering, Texas A&M University (GPA 3.87)

Work Experience:

June 2011 – **Wacari Group**, Boulder, Colorado
Chief Technologist
Technical consultant to assist with the commercialization of a range of inventions.

Aug. 2007 – **University of Colorado**, Boulder, Colorado
Dec. 2011 *Associate Professor, Associate Chair of Graduate Affairs*
Developing an active research program in the areas of spacecraft proximity flying, charged relative spacecraft motion, 3D tethered Coulomb structures, redundant attitude control using momentum exchange devices, relative spacecraft motion test bed development with UGVs, and visual servo control of unmanned vehicles. Leads the Autonomous Vehicle Systems (AVS) Lab which does research in relative motion sensing, dynamics and control of aerospace systems.

Aug. 2003 – **Virginia Tech**, Blacksburg, Virginia
July 2007 *Assistant Professor*
Developed a strong externally funded research program in spacecraft proximity flying and relative motion sensing and control research. Graduated 8 M.S. students and 1 Ph.D. student. Developed the Autonomous Vehicle Systems laboratory with the support of Sandia National Laboratories.

Sept. 1999 – **Orion International Technologies**, (Contract Labor for Sandia National Laboratories)
Aug. 2003 *Research Engineer*
Performed navigation and control research for distributed, collaborative robotic systems, helped identify, refine and implement the dynamics and control strategy of a swing-free Navy crane control system, and developed and installed a visual servoing system on a remote manipulator. Further, has performed research in the control of spacecraft formations, focusing on the use of both mean and osculating orbit elements for the design and control of the satellite formations.

May 1998 – **Texas A&M University**, Aerospace Engineering Department, College Station, Texas
Sept. 1999 *Post-Doctoral Research Assistant*
Performed research on adaptive control systems that enforce the actual closed-loop dynamics to be of a prescribed linear form. Further helped develop propellant-free relative orbits for spacecraft formation flying missions which are invariant to the Earth oblateness gravitational perturbation.

Projects and Grants:

- 6/1/11– 9/12/13 *Title:* Space-Based Search-Detect-Track
PI: Dr. G. Born
Co-PI's: Dr. Schaub, Dr. Axelrad
Sponsor: Air Force Research Laboratory
Research: Investigate methods to improve space object tracking.
Funds: \$600,000
- 8/15/11– 8/14/12 *Title:* Reduced Order Electrostatic Force Field Modeling of 3D Spacecraft Shapes
PI: Dr. H. Schaub
Sponsor: NASA NSTR fellowship award
Research: Investigate numerically fast electrostatic force field modeling techniques about general body shapes.
Funds: \$66,000
- 06/1/11– 7/1/12 *Title:* Electrostatic Charge Deflection Experiment
PI: Dr. H. Schaub
Sponsor: NASA Langley
Research: Perform electrostatic Gossamer structure experiments in plasma chamber with charge deflection.
Funds: \$50,923
- 06/16/10– 12/16/10 *Title:* SBIR, N093-223 Low Cost Orbital Debris Removal System
PI: Dr. H. Schaub
Sponsor: Wacari Group for DARPA SBIR
Research: Assist with a Phase I study of a geostationary space debris reorbiting method.
Funds: \$21,642
- 02/01/10– 10/31/10 *Title:* Tethered Coulomb Satellite
PI: Dr. H. Schaub
Sponsor: NRO Director's Innovation Initiative (DII)
Research: Concept study of the tethered Coulomb satellite concept. Co-PI is Dr. Maute of ASEN, and Dr. Moorer of the Wacari Group.
Funds: \$355,551
- 09/14/09– 06/1/11 *Title:* Crane Pendulation Control Technology Transition Support (TI-79)
PI: Dr. H. Schaub
Sponsor: Naval Surface Warfare Center (through BMT Designer & Planners)
Research: Assist NSWC with the industry transition of the pendulation control system developed for ship mounted cranes. Includes two travels to Sweden to discuss control solution with the crane manufacturer.
Funds: \$50,243
- 09/01/09– 12/31/09 *Title:* UMBRA Software Application Advising
PI: Dr. H. Schaub
Sponsor: Sandia National Labs)
Research: Assist Sandia with academic uses of the Sandia developed UMBRA software framework.
Funds: \$4,000

- 09/01/08– *Title:* Crane Pendulation Control Demo and Technology Support
09/30/09 *PI:* Dr. H. Schaub
Sponsor: Naval Surface Warfare Center (through BMT Designer & Planners)
Research: Assist with PCS control developments to perform ship-to-ship cargo transfer. Numerically model the new scenario including the relative motion sensors, and modify the control to perform the new cargo landing on the target ship.
Funds: \$118,400
- 09/01/08– *Title:* Crane Pendulation Control System Specification Development
04/30/09 *PI:* Dr. H. Schaub
Sponsor: Naval Surface Warfare Center (through BMT Designer & Planners)
Research: Assist with the PCS specification document development.
Funds: \$9,713.42
- 07/01/08– *Title:* Tethered Coulomb Structure Concept Study
06/30/09 *PI:* Dr. H. Schaub
Sponsor: University of Colorado Seed Grant
Research: Investigate a novel hybrid concept where the spacecraft are inter-connected by conducting tethers. With the tethered Coulomb structure the craft's electrostatic repulsion is exploited to keep the tether net tight, thus controlling the cluster size and shape. Study will investigate dynamical modeling, control and power issues.
Funds: \$42,000
- 01/01/08– *Title:* Relative Pose Estimation Using Visual Snakes in Variable Lighting Conditions
04/31/08 *PI:* Dr. H. Schaub
Sponsor: Sandia National Laboratories
Research: Investigate new sphere tracking algorithm using visual snakes. The spherical target is assumed to be only partially tracked.
Funds: \$24,500
- 05/01/06– *Title:* Cargo Throughput Improvement System Development
09/31/08 *PI:* Dr. H. Schaub
Sponsor: Naval Surface Warfare Center (through Jorge Scientific Corporation)
Research: Implement a new rate-based pendulation control system on 2 crane ships. A new ship motion sensor is used in this 2nd generation PCS implementation. Further, a new twin-crane mode is developed and tested. The new control algorithm is tested in an upgraded virtual crane simulation environment. Implement control strategy on a redundant degree of freedom rider-block-tagline crane system.
Funds: \$267,563
- 01/20/06– *Title:* ASPIRE: Spacecraft Collision Avoidance using Coulomb Forces
02/20/07 *PI:* Dr. H. Schaub
Sponsor: Virginia Tech
Research: Investigate using Coulomb forces to achieve spacecraft collision avoidance. The spacecraft are considered to be either in deep space (inertial frame) or in GEO (rotating frame). The feedback strategies attempt to perform the collision avoidance using only separation distance measurements, and avoid excessive escape velocities of the craft.
Funds: \$43,386

- 05/01/05– Title: UGV Battery modeling using UMBRA
 09/15/05 PI: Dr. H. Schaub
 Sponsor: Sandia National Laboratories
 Research: Develop an UMBRA based model of UGV batteries. This enables the virtual vehicles to simulate power consumption by careful motor torque computation, and integration of this module with the dynamic UGV modules.
 Funds: \$4,312
- 04/28/05– Title: Space-Based Distributed Radar Aperture Study Exploiting Spacecraft Charging
 03/28/06 PI: Dr. H. Schaub, also supports Dr. King and Dr. Parker at Michigan Tech as co-PI's
 Sponsor: DARPA, Special Projects Office
 Research: Investigate how Coulomb forces can be exploited to perform spacecraft relative motion control. In particular, this research investigates different charged spacecraft cluster concepts, the magnitude of the differential perturbations and what the associated required maintenance charge will be, as well as how a spacecraft charge servo system could be designed.
 Funds: \$190,495
- 06/15/04– Title: Technical Support For Visual Snake Based Servoing Of Unmanned Vehicles
 09/1/05 PI: Dr. H. Schaub
 Sponsor: Sandia National Laboratories
 Research: Investigate using color visual snakes (active deformable contours) in unmanned ground vehicle visual servo applications. The simulation test bed is to be developed using the UMBRA software framework and investigate how UMBRA can be used to interact between software and hardware simulation components.
 Funds: \$35,232
- 05/16/04– Title: Velocity-based Swing- Free Control Investigation For A Ship Mounted Boom Crane
 05/06/05 PI: Dr. H. Schaub
 Sponsor: Naval Surface Warfare Center, Carderock Division
 Research: Develop a new ship mounted crane control strategy which reduces the ship motion sensing requirements of the current Pendulation Control System (PCS). An augmented position-based PCS strategy is developed along with a new velocity-based PCS solution.
 Funds: \$93,036

Honors and Awards:

- April 2011 **Outstanding Faculty Advisor Award**, College of Engineering and Applied Sciences, University of Colorado
- 2010 **Provosts Faculty Achievement Award**, University of Colorado
- 2007 – 2011 **H. Joseph Smead Fellow**, University of Colorado
- July 2002 **Exemplary Performance Award**, ORION International Technologies
- April 1998 **Distinguished Graduate Student Doctoral Research Award**, Texas A&M University
- 1992 – 1993 Regents Graduate Fellowship for graduate study at Texas A&M University
- May 1992 Graduated with Magna Cum Laude (B.S. in Aerospace Engineering)
- 1991 – 1992 Engineering Scholars Program
- 1988 – 1992 Deans Honor List for 7 out of 8 undergraduate semesters

Professional Service:

Positions held:

- December 2011 **Advisory Board Member**, AIAA Education Series Editorial Board
- August 2011 **Technical Chair** of AAS Astrodynamics Specialist Conference

May 2010 – May 2011	Co-Editor for the JAS special edition of the George Born Astrodynamics Symposium
May 2010	Technical Chair of AAS George Born Astrodynamics Symposium
2010 –	AAS Technical Chair Sub-Committee member
Feb. 2009	Session chair for AAS Spaceflight Mechanics Meeting
Sept. 2008 – 2010	Section editor for the Encyclopedia of Aerospace Engineering to be published by Wiley
Sept. 2008 – Mar. 2009	Guest editor for the Landis Markley special edition of the Journal of Astronautical Sciences
Aug. 2008	Topics in Spacecraft Dynamics and Control Session chair for AIAA/AAS Astrodynamics Specialist Conference
Jan. 2008	Attitude Dynamics and Control Session chair for AAS Spaceflight Mechanics Meeting
Dec. 2007 –	Associate Editor for AIAA Journal of Guidance, Control and Dynamics
Aug. 2007	Formation Flying Session chair for AAS Astrodynamics Specialist Conference
2007 – 2008	AAS Technical Chair Sub-Committee member
Jan. 2007	Formation Flying II Session chair for AAS Spaceflight Mechanics Meeting
Jan. 2006	Formation Flying II Session chair for AAS Spaceflight Mechanics Meeting
Aug. 2005	Attitude Dynamics and Control Session Chair for AAS Astrodynamics Specialist Conference
Aug. 2005	Visual Control Special-Session Organizer for AIAA Guidance, Navigation and Control Conference
June 2005	Session Chair for the Malcolm D. Shuster Astronautics Symposium
Jan. 2005	Formation Flying Session Chair for AAS Spaceflight Mechanics Conference
Aug. 2004	Attitude Dynamics and Control Session Chair for AIAA Guidance, Navigation and Control Conference
Feb. 2004 – July 2008	AAS Committee chair of the John V. Breakwell Student Travel Award
Jan. 2004 – July 2008	Technical Committee Member of the American Astronautical Society
Oct. 2003 – Dec. 2007	Member of the International Association of Geodesy: Working Group T2.2 Satellite Group
May 2003	Session Chair for the AAS Junkins Astrodynamics Symposium
Aug. 2002	Space Robotics Session Chair for the AIAA Guidance, Navigation and Control Conference
Aug. 2002	Technical Area Chair for the AIAA Guidance, Navigation and Control Conference (Robotics, Space Automation, and Control of Robots)
Jan. 2001 – Jan. 2002	Adjunct Professor at Michigan Technological University (Honorary appointment to serve on student's Thesis committee)
1998	Session Chair, AIAA/AAS Astrodynamics Specialist Conference

External Reviewer for:

- AIAA Journal of Guidance, Control and Dynamics (65 papers)
- AAS Journal of the Astronautical Sciences (16 papers)
- AIAA Journal of Spacecraft and Rockets (9 papers)
- Journal of Celestial Mechanics (13 papers)
- IEEE Transactions on Control Systems Technology (9 papers)
- IEEE Transactions on Education (2 papers)
- Journal of Multi-Body Dynamics (Proceedings of the Institution of Mechanical Engineers Park K) (2 paper)
- Journal of Mechanical Engineering Science (Proceedings of the Institution of Mechanical Engineers Part C) (2 papers)
- The Royal Society (Proceedings of Mathematical, Physical and Engineering Sciences) (6 papers)
- IEEE Transactions on Systems, Man, and Cybernetics (1 paper)
- IEEE Transactions on Aerospace and Electronic Systems (15 papers)

- IEEE TRANSACTIONS ON ROBOTICS (3 papers)
- Journal of Mechanical Engineering Science (1 paper)
- Journal of Optimization Theory and Applications (1 paper)
- Journal of the Franklin Institute (1 paper)
- AIAA Journal (1 paper)
- International Journal of Control, Automation, and Systems (1 paper)
- the AAS Conference Submissions (15 papers)
- the AIAA GNC Conference Submissions (13 papers)
- the American Control Conference Submissions (24 papers)
- the European Control Conference Submission (4 papers)
- IEEE Conference on Decision and Control (4 papers)
- IEEE International Conference on Control & Automation (1 paper)
- International Conference on Intelligent Robots and Systems (IROS) (1 paper)
- 2005 Space Flight Mechanics Best Paper Award
- Aerospace and Science Technology (AST) (14 papers)
- International Conference on Technology and Automation (1 paper)
- ASME Journal of Dynamic Systems, Measurement and Control (5 papers)
- ASME Journal of Vibration and Acoustics (1 paper)
- Robotica (1 paper)
- Journal of Mathematical and Computer Modeling of Dynamical Systems (1 paper)
- Journal of Vibration and Control (1 paper)
- IEEE Control Systems Magazine (3 papers)
- IEEE Control Systems Society Conference (2 paper)
- MECCANICA – International Journal of the Italian Association of Theoretical and Applied Mechanics (2 papers)
- IEEE Multi-conference on Systems and Control (1 paper)
- IEEE International Conference on Industrial Technology - ICIT (1 paper)
- AIAA Infotech@Aerospace Conference and Exhibit (6 papers)
- JION Navigation (2 papers)
- Advances in Space Research (2 papers)
- Control Systems Magazine (1 paper)
- International Symposium on Systems and Control in Aeronautics and Astronautics (ISSCAA) (1 paper)
- Journal of Nonlinear Dynamics (1 paper)
- Optical Engineering (2 papers)
- Acta Astronautica (4 papers)
- ASCE Journal of Aerospace Engineering (2 papers)
- Journal of Zhejiang University (1 paper)
- Aircraft Engineering and Aerospace Technology (1 paper)
- International Journal of Aerospace Engineering (1 paper)

University Service:

May 2011	Provost Faculty Research Award Committee
Spring 2011	IGP Seed Grant Committee
Aug. 2010 –	ASEN Executive Committee Member
Aug. 2010 –	Graduate Education Council (GEC) Member
Fall 2010	PUEC chair for Diana Dimeff re-appointment
Aug. 2010–	Associate Chair of Graduate Affairs

2009 – 2012	Member of the ASEN graduate committee
2009 – 2012	Member of the ASEN undergraduate committee
2009	IGP Seed Grant review committee
2008 – 2009	Member of Undergraduate fellowship opportunities
2008 – 2009	Member of UROP (undergraduate research opportunities)
2008 – 2009	Member of external advisory board meeting for ColdQuanta
2007 – 2008	Member of Undergraduate Teaching Curriculum Committee
Fall 2007	Chair of graduate astrodynamics and navigation seminar series
2006 – 2007	Member of the aerospace and ocean engineering faculty search committee
Fall 2005	Chair of department seminar series
2005 – 2007	Chair of AOE Display Cabinet committee
2004 – 2006	Graduate Applications Committee Member
2004	Member of the ocean engineering faculty search committee
2004 – 2007	Department representative of undergraduate computing requirements committee
2003 – 2007	Member of the Student Opportunity Committee for the AOE department

Society Affiliations:

2003 –	Member of the American Society of Engineering Education (ASEE)
1998 –	Member of the American Astronautical Society (AAS)
March 1998–	Full Member of Sigma Xi (The Scientific Research Society)
1996 –	Associate Fellow of American Institute of Aeronautics and Astronautics (AIAA)
1991 –	Member of Sigma Gamma Tau, National Aerospace Engineering Honor Society
1991 – 1992	Member of Tau Beta Pi, National Engineering Honor Society
1990 – 1992	Member of Phi Kappa Phi, Engineering Honor Society

Refereed Journal Articles:

1. **H. Schaub**, P. Tsiotras, and J. L. Junkins. "Principal Rotation Representations of Proper NxN Orthogonal Matrices." *International Journal of Engineering Science*, Vol. 33, No. 15, Elsevier Science Ltd., Great Britain, 1995, pp. 2277–2295.
2. **H. Schaub** and J.L. Junkins. "Stereographic Orientation Parameters for Attitude Dynamics: A Generalization of the Rodrigues Parameters." *AAS Journal of the Astronautical Sciences*, Vol. 44, No. 1, Jan.–Mar. 1996, pp. 1–19.
3. **H. Schaub**, R. D. Robinett, and J. L. Junkins. "Adaptive External Torque Estimation by Means of Tracking a Lyapunov Function." *AAS Journal of the Astronautical Sciences*, Vol. 44, No. 3, July–Sept. 1996.
4. **H. Schaub**, R. D. Robinett, and J. L. Junkins. "Globally Stable Feedback Laws for Near-Minimum-Fuel and Near-Minimum-Time Pointing Maneuvers for a Landmark-Tracking Spacecraft." *AAS Journal of the Astronautical Sciences*, Vol. 44, No. 4, Oct.–Dec. 1996, pp. 443–466.
5. **H. Schaub**, R. D. Robinett, and J. L. Junkins. "New Penalty Functions For Optimal Control Formulation for Spacecraft Attitude Control Problems." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 20, No. 3, May–June, 1997, pp. 428–434.
6. P. Tsiotras, J. L. Junkins, and **H. Schaub**. "Higher Order Cayley Transforms with Applications to Attitude Representations." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 20, No. 3, May–June, 1997, pp. 528–534.
7. J. L. Junkins and **H. Schaub**. "An Instantaneous Eigenstructure Quasivelocety Formulation for Nonlinear Multibody Dynamics." *AAS Journal of the Astronautical Sciences*, Vol. 45, No. 3, July–Sept. 1997, pp. 279–295.
8. R. D. Robinett, G. G. Parker, **H. Schaub**, and J. L. Junkins. "Lyapunov Optimal Saturated Control for Nonlinear Systems." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 20, No. 6, Nov.–Dec., 1997, pp. 1083–1088.
9. J. L. Junkins and **H. Schaub**. "Orthogonal Square Root Eigenfactor Parameterization of Mass Matrices." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 20, No. 6, Nov.–Dec., 1997, pp. 1118–1124.
10. **H. Schaub** and J. L. Junkins. "Feedback Control Law Using the Eigenfactor Quasi-Coordinate Velocity Vector." *Journal of the Chinese Society of Mechanical Engineers*, Vol. 19, No. 1, 1997, pp. 51–59.

11. **H. Schaub**, S. R. Vadali, and J. L. Junkins. "Feedback Control Law for Variable Speed Control Moment Gyroscopes." *AAS Journal of Astronautical Sciences*, Vol. 46, No. 3, July–Sept., 1998, pp. 307–328.
12. **H. Schaub**, S. R. Vadali, J. L. Junkins and K. T. Alfriend, "Spacecraft Formation Flying Control Using Mean Orbit Elements." *AAS Journal of Astronautical Sciences*, Vol. 48, No. 1, Jan.–March, 2000, pp. 69–87.
13. **H. Schaub** and J. L. Junkins. "Singularity Avoidance Using Null Motion and Variable-Speed Control Moment Gyros." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 23, No. 1, Jan.–Feb., 2000, pp. 11–16.
14. K. T. Alfriend and **H. Schaub**, "Dynamics and Control of Spacecraft Formations: Challenges and Some Solutions." *AAS Journal of the Astronautical Sciences*, Vol. 48, Nos. 2 and 3, April–Sept. 2000, pp. 249–267.
15. **H. Schaub**, M. Akella and J. L. Junkins, "Adaptive Realization of Linear Closed-Loop Tracking Dynamics in the Presence of Large System Model Errors." *AAS Journal of Astronautical Sciences*, Vol. 48, No. 4, Oct.–Dec., 2000, pp. 537–551.
16. **H. Schaub**, M. Akella and J. L. Junkins, "Adaptive Control of Nonlinear Attitude Motions Realizing Linear Closed-Loop Dynamics." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 24, No. 1, Jan.–Feb., 2001, pp. 95–100.
17. **H. Schaub** and K. T. Alfriend, "Impulsive Feedback Control to Establish Specific Mean Orbit Elements of Spacecraft Formations", *AIAA Journal of Guidance, Control and Dynamics*, Vol. 24, No. 4, July–Aug., 2001, pp. 739–745.
18. **H. Schaub**, K. T. Alfriend, "J₂ Invariant Relative Orbits for Spacecraft Formations." *Celestial Mechanics and Dynamical Astronomy*, Vol. 79, 2001, pp. 77–95.
19. K. T. Alfriend, S. R. Vadali and **H. Schaub**, "Formation Flying Satellites: Control By an Astrodynasticist" *Celestial Mechanics and Dynamical Astronomy*, Vol. 81, Nos. 1–2, 2001, pp. 57–62.
20. **H. Schaub** and K. T. Alfriend, "Hybrid Cartesian and Orbit Element Feedback Law for Formation Flying Spacecraft", *AIAA Journal of Guidance, Control and Dynamics*, Vol. 25, No. 2, March–Apr., 2002, pp. 387–393.
21. G. G. Parker, M. J. Agostini, **H. Schaub**, K. Groom and R. D. Robinett, "Generating Swing-Suppressed Maneuvers for Crane Systems with Rate Saturation," *IEEE Transactions on Control Systems Technology*, Vol. 11, No. 4, July 2003, pp. 471–481.
22. **H. Schaub**, G. G. Parker and L. B. King, "Challenges and Prospects of Coulomb Spacecraft Formations," *AAS Journal of Astronautical Sciences*, Vol. 52, Nos. 1–2, Jan.–June., 2004, pp. 169–193.
23. **H. Schaub**, "Relative Orbit Geometry Through Classical Orbit Element Differences." *AIAA Journal of Guidance, Control and Dynamics*, Vol. 27, No. 7, Sept.–Oct., 2004, pp. 839–848.
24. **H. Schaub**, "Stabilization of Satellite Motion Relative to a Coulomb Spacecraft Formation," *AIAA Journal of Guidance, Control and Dynamics*, Vol. 28, No. 6, Nov.–Dec. 2005, pp. 1231–1239.
25. A. Natarajan and **H. Schaub**, "Linear Dynamics and Stability Analysis of a Two-Craft Coulomb Tether Formation," *AIAA Journal of Guidance, Control and Dynamics*, Vol. 29, No. 4, July–Aug. 2006, pp. 831–839.
26. **H. Schaub**, C. D. Hall, and J. Berryman, Necessary Conditions for Circularly-Restricted Static Coulomb Formations, *AAS Journal of Astronautical Sciences*, Vol 54, No. 3–4, July–Dec 2006, pp 525–541.
27. I. I. Hussein and **H. Schaub**, "Invariant Shape Solutions of the Spinning Three Craft Coulomb Tether Problem," *Journal of Celestial Mechanics and Dynamical Astronomy*, Vol. 96, No. 2, Oct. 2006, pp. 137–157.
28. M. Kim and **H. Schaub**, "Coulomb Formation Conservation Laws Using Differential Orbit Elements," *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, Vol. 220, No. 5, 2006, pp. 463–474.
29. A. Natarajan, **H. Schaub**, and G. G. Parker, "Reconfiguration of a Nadir-Pointing 2-Craft Coulomb Tether," *Journal of the British Interplanetary Society*, Vol. 60, No. 6, June 2007, pp. 209–218..
30. C. D. Karlgaard and **H. Schaub**, "Huber-Based Divided Difference Filtering," *AIAA Journal of Guidance, Control and Dynamics*, Vol. 30, No. 3, May–June 2007, pp. 885–891.
31. C. M. Saaj, V. Lappas, D. Richie, **H. Schaub**, and D. Izzo, "Hybrid Propulsion System for Spacecraft Swarm Aggregation using Coulomb Force," *Journal of British Interplanetary Society*, July 2007.
32. C. M. Southward, J. Ellis and **H. Schaub**, "Spacecraft Attitude Control Using Symmetric Stereographic Orientation Parameters", *Journal of Astronautical Sciences*, Vol. 55, No. 3, July–Sept., 2007, pp. 389–405.

33. J. Berryman and **H. Schaub**, “Analytical Charge Analysis for 2- and 3-Craft Coulomb Formations,” *AIAA Journal of Guidance, Control and Dynamics*, Vol. 30, No. 6, Nov.–Dec. 2007, pp. 1701–1710.
34. James Doebbler, Theresa Spaeth, John Valasek, Mark J. Monda, and **H. Schaub**, “Boom and Receptacle Autonomous Air Refueling Using Visual Pressure Snake Optical Sensor,” *AIAA Journal of Guidance, Control and Dynamics*, Vol. 30, No. 6, Nov.–Dec. 2007, pp. 1753–1769.
35. **H. Schaub** “Rate-Based Ship-Mounted Crane Payload Pendulation Control System,” *IFAC Control Engineering Practice*, Vol. 16, No. 1, 2008, pp. 132–145.
36. H. Vasavada and **H. Schaub**, “Analytic Solutions for Equal Mass 4-Craft Static Coulomb Formation,” *Journal of Astronautical Sciences*, Vol. 56, No. 1, January–March 2008, pp. 7–40.
37. S. Wang and **H. Schaub**, “Spacecraft Collision Avoidance using Coulomb Forces with Separation Distance Feedback,” *AIAA Journal of Guidance, Control and Dynamics*, Vol. 31, No. 3, May–June, 2008, pp. 740–750.
38. A. Natarajan and **H. Schaub**, “Orbit-Nadir Aligned Coulomb Tether Reconfiguration Analysis,” *Journal of Astronautical Sciences*, Vol. 56, No. 4, Oct.–Dec. 2008, pp. 573–592.
39. C. R. Seubert and **H. Schaub**, “Tethered Coulomb Structures: Prospects and Challenges,” *Journal of Astronautical Sciences*, Vol. 57, Nos. 1–2, Jan. – June, 2009.
40. **H. Schaub** and V. J. Lappas, “Redundant Reaction Wheel Torque Distribution Yielding Instantaneous L_2 Power-Optimal Attitude Control,” *AIAA Journal of Guidance, Control and Dynamics*, Vol. 32, No. 4, July–Aug. 2009, pp. 1269–1276.
41. A. Natarajan and **H. Schaub**, “Hybrid Control of Orbit Normal and Along-Track Two-Craft Coulomb Tethers,” *Aerospace Science and Technology*, Vol. 13, Nos. 4–5, 2009, pp. 183–191.
42. I. Hussein and **H. Schaub**, “Stability and Control of Relative Equilibria for the Three-Spacecraft Coulomb Tether Problem”, *Acta Astronautica*, Vol. 65, Nos. 5-6, 2009, pp. 738–754.
43. J. McMahon and **H. Schaub**, “Simplified Singularity Cost Function for VSCMG Nullmotion Steering Laws,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 32, No. 6, Nov.–Dec. 2009, pp. 1938–1943.
44. C. M. Saaj, V. Lappas, **H. Schaub**, and D. Izzo, “Hybrid Propulsion System for Formation Flying using Electrostatic Forces,” *Aerospace Science and Technology*, Vol. 14, No. 5, 2010, pp. 348–355.
45. J. Mullen and **H. Schaub**, “Hypersphere Stereographic Orientation Parameters,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 33, No. 1, Jan.–Feb. 2010, pp. 249–254.
46. S. Wang and **H. Schaub**, “Electrostatic Spacecraft Collision Avoidance Using Piece-Wise Constant Charges,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 33, No. 2., March–April 2010, pp. 510–520.
47. **H. Schaub** and I. Hussein, “Stability and Reconfiguration Analysis of a Circularly Spinning 2-Craft Coulomb Tether,” *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 46, No. 4, October 2010, pp. 1675–1686.
48. C. R. Seubert and **H. Schaub**, “Closed-Loop Charged Relative Motion Experiments Simulating Constrained Orbital Motion,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 33, No. 6, 2010, pp. 1856–1865.
49. C. D. Karlgaard and **H. Schaub**, “Comment on ‘Huber-Based Unscented Filtering and its Application to Vision-Based Relative Navigation,’” *IET Radar, Sonar & Navigation*, Vol. 4, No. 5, 2010, pp. 744–745.
50. C. Karlgaard and **H. Schaub**, “Nonsingular Attitude Filtering Using Modified Rodrigues Parameters,” *Journal of the Astronautical Sciences*, Vol. 57, No. 4, 2010, pp. 777–791.
51. C. D. Karlgaard, and **H. Schaub**, “Adaptive Nonlinear HuberBased Navigation For Rendezvous in Elliptical Orbit,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 34, No. 2, March–April 2011, pp. 388–402.
52. S. Wang and **H. Schaub**, “Nonlinear Charge Control for a Collinear Fixed Shape Three-Craft Equilibrium,” *AIAA Journal of Navigation, Control and Dynamics*, Vol. 34, No. 2, March–April 2011, pp. 356–366.
53. C.R. Seubert, S. A. Panosian, and **H. Schaub**, “Rotational Stiffness Study of Two-Element Tethered Coulomb Structures,” *AIAA Journal of Spacecraft and Rockets*, Vol. 48, No. 3, May–June, 2011, pp. 488–497.
54. S. Wang and **H. Schaub**, “Nonlinear Coulomb Feedback Control of a Spinning Two Spacecraft Virtual Structure,” *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 47, No. 3, July 2011, pp. 2055–2067.

55. S. Wang and **H. Schaub**, “Coulomb Control of Nonequilibrium Fixed Shape Triangular Three-Vehicle Cluster,” *AIAA Journal of Navigation, Control and Dynamics* for publication, Vol. 34, No. 1, January–February 2011, pp 259–270.
56. C. R. Seubert and **H. Schaub**, “Attitude and Power Analysis of Multi-Tethered, Two-Node Tethered Coulomb Structures,” *AIAA Journal of Spacecraft and Rockets*, Vol. 48, No. 6, Nov.–Dec. 2011, pp. 1033-1045.
57. E. Hogan and **H. Schaub**, “Collinear Invariant Shapes for Three-Spacecraft Coulomb Formations,” *Acta Astronautica*, Vol. 12, March–April 2012, pp. 78–89.
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2. **H. Schaub**, “Novel Developments in Attitude Dynamics and Control,” Department of Aerospace Engineering and Mechanics, University of Minnesota, April 14, 1999.
3. **H. Schaub**, “Novel Developments in Attitude Dynamics and Control,” Department of Aerospace Engineering, Penn State University, April 26, 1999.
4. **H. Schaub**, “Novel Developments in Attitude Dynamics and Control,” School of Aeronautics and Astronautics, Purdue University, May 3, 1999.
5. **H. Schaub**, “Spacecraft Formation Flying: an Elementary Problem,” Department of Mechanical and Aerospace Engineering, Utah State University, Logan, Utah, January 14, 2002.
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12. **H. Schaub** and G. G. Parker, “Virtual Space Structures using Coulomb Fields,” National Institute of Aerospace, Hampton, VA, Dec. 2, 2004.
13. **H. Schaub** “Electrostatic Spacecraft Relative Motion Control”, Department of Aerospace Engineering Science, University of Colorado, Boulder, CO, April 20, 2006.
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19. **H. Schaub**, “Electrostatic Spacecraft Relative Control Applications,” Air Force Research Laboratories, Albuquerque, New Mexico, July 28, 2008.
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23. **H. Schaub**, “Teaching CAETE Courses,” University of Colorado, Boulder, CO, Dec. 17, 2009.
24. **H. Schaub**, K. K. Maute, D. F. Moorer, “Electrostatically Inflated Space Structures,” Structural Space Systems Workshop, Air Force Research Labs, Albuquerque, NM, May 25–26, 2010.
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30. **H. Schaub**, “Preparing a Lecture,” University of Colorado, Boulder, CO, February 2nd, 2011.
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86. S. Wang, and **H. Schaub**, “Nonlinear Charge Control for a Collinear Fixed Shape Three-Craft Equilibrium,” AAS Astrodynamics Specialist Conference, Toronto, Canada, Aug. 2–5, 2010.
87. R. Inampudi, and **H. Schaub**, “Orbit Radial Dynamic Analysis of Two-craft Coulomb Formation at Libration Points,” AAS Astrodynamics Specialist Conference, Toronto, Canada, Aug. 2–5, 2010.
88. R. Inampudi, and **H. Schaub**, “Optimal Maneuvers of Two-Craft Coulomb Formation in Circular Orbits,” AAS Astrodynamics Specialist Conference, Toronto, Canada, Aug. 2–5, 2010. **(selected best paper in session)**
89. C. Seubert and **H. Schaub**, “Coulomb Testbed Force Model Verification for Charged Relative Motion Experiments,” 61th International Astronautical Congress, Prague, Czech Republic, Sept. 27–Oct. 1, 2010. Paper IAC-10.C1.1.9.
90. E. Hogan and **H. Schaub**, “Linear Stability and Shape Analysis of Spinning Three-Craft Coulomb Formations,” AAS Spaceflight Mechanics Meeting, New Orleans, Louisiana, February 13–17, 2011. Paper No. AAS 11–225
91. L. A. Stiles and **H. Schaub**, “Voltage Requirements for Electrostatic Inflation of Gossamer Space Structures,” 12th AIAA Gossamer Systems Forum, Denver, Colorado, April 4–7, 2011.
92. L. A. Stiles and **H. Schaub**, “Electrostatically Inflated Membrane Structures: Prospects and Challenges,” Oral Presentation at the 5th European Workshop on Inflatable Space Structures, Noordwijk, The Netherlands, May 10-12, 2011.
93. R. Inampudi and **H. Schaub**, “Orbit-Radial Control of a Two-Craft Coulomb Formation about Circular Orbits and Libration Points,” 4th International Conference on Spacecraft Formation Flying Missions & Technologies, St-Hubert, Québec, May 18–20, 2011.

94. **H. Schaub** and L. E. Z. Jasper, “Circular Orbit Radius Control Using Electrostatic Actuation for 2-Craft Configurations,” AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska, July 31 – August 4, 2011. Paper No. AAS 11–498
95. E. A. Hogan and **H. Schaub**, “Relative Motion Control for Two-Spacecraft Electrostatic Orbit Corrections,” AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska, July 31 – August 4, 2011. Paper No. AAS 11–466
96. L. E. Z. Jasper and **H. Schaub**, “Effective Sphere Modeling for Electrostatic Forces on a Three-Dimensional Spacecraft Shape,” AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska, July 31 – August 4, 2011. Paper No. AAS 11–465
97. D. Stevenson and **H. Schaub**, “Nonlinear Control Analysis of a Double Gimbal Variable Speed Control Moment Gyro,” AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska, July 31 – August 4, 2011. Paper No. AAS 11–567
98. C. R. Seubert, S. Panosian and **H. Schaub**, “Operational Analysis of a Tethered Coulomb Structure for Close Proximity Situational Awareness,” AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska, July 31 – August 4, 2011. Paper No. AAS 11–632
99. M. Nazari, E. Samiei, E. A. Butcher and **H. Schaub**, “Spacecraft Local Attitude Stabilization using Nonlinear Delayed Actuator Control,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
100. E. A. Hogan, P. Jasch and **H. Schaub**, “Three-Dimensional Linear Stability Analysis of Spinning Three-Craft Coulomb Formations,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
101. E. Samiei, M. Nazari, E. A. Butcher and **H. Schaub**, “Delayed Feedback Control of Rigid Body Attitude using Neural Networks,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
102. L. E. Z. Jasper, C. R. Seubert, **H. Schaub**, T. Valery and E. Yutkin, “Tethered Tug for Large LEO Debris Removal,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
103. D. Stevenson and **H. Schaub**, “Multi-Sphere Modeling for Electrostatic Forces on Three-Dimensional Spacecraft Shapes,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
104. L. A. Stiles, C. R. Seubert and **H. Schaub**, “Effective Coulomb Force Modeling in a Space Environment,” Accepted to the AAS Spaceflight Mechanics Meeting, Charleston, January 29 – February 2, 2012.
105. E. A. Hogan and **H. Schaub**, “Space Debris Reorbiting Using Electrostatic Actuation,” Submitted to the AAS Guidance, Navigation and Control Conference, Breckenridge, February 3–8, 2012.
106. L. A. Stiles and **H. Schaub**, “Active Charge Deflection Experiments with Coulomb Gossamer Structures,” Accepted to the 13th AIAA Gossamer Systems Forum, Honolulu, Hawaii, April 23–26, 2012.
107. P. Anderson Stiles and **H. Schaub**, “Local Orbital Debris Flux Study in the Geostationary Ring,” Submitted to the AIAA/AAS Astrodynamics Specialist Conference, Minneapolis, MN, August 13–16, 2012
108. P. Anderson Stiles and **H. Schaub**, “Impulsive Feedback Control of Nonsingular Elements in the Geostationary Regime,” Submitted to the AIAA/AAS Astrodynamics Specialist Conference, Minneapolis, MN, August 13–16, 2012
109. P. Anderson Stiles and **H. Schaub**, “Attitude Parameter Inspired Descriptions of Relative Orbital Motion,” Submitted to the AIAA/AAS Astrodynamics Specialist Conference, Minneapolis, MN, August 13–16, 2012

Technical Reports:

1. **H. Schaub** and J. L. Junkins, “An Eigenfactor Square Root Algorithm Formulation for Nonlinear Dynamics,” Technical Report, Texas A&M University, College Station, TX, May 16th, 1996.
2. **H. Schaub** and J. L. Junkins, “Dynamics and Control of Micro-Robot Swarms: Planar Motion and State Estimation,” Technical Report, Texas A&M University, College Station, TX, Aug, 1998.
3. **H. Schaub** and J. L. Junkins, “Dynamics and Control of Micro-Robot Swarms: Three-Dimensional Surface,” Technical Report, Texas A&M University, College Station, TX, Aug, 1998.

4. **H. Schaub** and J. L. Junkins, “Kalman Filter Study of a Micro-Robot With Track Slippage,” Technical Report, Texas A&M University, College Station, TX, May, 1999.
5. **H. Schaub** and K. Groom, “Ship Motion Filter Algorithm,” Technical Report, Sandia National Labs, Albuquerque, NM, July, 2001.
6. **H. Schaub**, Cartesian Payload Swing Damping, Technical Report, Sandia National Labs, Albuquerque, NM, August, 2001.
7. **H. Schaub** and K. Groom, Lighter Tracking Control Algorithm Study, Technical Report, Sandia National Labs, Albuquerque, NM, March, 2002.
8. **H. Schaub** and C. Wilson, “Matching a Statistical Pressure Snake to a Four-Sided Polygon and Estimating the Polygon Corners,” Technical Report, Sandia National Labs, SAND2004-1871, Albuquerque, NM, February, 2003.
9. **H. Schaub**, Extracting Primary Features of a Statistical Pressure Snake, Technical Report, Sandia National Labs, SAND2004-1869, Albuquerque, NM, February, 2003.
10. **H. Schaub**, Reading Color Barcodes using Visual Snakes, Technical Report, Sandia National Labs, SAND2004-1870, Albuquerque, NM, April, 2003.
11. **H. Schaub**, Statistical Pressure Snakes based on Color Images, Technical Report, Sandia National Labs, SAND2004-1867, Albuquerque, NM, April, 2003.
12. **H. Schaub**, Visual Servoing Using Statistical Pressure Snakes, Technical Report, Sandia National Labs, SAND2004-1868, Albuquerque, NM, April, 2003.
13. **H. Schaub**, Performance Study of the Rate-Based Pendulation Control System, Technical Report, Virginia Tech, Aerospace and Ocean Engineering Department, Blacksburg, VA, April, 2005.
14. **H. Schaub**, Rate-Based Pendulation Control System Study, Technical Report, Virginia Tech, Aerospace and Ocean Engineering Department, Blacksburg, VA, April, 2005.
15. **H. Schaub**, G. G. Parker, and L. B. King, “Coulomb Thrusting Application Study,” Technical Report, Virginia Tech, Aerospace and Ocean Engineering Department, Blacksburg, VA, January, 2006. Report No. A261344.
16. S. Dieckmann and **H. Schaub**, “Disk and Ellipse Tracking in Video Stream Data using Statistical Pressure Snakes,” Technical Report, University of Colorado, Aerospace Engineering Sciences Department, Boulder, CO, October, 2010.
17. **H. Schaub**, K. K. Maute, and D. F. Moorer, “Tethered Coulomb Structure,” Technical Report, University of Colorado, Aerospace Engineering Sciences Department, Boulder, CO, October, 2010.
18. **H. Schaub**, “Electrostatic Charge Deflection Experiments,” University of Colorado, Aerospace Engineering Sciences Department, Boulder, CO, October, 2011.

Primary Graduate Student Advisor:

Ph.D. Students:

1. Arun Natarajan, “2-Craft Coulomb Tether Concept,” Ph.D. Dissertation, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2007.
2. Shuquan Wang, “Shape Control of Charged Spacecraft Cluster with Two or Three Nodes,” Ph.D. Dissertation, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2010.
3. Chris Karlgaard, “Robust Adaptive Estimation for Autonomous Rendezvous in Elliptical Orbit,” Ph.D. Dissertation, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, August 2010.
4. Ravi Inampudi, “Two-Craft Coulomb Formation Study about Circular Orbits and Libration Points,” Ph.D. Dissertation, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, December 2010.
5. Carl R. Seubert, “One-Dimensional Spacecraft Formation Flight Testbed for Terrestrial Charged Relative Motion Experiments,” Ph.D. Dissertation, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, December 2011.

6. [Laura Stiles, 2008–](#)
7. [Erik Hogan, 2009–](#)
8. [Lee Jasper, 2010–](#)
9. [Daan Stevenson, 2010–](#)
10. [Steve O’Keefe, 2011–](#)
11. [Paul Anderson, 2011–](#)

Master of Science (Thesis):

1. Hyunsik Joe, “Sensor Craft Control Using Drone Craft with Coulomb Propulsion System,” Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2005.
2. John Berryman, “Analytical and Numerical Analysis of Static Coulomb Formations,” Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, December 2005. (2004, 2005 AFOSR Space Scholar Award)
3. Mark J. Monda, “Hardware Testbed for Relative Navigation of Unmanned Vehicles Using Visual Servoing,” Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2006. (NDSEG Fellowship Award)
4. Christopher Romanelli, “Software Simulation of an Unmanned Vehicle Performing Relative Spacecraft Orbits,” Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2006.
5. Josh Zhou, “Simplified Analysis of IMU Sensor Corruptions on Existing Pendulation Control System For Ship-Mounted Crane,” Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, December 2006.
6. Harsh Vasavada, Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2007.
7. Charles M. Southward III, Master’s Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2007.
8. Brady W. Young, “Design and Specication of an Attitude Control System for the DANDE Mission,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2008.
9. Stephen Panosian, “Stiffness Analysis of the Tethered Coulomb Structure Concept and Application,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
10. Samantha Kroening, “Visual Spacecraft Relative Motion Control using Higher Order Geometric Moments,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
11. Daniel Dunn, “A Hybrid Hardware and Software Simulation Environment for Relative Orbit Motion Studies,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
12. Robin Blenden, “Regenerative Power Optimal Reaction Wheel Attitude Control,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
13. Marc Saunders, “Adaptive Formation Flying Maneuvers for Multiple Relative Orbits,” Master’s Thesis, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, August 2011.
14. [Stephanie L. Jones, expected 2013.](#)

Master of Science (Non-Thesis):

1. Donald Shrewsbury, "Providing a Camera Sensor with Pointing Capabilities Independent of an Unmanned Ground Vehicle," Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, December 2006.
2. Paul Speth, "A Probabilistic Assessment of Earth-Orbiting Spacecraft Lifetime," Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2008.
3. Nicholas E. Bradley, "Low Earth Orbit Plasma Environment Visualization," Non-Thesis Master's Degree, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2010.
4. Nicholas P. Tarasenko, Non-Thesis Master's Degree, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, December 2010.
5. Daan Stevenson, Non-Thesis Master's Degree, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
6. Laura Stiles, Non-Thesis Master's Degree, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, December 2011.
7. [Khashayar Parsay, expected 2012](#)
8. [Nicholas Zinner, expected 2013.](#)
9. [Peter Jasch, expected 2013.](#)
10. [Felix Bidner, expected 2013](#)
11. [Kevin Dinkel, expected 2013](#)
12. [John P. Mills, expected 2013](#)
13. [Andres Zizzi, expected 2013](#)

Master of Engineering:

1. Rajtilok Chakravarty, 2006–2009
2. Sarah Stansbury, 2009– 2011

Undergraduate Research Advisor:

1. Justin McFarland, "Modeling the Ballistic Missile Problem with the State Transition Matrix: An Analysis of Trajectories including a Rotating Earth and Atmospheric Drag," AOE 4994 Semester Report, Virginia Tech, Blacksburg, VA 24061, May 2004.
2. Jeremy Davis, "Mathematical Modeling of Earth's Magnetic Field," AOE 4994 Semester Report, Virginia Tech, Blacksburg, VA 24061, May 2004.
3. Kevin Daugherty, "Restricted Three-Body Problem," AOE 4994 Semester Report, Virginia Tech, Blacksburg, VA 24061, Dec. 2004.
4. Thomas Reppert, "Extending the Patched-Conic Approximation to the Restricted Four-Body Problem," AOE 4994 Semester Report, Virginia Tech, Blacksburg, VA 24061, May. 2006.
5. Thomas Reppert, "Interplanetary Trajectory Development: Sensitivities of the Restricted Four-Body Problem," AOE 4994 Semester Report, Virginia Tech, Blacksburg, VA 24061, Dec. 2006.
6. Thomas Reppert, "Interplanetary Trajectory Development," Undergraduate Honors Thesis, Virginia Tech, Blacksburg, VA 24061, May 2007.
7. Nicholas Zinner, "Spacecraft Coulomb Thrust Testbed Enhancements," Discovery Learning Apprenticeship Oral Presentation Winner, University of Colorado, Boulder, May 2009.
8. Wenceslao E. Shaw-Cortez, "Coulomb Thrusting Testbed," Discovery Learning Apprenticeship Oral Presentation Winner, University of Colorado, Boulder, May 2010.
9. Brandon Bosomworth, "Identification and Reduction of External Forces On The Coulomb Testbed", Discovery Learning Apprenticeship, University of Colorado, Boulder, May 2011.
10. [John P. Mills, Discovery Learning Apprenticeship, University of Colorado, Boulder, Aug. 2011–](#)
11. [Tyson M. Sparks, Discovery Learning Apprenticeship, University of Colorado, Boulder, Aug. 2011–](#)

Graduate Degree Advisory Committee Member:

Ph.D. Students:

1. Matthew Berry, "A Variable-Step Double-Integration Multi-Step Integrator," Ph.D. Dissertation, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, May 2004.
2. Jana L. Schwartz, "The Distributed Spacecraft Attitude Control System Simulator: From Design Concept to Decentralized Control," Ph.D. Dissertation, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, July 2004.
3. Mischa Kim, "Continuous Low-Thrust Trajectory Optimization: Techniques and Applications," Ph.D. Dissertation, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, May 2005.
4. Marcus Holzinger, "Optimal Control Applications in Space Situational," Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, May 2011.
5. Sungwoo Moon, "Auto-Tuning of Digitally Controlled Single-Phase Low Harmonic Rectifiers and Inverters," Electrical Engineering Department, University of Colorado, Boulder, CO, May 2011.
6. Jay McMahon, "An Analytical Theory for the Perturbative Effect of Solar Radiation Pressure on Natural and Artificial Satellites," Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, August 2011.
7. Jill Tombasco, "Orbit Estimation of Geosynchronous Objects Via Ground-Based and Space-Based Optical Tracking," Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, August 2011.
8. Mike Krieg, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO.
9. Aurore Sibois, "GPS-based Sub-Hourly Polar Motion Estimates: Strategies and Applications," Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO, December, 2011.
10. Christine Hartzell, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO.
11. Dylan Boone, Aerospace Engineering Sciences Department, University of Colorado, Boulder, CO.

Master of Sciences (Thesis) Students:

1. Erin E. Kruse, "Nonlinear Modeling and Simulation of a Hydrostatic Drive System," Master's Thesis, Mechanical Engineering Department, Michigan Technological University, Houghton, MI, December 2001.
2. Matthew C. VanDyke, "Decentralized Coordinated Attitude Control of a Formation of Spacecraft," Master's Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, July 2004.
3. Scott E. Lennox "Coupled Attitude and Orbital Control System Using Spacecraft Simulators," Master's Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, July 2004.
4. Michael Morrow, "A Self-Sustaining, Boundary-Layer-Adapted System for terrain Exploration and Environmental Sampling," Master's Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, June 2005.
5. Christopher L. Nickell, "Modular Modification of a Buoyant AUV for Low-Speed Operation," Master's Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, September 2005.
6. Amir F. Ajami, "Adaptive Flight Control in the Presence of Input Constraint," Master's Thesis, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute, Blacksburg, VA, December 2005.
7. Farheen Rizvi, "SOLAR SAIL ATTITUDE DYNAMICS AND CONING CONTROL: On Developing Control Methods for Solar Sail Coning at Orbit Rate to Attain Desired Orbital Effects," Aerospace Engineering Sciences Department, University of Colorado, Boulder, Colorado, December 2010.
8. Nathan Shupe, "Orbit Options for an Orion-Class Spacecraft Mission to a Near-Earth Object," Aerospace Engineering Sciences Department, University of Colorado, Boulder, Colorado, December 2010.

Master of Sciences (Non-Thesis) Students:

1. Samuel Wright, "Parameter Estimation of a Spacecraft Simulator Using Parameter-Adaptive Control," Non-Thesis Master's Project, Aerospace and Ocean Engineering Department Virginia Polytechnic Institute, Blacksburg, VA, May 2006.
2. Mohammed Ali Nejat, Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, December 2006.
3. William Oehlschlager, "Nonlinear and Linear Control Law Study of Front-Wheel Steering Dynamics," Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, December 2006.
4. Chris Legendre, "Solar Electric Propulsion for a Lunar/Martian Tug," Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, May 2007.
5. Curtis Wilkerson, "Specialized Attitude Coordinate Development," Non-Thesis Master's Degree, Aerospace and Ocean Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA, August 2007.

Courses Taught:**University of Colorado:**

Course	Nos.	New	Restr.	Description
ASEN 3200	3x			Orbital Mechanics/Attitude Dynamics and Control: Covered the spacecraft attitude and control section of this class.
ASEN 4018	1x			Senior Design: Was a PAB member for senior design for the fall and spring semester.
ASEN 5010	4x		x	Spacecraft Dynamics and Control: required graduate course for ASEN, taught it 2x as a CAETE course, and once using my own lecture recording software
ASEN 6014	2x	x		Spacecraft Formation Flying: developed this new course. only such special topics course offered at US universities.
ASEN 6519	2x	x		Special Topics: Advanced Spacecraft Dynamics and Control: developed this new course, and taught it the 2nd time on CAETE
ASEN 6519	1x			ASN Seminar Series: Organize and host the astrodynamics and navigation seminar series by inviting external speakers

Virginia Tech:

Course	Nos.	New	Restr.	Description
AOE 4134	4x		x	Astromechanics: Required AOE undergraduate course. Broke the large 100-130 student classes into two sections. Restructured this course around a new text book.
AOE 4140	1x		x	Spacecraft Dynamics and Control: AOE technical elective, required for seniors doing space related design project. Restructured this course around a new text book.
AOE 5234	2x	x		Orbital Mechanics: developed a new graduate course to cover this material. Taught it using real-time two-way video conferences for both on- and off-campus students.
ASEN 6234	1x	x		Spacecraft Dynamics and Control: developed this new graduate course.

Texas A&M University:

Course	Nos.	New	Restr.	Description
AERO 310	2x		x	Aerospace Dynamics: Required AERO undergraduate course. Redeveloped this course to have a stronger focus on fundamental rigid body kinematics, as well as new text book.