

PENINA AXELRAD

University of Colorado Distinguished Professor
 Joseph T. Negler Professor of Aerospace Engineering Sciences
 Colorado Center for Astrodynamics Research
 Ann and H.J. Smead Aerospace Engineering Sciences
 3775 Discovery Drive, Boulder, CO 80303-0429
 Office: AERO 417, Phone: (303) 492-6872
 email : Penina.Axelrad@Colorado.EDU
<https://orcid.org/0000-0002-9749-7740>

Research Interests

Global Positioning System (GPS), Global Navigation Satellite System (GNSS), and alternative technologies and applications for position, navigation and timing (PNT); satellite orbit determination; satellite timing systems and space-based time and frequency transfer; space applications of quantum technology; GNSS-based remote sensing; GNSS multipath characterization and mitigation.

Education

Ph.D. in Aeronautics and Astronautics, 1991, Stanford University, Stanford, CA
 Dissertation: "A Closed-Loop GPS-Based Orbit Trim System for Gravity Probe B."
 S.M. in Aeronautics and Astronautics, 1986, Massachusetts Institute of Technology, Cambridge, MA, Master's thesis: "Near-Earth Orbit Determination and Rendezvous Navigation Using GPS."
 S.B. in Aeronautics and Astronautics (Avionics Option), 1985, Massachusetts Institute of Technology, Cambridge, MA.

Professional Experience

2020-present	University of Colorado Distinguished Professor, Ann and H.J. Smead Aerospace Engineering Sciences, Colorado Center for Astrodynamics Research, University of Colorado Boulder.
Spring 2024	Interim Associate Dean of Faculty Advancement, College of Engineering and Applied Science, University of Colorado Boulder.
2017-2018	NRC Senior Research Associate, AFRL/RVEP Space Experiments and Programs, Albuquerque, NM.
2012-2017	Chair, Ann and H.J. Smead Dept. of Aerospace Engineering Sciences, University of Colorado Boulder.
2008-2009	Visiting Scientist COSMIC Program Office, University Corporation for Atmospheric Research (UCAR).
2007-2008	Acting Chair, Department of Aerospace Engineering Sciences, University of Colorado Boulder.
2005-2007	Associate Chair, Department of Aerospace Engineering Sciences, University of Colorado Boulder.
2005-2020	Professor, Ann and H.J. Smead Aerospace Engineering Sciences, University of Colorado Boulder.
1999-2005	Associate Professor, University of Colorado Boulder.
1992-1999	Assistant Professor, University of Colorado Boulder.
1991-2011	Instructor, Navtech Seminars, Inc., Arlington, VA.
1991-1992	Lecturer, Department of Aeronautics and Astronautics, Stanford University.
1990-1992	Member of the Technical Staff and Program Manager, GPS Systems Organization, Stanford Telecommunications Inc., Santa Clara, CA.
1986-1990	Graduate Research Assistant, Gravity Probe B, Stanford University.
1985-1986	Systems Engineer, Space and Communications Group, Hughes Aircraft Co., El Segundo, CA.

Honors and Awards

AIAA and NAE Yvonne C. Brill Lectureship in Aerospace Engineering (2024)
 Smead Aerospace Outstanding Faculty Award Outstanding Graduate Teaching and Mentoring (2023)
 University of Colorado Distinguished Professor (2020)
 Smead Aerospace Outstanding Faculty Award for Research (2020)

Member of the National Academy of Engineering (2019)
 Joseph T. Negler Professor of Aerospace Engineering Sciences (2018-Present)
 University of Colorado Excellence in Leadership Award (2017)
 National Research Council (NRC) Senior Research Associate, Air Force Research Laboratory (AY2017-2018)
 Women in Aerospace Educator Award (2015)
 Institute of Navigation Samuel Burka Award (2011)
 American Institute of Aeronautics and Astronautics Summerfield Book Award (2011)
 University of Colorado, College of Engineering and Applied Science, Max S. Peters Faculty Service Award (2009)
 Institute of Navigation Johannes Kepler Award (2009)
 Fellow, American Institute of Aeronautics and Astronautics (2008)
 Institute of Navigation Outstanding Service Award (2005)
 Fellow, Institute of Navigation (2004)
 University of Colorado, Subaru Educator Spotlight (2004)
 Senior Member, Institute of Electrical and Electronics Engineers (2003)
 Institute of Navigation Tycho Brahe Award (2003)
 AIAA Lawrence Sperry Award (1996)
 AAS/AIAA Space Flight Mechanics Meeting Best Paper Award (1996)
 Naval Research Laboratory Alan Berman Annual Research Publications Award (1995, 2000)
 AIAA Rocky Mountain Section, Young Engineer of the Year (1995)
 AIAA Guidance, Navigation and Control Conference Best Paper Award (1993)
 Stanford University Graduate Fellowship (1986)
 Hughes Aircraft Company Graduate Fellowship (1986)
 James Means Award for Leadership in Aerospace Design (1985)
 Member Sigma Xi and Tau Beta Pi

Research Funding – Award Total: \$17.6M (Axelrad share \$13.9M), Award Total as PI: \$13.1M

Professional Activities

Current External Service and Committee Memberships

2024-Present	AAS Rocky Mountain Section, Guidance, Navigation and Control Conference, Session Co-Chair
2024-Present	AIAA Fellow Selection Flight Mechanics PAG Lead
2020-Present	National Research Council Space Technology Industry-Government-University Roundtable (STIGUR)
1993-Present	Associate Editor, Navigation

Past External Service and Committee Memberships

2023	University of Washington Aeronautics & Astronautics External Review Committee
2013-2023	National Space-Based Positioning, Navigation and Timing (PNT) Advisory Board
2023	Stanford University Aeronautics & Astronautics Visiting Committee, May 24-26, 2023
2022-2023	Assessment of Weapons Sciences at the Army Research Laboratory (ARL) Panel Member, National Academies of Sciences, Engineering, and Medicine
2022	CU-MIT-Stanford Rising Stars in Aerospace Symposium Co-Organizer, May 12-13, 2022
2022	U.S. Naval Academy Aerospace Engineering Program Visiting Committee, March 7-9, 2022
2013, 2019-2022	AIAA Fellow Peer Reviewer
1994-2021	Member of the Draper Corporation
2016-2019	NASA Advisory Council Member at Large
2019	Panel Member Purdue University Amelia Earhart Summit, September 2019
2019	Panel Member MIT-Stanford-CU Women in Aerospace Symposium, May 2019

2017	CU-MIT-Stanford Women in Aerospace Symposium Organizer and Host, May 30- Jun 1 https://www.colorado.edu/aerospace/wias
2016	International Committee on Global Navigation Satellite Systems (ICG-10) Organizing Committee Member
2014-2018	AIAA Publications Ethics Subcommittee
2013-2015	Institute of Navigation (ION) Awards Chair
2013-2014	Astrodynamics Collaboration Environment Working Group (AFRL)
2012-2016	Member of the Board of eSpace: The Center for Space Entrepreneurship
2009	Keck Institute for Space Studies External Advisory Committee
2007-2010	Program Co-Chair, ION/IEEE PLANS
2005-2006	NASA ST9 Precision Formation Flying Technology Review Board
2004-2005	Institute of Navigation (ION) President
2003-2004	Institute of Navigation (ION) Executive Vice President
2002-2012	Massachusetts Institute of Technology, Department of Aeronautics and Astronautics Visiting Committee
2000-2002	Institute of Navigation (ION) Chair, Satellite Division
1998-2000	Institute of Navigation (ION) Vice-Chair, Satellite Division
1997	General Chair, ION GPS-97
1996	Program Chair, ION GPS-96
1995	General Chair, ION National Technical Meeting
1994-1995	Member, National Research Council Committee on the Future of the Global Positioning System
1994-1996	Institute of Navigation (ION) Secretary, Satellite Division
1994-1995	Institute of Navigation (ION) Vice President, Western Region
1994	Technical Program Chair, ION National Technical Meeting
1993-1996	Faculty Advisor, University of Colorado Student Chapter Institute of Navigation (ION)
1993-1994	Institute of Navigation (ION) Chair, Student Awards Committee
1992-1994	Institute of Navigation (ION) Council Space Representative
1993	Institute of Navigation (ION) Technical Chair, ION GPS-93
1993	Institute of Navigation (ION) Chair, Rocky Mountain Section
1991-1992	Institute of Navigation (ION) Western Region Council Member at Large
1988-1989	Institute of Navigation (ION) Chair, Annual Satellite Division Student session

University of Colorado (CU) Service Activities

Spring 2024	Interim Associate Dean of Faculty Advancement, College of Engineering and Applied Science, University of Colorado Boulder.
2021-2024	Smead Aerospace Awards Committee Chair
2019-2024	Rose M. Litman Distinguished Lecture Advisory Committee
2023	LEAP Orientation Panelist
2022-2023	Smead Aerospace Primary Unit Evaluation Committee Chair
2021-2022	CU Teaching Quality Framework Committee
2022	College of Engineering Professional Rights and Responsibilities Investigation (Ad hoc)
2020-2022	Smead Aerospace Performance Evaluation Committee
2019-2021	Smead Aerospace Graduate Committee, Astrodynamics and Satellite Navigation Focus Lead
2018-2021	College of Engineering and Applied Science First Level Review Committee
2018-2021	Smead Aerospace Executive Committee
2005-2019	Faculty Teaching Excellence Faculty Associate and Advisory Board Member
2016-2017	Aerospace Building Design Committee
2012-2017	Chair CU AeroSpace Ventures Executive Committee
2016-2017	Provost's Chairs Committee (Ad hoc)
2016	College of Engineering and Applied Science Dean's Search Committee

2014-2015	CU Grand Challenge Steering Committee
2014-2015	Internal Review Committee – Continuing Education
2014-2015	CU Libraries Dean’s Review Committee
2011-2012	Internal Review Committee - Geography
2006-2007	University of Colorado Emerging Leaders Program Fellow
2005-2007	College of Engineering First Level Review Committee
2005-2007	Aerospace Engineering Sciences Coop Program Faculty Advisor
2004-2006	CRCW Committee
2003-2005	LEAP Program Coach
2002-03, 04-05	Aerospace Engineering Sciences Department, Search Committee Chair
1999-2008	Faculty Teaching Excellence Program Advisory Board
1998-2002	CU, College of Engineering Summer Success Institute
1994-2002	Lab Demonstrations for Women in Engineering Program High School Career Day

Journal Publications

Names of Dr. Axelrad's students are underlined.

1. Parkinson, B.W. and P. Axelrad, "Autonomous GPS Integrity Monitoring Using the Pseudorange Residual," *NAVIGATION*, Vol. 35, No. 2, p. 255-274, 1988.
2. Axelrad, P. and B.W. Parkinson, "Closed Loop Navigation and Guidance for Gravity Probe B Orbit Insertion," *NAVIGATION*, Vol. 36, No. 1, p. 45-61, 1989.
3. Green, G.B. and P. Axelrad, "Space Applications of GPS," *NAVIGATION*, Vol. 36, No. 3, p. 239-251, 1989.
4. Kee, C., B.W. Parkinson, P. Axelrad, "Wide Area Differential GPS," *NAVIGATION*, Vol. 38, No. 2, p. 123-146, 1991.
5. Born, G.H., M.E. Parke, P. Axelrad, K.L. Gold, J. Johnson, K.W. Key, D.G. Kubitschek, E.J. Christensen, "Calibration of the TOPEX altimeter using a GPS buoy," *Journal of Geophysical Research*, Vol. 99, No. C12, p. 24,517-24,526, 1994.
6. Adams, L.J., P. Axelrad, et al., The Global Positioning System - A Shared National Asset, A Report by the Committee on the Future of the Global Positioning System, National Academy Press, 264 pages, 1995.
7. Axelrad, P., C.J. Comp, P.F. MacDoran, "SNR Based Multipath Error Correction for GPS Differential Phase," *IEEE Transactions on Aerospace & Electronic Systems*, Vol. 32, No. 2, p. 650-660, April 1996.
8. Axelrad, P. and L.M. Ward, "Spacecraft Attitude Estimation Using the Global Positioning System: Methodology and Results for RADCAL," *Journal of Guidance, Control and Dynamics*, Vol. 19, No. 6, p. 1201-1209, November-December 1996.
9. Melvin, P.J., L.M. Ward, P. Axelrad, "The Analysis of GPS Attitude Data From a Slowly Rotating, Symmetrical Gravity Gradient Satellite," *Journal of the Astronautical Sciences*, Vol. 44, p. 515-539, October-December 1996.
10. Axelrad, P. and C.P. Behre, "Attitude Estimation Algorithms for Spinning Satellites Using GPS Phase Data," *Journal of Guidance, Control and Dynamics*, Vol. 20, No. 1, p. 164-169, January-February 1997.
11. Ward, L.M. and P. Axelrad, "A Combined Filter for GPS-Based Attitude and Baseline Estimation," *NAVIGATION*, Vol. 44, No. 2, p. 195-213, 1997.
12. Comp, C.J. and P. Axelrad, "Adaptive SNR-Based Carrier Phase Multipath Mitigation Technique," *IEEE Transactions on Aerospace & Electronic Systems*, Vol. 34, No. 1, p. 264-276, January 1998.
13. Irish, K., K. Gold, G. Born, A. Reichert, P. Axelrad, "Precision Orbit Determination for the Geosat Follow-On Satellites," *Journal of Spacecraft and Rockets*, Vol. 35, No. 3, p. 336-341, May-June 1998.
14. Garrison, J.L., P. Axelrad, N.J. Kasdin, "Ill-Conditioned Covariance Matrices in the First-Order Two-Step Estimator," *Journal of Guidance, Control and Dynamics*, Vol. 21, No. 5, p. 754-760, September-October 1998.
15. Axelrad, P., and C.P. Behre, "Satellite Attitude Determination Based on GPS Signal-to-Noise Ratio," (Invited Paper) *Proceedings of the IEEE*, Vol. 87, No. 1, p. 133-144, January 1999.
16. Komjathy, A., V.U. Zavorotny, P. Axelrad, G.H. Born, J.L. Garrison, "GPS Signal Scattering from Sea Surface: Wind Speed Retrieval Using Experimental Data and Theoretical Model," *Journal of Remote Sensing of Environment*, Vol. 73, p. 162-174, August 2000.
17. Moreau, M., P. Axelrad, J.L. Garrison, A. Long, "GPS Receiver Architecture and Expected Performance for Autonomous Navigation in High Earth Orbits," *NAVIGATION*, Vol. 47, No. 3, p. 191-204, 2000.
18. Bauer, F.H., P. Axelrad, et al., "Enabling Spacecraft Formation Flying in Any Earth Orbit Through Spaceborne GPS and Enhanced Autonomy Technologies," *Space Technology*, Vol. 20, No. 4, p. 175-185, 2001.
19. Reichert, A.K. and P. Axelrad "Carrier-Phase Multipath Corrections for GPS-Based Satellite Attitude Determination," *NAVIGATION*, Vol. 48, No. 2, p. 77-88, 2001.
20. Goldstein, D., G. Born, P. Axelrad "Real-time, Autonomous, Precise Orbit Determination Using GPS," *NAVIGATION*, Vol. 48, No. 3, p. 155-168, 2001.

21. Thompson, B., M.C. Meek, K.L. Gold, P. Axelrad, G.H. Born, D.G. Kubitschek, "Orbit Determination for the QuikSCAT Spacecraft," *Journal of Spacecraft and Rockets*, Vol. 39, No. 6, p. 852-858, November-December 2002.
22. Madhani, P.H., P. Axelrad, K. Krumvieda, J. Thomas, "Application of Successive Interference Cancellation to the GPS Pseudolite Near-Far Problem," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 39, No.2, p. 481-489, April 2003.
23. Komjathy, A., M. Armatys, D. Masters, P. Axelrad, V.U. Zavorotny, S.J. Katzberg, "Retrieval of Ocean Surface Wind Speed and Wind Direction Using Reflected GPS Signals," *Journal of Atmospheric and Oceanic Technology*, Vol.21, No.3, p. 515-526, March 2004.
24. Mickler, D., G.H. Born, P. Axelrad "Using GPS Reflections for Satellite Remote Sensing," *Acta Astronautica*, Vol. 55:1, p. 39-49, 2004.
25. Masters, D., P. Axelrad, S. Katzberg, "Initial Results of Land-Reflected GPS Bistatic Radar Soil Moisture Measurements in SMEX02," *Remote Sensing of Environment*, Vol. 92:4 p. 507-520, 2004.
26. Choi, K., A. Bilich, K.M. Larson, P. Axelrad, "Modified Sidereal Filtering: Implications for High-Rate GPS Positioning," *Geophys. Res. Lett.*, Vol. 31, No. 22, 2004.
27. Weiss, J.P., S. Anderson, P. Axelrad, "Development of Multipath Error Budgets for JPALS Ground Station Receivers," *NAVIGATION*, Vol. 52, No. 3, p. 145-154, 2005.
28. Lane, C. and P. Axelrad, "Formation Design in Eccentric Orbits Using Linearized Equations of Relative Motion," *Journal of Guidance, Control, and Dynamics*, Vol. 29, No. 1, p. 146-160, 2006.
29. Meek, M.C., G.H. Born, P. Axelrad, "Automated Operational Orbit Determination for the Ice Cloud and Land Elevation Satellite Mission," *Journal of Spacecraft and Rockets*, Vol. 43, No. 5, p. 1048-1053, Sept-Oct 2006.
30. Belmonte-Rivas, M., J. Maslanik, J. Sonntag, P. Axelrad, "Sea Ice Roughness from Airborne Lidar Profiles," *IEEE Transactions on Geoscience and Remote Sensing*, Volume 44, Issue 11, p. 3032 – 3037, 2006.
31. Lane, C. and P. Axelrad, "Analysis of Relative Navigation in High Earth Orbits," *Journal of the Astronautical Sciences*, Vol. 55, No 1, Jan-Mar 2007, p. 23-52.
32. Larson, K., A. Bilich, P. Axelrad, "Improving the precision of high-rate GPS," *Journal of Geophysical Research*, 112, B05422, DOI:10.1029/2006JB004367, 2007.
33. Lane, C. and P. Axelrad, "Relative Semimajor Axis Uncertainty in High Earth Orbits," *Journal of Guidance, Control, and Dynamics*, Vol. 30, No. 6, p. 1827-1830, 2007.
34. Weiss, Jan P., P. Axelrad, S. Anderson, "A GNSS Code Multipath Model for Semi-Urban, Aircraft, and Ship Environments," *NAVIGATION*, Vol. 54, No.4, p. 294-307, 2007.
35. Larson, K. M., E. E. Small, E. Gutmann, A. Bilich, P. Axelrad, J. Braun, "Using GPS multipath to measure soil moisture fluctuations: initial results," *GPS Solutions*, Vol 12 (3), p. 173-177, DOI:10.1007/s10291-007-0076-6, July 2008.
36. Bilich, A., K. M. Larson, P. Axelrad, "Modeling GPS Phase Multipath with SNR: Case study from Salar de Uyuni, Bolivia," *Journal of Geophysical Research*, 113, B04401, DOI:10.1029/2007JB005194, 2008.
37. Jah, M.K., M.E. Lisano, G.H. Born, P. Axelrad, "Mars Aerobraking Spacecraft State Estimation by Processing Inertial Measurement Unit Data," *Journal of Guidance, Control, and Dynamics*, Vol. 31, No. 6, p. 1802-1813, 2008.
38. Belmonte Rivas, M., J. Maslanik, P. Axelrad, "Bistatic scattering of GPS signals off Arctic Sea Ice," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 48, No. 3, p. 1548-1553, doi: 10.1109/TGRS.2009.2029342, 2010.
39. Vinande, E., P. Axelrad, D. Akos, "Mounting Angle Estimation for Personal Navigation Devices," *IEEE Transactions on Vehicular Technology*, Vol.59, No. 3, p. 1129-1138, March 2010.
40. Tombasco, J., P. Axelrad, M. Jah, "Analysis of Specialized Coordinate Representation for Dynamic Modeling and Orbit Estimation in the Geosynchronous Regime," *Journal of Guidance, Control, and Dynamics*, Vol. 33, No. 6, p. 1824-1836, 2010.

41. Axelrad, P., "Global Navigation Satellite Systems," in *Encyclopedia of Aerospace Engineering*, R. Blockley and W. Shyy (eds). John Wiley & Sons Ltd., Chichester, UK, p. 3167-3178, 2010.
42. Tombasco, J.M. and P. Axelrad, "A Study of the Achievable Geosynchronous Angles-Only Orbit Estimation Accuracy," *Journal of Astronautical Sciences*, Vol. 58, No. 2, April-June 2011, pp. 275-290.
43. Axelrad, P., B.K. Bradley, J. Donna, M. Mitchell, S. Mohiuddin, "Collective Detection and Direct Positioning Using Multiple GNSS Satellites," *NAVIGATION*, Vol. 58, No. 4, p. 305-321, 2011.
44. L.B. Cornman, R.K. Goodrich, P. Axelrad, E. Barlow, "Progress in turbulence detection via GNSS occultation data," *Atmospheric Measurement Techniques*, 5, 789-808, DOI:10.5194/amt-5-789-2012, 2012.
45. Tombasco, J.M. and P. Axelrad, "Along-Track Separation Uncertainty Modeling Given Space-Based Angles-Only Tracking," *Journal of Guidance, Control, and Dynamics*, Vol. 35, No. 3, p. 732-739, DOI: 10.2514/1.56240, 2012.
46. Tombasco, J.M. and P. Axelrad, "Observability of Relative Hybrid Elements Given Space-Based Angles-Only Observations," *Journal of Guidance, Control, and Dynamics*, Vol. 35, No. 5, p. 1681-1686, DOI: 10.2514/1.54981, 2012.
47. Pratt, J., P. Axelrad, K.M. Larson, B. Lesage, R. Gerren, N. DiOrio, "Satellite clock bias estimation for iGPS," *GPS Solutions*, 17(3): 381-389, doi: 10.1007/s10291-012-0286-4, 2013.
48. Bradley, B.K., B.A. Jones, G. Beylkin, K. Sandberg, P. Axelrad, "Bandlimited Implicit Runge-Kutta Integration for Astrodynamics," *Celestial Mechanics and Dynamical Astronomy*, 119:143–168, doi: 10.1007/s10569-014-9551-x, 2014.
49. Bradley, B.K., A. Sibois, P. Axelrad, "Influence of ITRF/GCRF Implementation for Astrodynamics: Coordinate Transformations" *Advances in Space Research*, Vol. 57, Issue 3, p. 850-866, doi: 10.1016/j.asr.2015.11.006, 2016.
50. Mashburn, J., P. Axelrad, S. T. Lowe, K. M. Larson, "An Assessment of the Precision and Accuracy of Altimetry Retrievals for a Monterey Bay GNSS-R Experiment," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 9, no. 10, pp. 4660-4668, doi: 10.1109/JSTARS.2016.2537698, 2016.
51. Gehly, S., B. Jones, P. Axelrad, "Sensor Allocation for Tracking Geosynchronous Space Objects," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 41, No. 1, pp. 149-163, doi: 10.2514/1.G000421, 2018.
52. Strandjord, K.L. and P. Axelrad, "Improved Prediction of GPS Satellite Clock Sub-Daily Variations Based on Daily Repeat," *GPS Solutions*, 22:58, doi: 10.1007/s10291-018-0723-0, 2018.
53. Mashburn, J., P. Axelrad, S. Lowe, K.M. Larson, "Global Ocean Altimetry with GPS Reflections from TechDemoSat-1," *IEEE Trans. on Geoscience and Remote Sensing*, 56(7) doi: 10.1109/TGRS.2018.2823316, 2018.
54. Gehly, S., B. Jones, P. Axelrad "Search-Detect-Track Sensor Allocation for Geosynchronous Space Objects" *IEEE Trans. on Aerospace and Electronic Systems*, Vol. 54, No. 6, pp. 2788-2808, doi: 10.1109/TAES.2018.2830578, 2018.
55. Schumacher, P.W., J. Gaebler, C. Roscoe, M. Wilkins, P. Axelrad, "Parallel Initial Orbit Determination Using Angles-Only Observation Pairs," *Celestial Mech and Dynamical Astronomy*, 130(60), doi: 10.1007/s10569-018-9852-6, 2018.
56. Klein, V., P. Axelrad, "Advanced multipath modeling and validation for GPS onboard the International Space Station," *NAVIGATION*, Vol. 66, pp. 559– 575, doi.org/10.1002/navi.327, 2019.
57. Mutschler, S., P. Axelrad, T. Matsuo, "A Partially Orthogonal EnKF approach to atmospheric density estimation using orbital debris," *Advances in Space Research*, 65(8), pp. 1965-1980, <https://doi.org/10.1016/j.asr.2020.01.021>, 2020.
58. Mashburn, J., P. Axelrad, C. Zuffada, E. Loria, A. O'Brien, B. Haines, "Improved GNSS-R Ocean Surface Altimetry with CYGNSS in the Seas of Indonesia," in *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 58, No. 9, pp. 6071-6087, doi: 10.1109/TGRS.2020.2973079, Sept. 2020.
59. Strandjord, K.L., P. Axelrad, S. Mohiuddin, "Improved Urban Navigation with Collaborative Shadow Matching and Specular Matching in Formation," *NAVIGATION*, 67:547-565, <https://doi.org/10.1002/navi.378>, 2020.
60. Gaebler, J., P. Axelrad, P. Schumacher, "CubeSat Cluster Deployment Track Initiation via a Radar Admissible Region Birth Model," *Journal of Guidance, Control, and Dynamics*, Vol. 43, No. 10, p. 1927-1934, doi.org/10.2514/1.G005139, October 2020.

61. Gaebler, J. and P. Axelrad, "Identity Management of Clustered Satellites with a Generalized Labeled Multi-Bernoulli Filter," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 43, No. 11, p. 2046-2057, doi.org/10.2514/1.G004725, November 2020.
62. Rybak, M., P. Axelrad, J. Seubert, T. Ely, "Chip Scale Atomic Clock–Driven One-Way Radiometric Tracking for Low-Earth-Orbit CubeSat Navigation," *AIAA Journal of Spacecraft and Rockets*, Vol. 58, No. 1, p. 200-2019, doi.org/10.2514/1.A34684, 2021.
63. VanBuren, D., P. Axelrad, S. Palo, "A Low Complexity Smoothing Algorithm for Improved GPS Point Solutions Onboard LEO Spacecraft," *NAVIGATION*, 68:185-198, doi: 10.1002/navi.410, 2021.
64. VanBuren, D., P. Axelrad, S. Palo, "Design of a high-stability heterogeneous clock system for small satellites in LEO," *GPS Solutions*, 25:105, doi.org/10.1007/s10291-021-01134-x, 2021.
65. Nicotra, M.M., J. Shao, J. Combes, A.C. Theurkauf, P. Axelrad, L.Y. Chih, M. Holland, A. Zozula, C.K. LeDesma, K. Mehling, D.Z. Anderson, "Modeling and Control of Ultracold Atoms Trapped in an Optical Lattice: An Example-driven Tutorial on Quantum Control," in *IEEE Control Systems Magazine*, vol. 43, no. 1, pp. 28-43, doi: 10.1109/MCS.2022.3216652, 2023.
66. Mutschler, S.M., P. Axelrad, E.K. Sutton, D. Masters, D. "Physics-based approach to thermospheric density estimation using CubeSat GPS data," *Space Weather*, 21, e2021SW002997. <https://doi.org/10.1029/2021SW002997>, 2023.
67. Rybak, M., P. Axelrad, C. LeDesma, D. Anderson, T. Ely, "Application of Shaken Lattice Interferometry Based Sensors to Space Navigation," *Advances in Space Research*, 71:4288-430, doi.org/10.1016/j.asr.2022.12.050, 2023.
68. Conrad, A., P. Axelrad, B. Haines, C. Zuffada, A. OBrien, E. Loria, "Improved Single-frequency Orbit Determination for the CYGNSS Spacecraft in GipsyX," *NAVIGATION*, 70 (1), <https://navi.ion.org/content/70/1/navi.565>, 2023.
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70. Flood, C., P. Axelrad, J. Hinks, "The Formation of a Chip Scale Atomic Clock Ensemble using Software Defined Radios," *IEEE Open Journal of Ultrasonics, Ferroelectrics, & Freq Control*, 3:77-87, doi:10.1109/OJUFFC.2023.3285204, 2023.
71. Dobbin, M. and P. Axelrad, "A Flexible Ephemeris Representation for GNSS and Alternative PNT Signal Sources Using B-splines," *Navigation*, 70(4), <https://doi.org/10.33012/navi.610>, 2023.
72. Gill E., J. Morton, P. Axelrad, D.M. Akos, M. Centrella, S. Speretta, "Overview of Space-Capable Global Navigation Satellite Systems Receivers: Heritage, Status and the Trend towards Miniaturization," *Sensors*, 23(17):7648 <https://doi.org/10.3390/s23177648>, 2023.
73. Conrad, A., P. Axelrad, S. Desai, B. Haines, "Sentinel-6 Michael Freilich precise orbit determination using PODRIX and TriG receiver measurements," *J. of Geodesy* 98:39, <https://doi.org/10.1007/s00190-024-01842-5>, 2024.
74. LeDesma, C., K. Mehling, J. Shao, J. Wilson, P. Axelrad, M. Nicotra, D. Anderson, M. Holland, "Demonstration of a programmable optical lattice atom interferometer," *Physical Review Research*, 6(4) 043120, <https://doi.org/10.1103/PhysRevResearch.6.043120>, 2024.
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103. Klein, V., P. Axelrad, J. Veldman, "Characterization of Expected Multipath Error for the NICER X-Ray Telescope Payload," *Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014)*, pp. 2448-2456, Tampa, FL, September 2014.
104. Barlow, E., P. Axelrad, P. Withnell, D. Nuding, "Analysis of Error Sources in Phase Rate Measurements in GPS Radio Occultation," *Proceedings of the 27th International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2014)*, Tampa, FL, pp. 1478-1491, September 2014.
105. Ashman, B., J. L. Veldman, J. L. Garrison, P. Axelrad, "Evaluation of the GNSS Multipath Environment in Space Proximity Operations: Experimental and Simulation Studies of Code Correlations in Hubble Servicing Mission 4," *Proceedings of the Pacific PNT Meeting of the Institute of Navigation*, Honolulu, HI, April 2015, pp. 863-871.

106. Garcia, J.G., P. Axelrad, P.A. Roncagliolo, C.H. Muravchik, "Fast and Reliable GNSS Attitude Estimation Using a Constrained Bayesian Ambiguity Resolution Technique (C-BART)," *Proceedings of the 28th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2015)*, Tampa, FL, pp. 2809-2820, September 2015.
107. Herz, A., B. Jones, E. Herz, D. George, P. Axelrad, S. Gehly, "Heimdall System for MSSS Sensor Tasking," *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, 11 pages, September 15-18, 2015.
108. Gaebler, J.A. and P. Axelrad, "Characterization of Specialized Geosynchronous Elements for Space Situational Awareness Applications," *AIAA/AAS Astrodynamics Specialist Conference, AIAA SPACE Forum*, (AIAA 2016-5503), Long Beach, CA, 10 pages, September 2016.
109. Ashman, B. W., J.L. Veldman, P. Axelrad, J.L. Garrison, L.B. Winternitz, L.B., "Validation of GNSS Multipath Model for Space Proximity Operations Using the Hubble Servicing Mission 4 Experiment," *Proceedings of the 29th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2016)*, Portland, Oregon, September 2016, pp. 3635-3643. (Received award for best presentation in session.)
110. Herz, A., E. Herz, K. Center, P.D. George, P. Axelrad, S. Mutchler, B. Jones, "Utilizing novel non-traditional sensor tasking approaches to enhance the space situational awareness picture maintained by the Space Surveillance Network," *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, 14 pages, September 20-23, 2016.
111. Klein, V. and P. Axelrad, "Multipath Modeling and Validation for GPS Onboard the International Space Station," *AAS Guidance and Control Conference*, Breckenridge, CO, 11 pages, February 4, 2017.
112. Gaebler, J.A. and P. Axelrad, "Cubesat Cluster Deployment Tracking with a CPHD Filter," *9th International Workshop on Satellite Constellations and Formation Flying*, Boulder, CO, 12 pages, June 21, 2017.
113. Gaebler, J.A., P. Axelrad, P.W. Schumacher, "Boundaries on Range-Range Constrained Admissible Regions for Optical Space Surveillance," *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, 12 pages, September 19-22, 2017.
114. Mutschler, S., P. Axelrad, T. Matsuo, "Harnessing Orbital Debris to Sense the Space Environment," *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, 14 pages, September 19-22, 2017.
115. Strandjord, K.L. and P. Axelrad, "A Framework for Regional GNSS Situational Awareness," *Proceedings of the 29th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2017)*, Portland, Oregon, pp. 2452-2466, September 2017.
116. Mashburn, J., A. O'Brien, P. Axelrad, C. Zuffada, S. Lowe, R. Shah, A. Voronovich, V. Zavorotny, "A Comparison of Waveform Model Re-Tracking Methods Using Data from CYGNSS," *Proceedings of IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Valencia, Spain, pp. 4289-4292, July 2018.
117. Zuffada, C., B. Haines, G. Hajj, Z. Li, S. Lowe, R. Shah, J. Mashburn, P. Axelrad, A. O'Brien, P. Cipollini, V. Zavorotny, A. Voronovich, "Assessing the Altimetric Measurement from CYGNSS Data," *Proceedings of IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Valencia, Spain, pp. 8292-8295, July 2018.
118. Rybak, M., P. Axelrad, J. Seubert, "Investigation of CSAC Driven One-Way Ranging Performance for CubeSat Navigation," *Proceedings 32nd Annual AIAA/USU Conference on Small Satellites*, SSC18-X-06, 13 pages, August 2018.
119. Strandjord, K.L. and P. Axelrad, "Framework and Techniques for Cooperative Group Situational Awareness in Urban Environments," *Proceedings of the 30th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2018)*, Miami, Florida, pp. 253-270, September 2018.
120. Gaebler, J.A. and P. Axelrad, "Label Assignments in CubeSat Cluster Deployment Tracking," *Proceedings of AAS/AIAA Space Flight Mechanics Meeting*, Ka'anapali Maui, AAS 19-540, 15 pages, January 2019.
121. Van Buren, D., S. Palo, P. Axelrad, "High Stability Reference Clock for Small Satellites," *Proceedings of the Precise Time and Time Interval Meeting*, Reston, VA, 21 pages, January 2019.

122. Gaebler, J.A. and P. Axelrad, "Improving Orbit Determination of Clustered CubeSat Deployments using Camera-Derived Observations," *Proceedings of the 42nd AAS Rocky Mountain Section Guidance, Navigation, and Control Conference 2019*, Advances in the Astronautical Sciences, Vol. 169, Breckenridge, CO, AAS 19-041, pp. 191-200, February 2019.
123. Boylston, A., J.A. Gaebler, and P. Axelrad, "Extracting CubeSat Relative Motion Using In Situ Deployment Imagery," *Proceedings of the 42nd AAS Rocky Mountain Section Guidance, Navigation, and Control Conference 2019*, Advances in the Astronautical Sciences, Vol. 169, Breckenridge, CO, AAS 19-016, pp. 59-68, February 3, 2019.
124. Loria, E., J. Mashburn, A. O'Brien, P. Axelrad, C. Zuffada, Z. Li, and B. Haines, Towards an Ocean Altimetry Product Using CYGNSS," *Proceedings of IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Yokohama, Japan, pp. 8700-8702, July 2019.
125. Gaebler, J.A. and P. Axelrad, "Track Initiation for CubeSat Cluster Deployment Tracking," *2019 AAS/AIAA Astrodynamics Specialist Conference*, Portland, ME, AAS 19-862, 11 pages, August 2019.
126. Van Buren, D., S. Palo, P. Axelrad, "Simulation of a High Stability Reference Clock for Small Satellites with Modeled GPS Timing Errors," *Proceedings of the AIAA/USU Conference on Small Satellites*, SSC19-XII-03, 11 pages, <http://digitalcommons.usu.edu/smallsat/2019/all2019/159>, August 2019.
127. Mutschler, S., P. Axelrad, T. Matsuo, E. Sutton, "Physics-based Approach to Density Estimation and Prediction using Orbital Debris Tracking Data," *AMOS – Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, September 17-20, 2019.
128. Strandjord, K.L., P. Axelrad, D.M. Akos, S. Mohiuddin, "Improved Urban Navigation with Direct Positioning and Specular Matching," *Proceedings of the 2020 International Technical Meeting of The Institute of Navigation*, San Diego, CA, pp. 787-800, January 21-24, 2020.
129. Rybak, M.M., P. Axelrad, J. Seubert, T. Ely, "Estimation of Thermal and Stochastic Variations of Chip Scale Atomic Clocks for Navigation of a Lunar CubeSat," *Proceedings of the 51st Precise Time and Time Interval Systems Meeting*, San Diego, CA, pp. 221-233, <https://doi.org/10.33012/2020.17302>, January 21-24, 2020.
130. Khatrri, Y., A. Aboaf, D. Dowd, C. Flood, H. Dixon, P. Axelrad, "CSAC Flight Experiment to Characterize On-Orbit Performance," *Proceedings of the AIAA/USU Conference on Small Satellites*, SSC20-XIII-03, <https://digitalcommons.usu.edu/smallsat/2020/all2020/46/>, August 2020.
131. Conrad, A., P. Axelrad, C. Zuffada, B. Haines, A. O'Brien, E. Loria, "Improved Single Frequency Orbit Determination for the CYGNSS Spacecraft," *Proceedings of the 33rd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2020)*, pp. 3875-3887, September 2020 (Virtual).
132. Conrad, A., P. Axelrad, C. Zuffada, B. Haines, A. O'Brien, E. Loria, "Improved Orbit Determination of the CyGNSS Satellites and Its Application to GNSS-R Ocean Altimetry", *IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, September 27 – October 2, 2020 (Virtual).
133. Flood, C., M.Q. LaBarge, L. Schement, H. Dixon, P. Axelrad, "A Testbed for Low-SWaP Atomic Clock Ensemble Development," *Proceedings of the 52nd Annual Precise Time and Time Interval Systems and Applications Meeting*, pp. 287-300. <https://doi.org/10.33012/2021.17790>, January 2021 (Virtual).
134. Mutschler, S., P. Axelrad, E. Sutton, "Application of SoleiTool for Density Estimation using CubeSat GPS Data," *AMOS – Advanced Maui Optical and Space Surveillance Technologies Conference*, Maui, HI, September 14-17, 2021.
135. Flood, C., W. Watkins, P. Axelrad, "Signal Generation in a Low-SWaP Atomic Clock Ensemble," *Proceedings of the 53rd Annual Precise Time and Time Interval Systems and Applications Meeting*, Long Beach, CA, pp. 45-57, January 2022.
136. Dobbin, M., C. Colpaert, C. Krebs, P. Axelrad, "Characterizing CSAC Performance in a Simulated Mission Environment," *Proceedings of the 44th Annual AAS Rocky Mountain Section Guidance, Navigation, and Control Conference 2022*, Advances in the Astronautical Sciences, Breckenridge, CO, AAS 22-013, 18 pages, February 2022.
137. Flood, C., P. Axelrad, A.J. Metcalf, B.K. Stuhl, "Estimation Architectures for Precise Time and Frequency Transfer in a LEO Constellation," *2022 Joint Conference of the European Frequency and Time Forum & the IEEE International*

- Frequency Control Symposium (EFTF/IFCS)*, Paris, France, 5 pages, doi: 10.1109/EFTF/IFCS54560.2022.9850585, April 2022.
138. Dobbin, M. and P. Axelrad, "A Flexible Ephemeris Representation for GNSS and Alternative PNT Signal Sources Using B-Splines," *Proceedings of the 35th International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2022)*, pp. 799-807, September 2022.
 139. Conrad, A., P. Axelrad, S. Desai, B. Haines, "Improved Modeling of the Solar Radiation Pressure for the Sentinel-6 MF Spacecraft," *Proceedings of the 35th International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2022)*, pp. 3618-3631, September 2022.
 140. Patel, R., C. Flood, P. Axelrad, "Multi-CubeSat Formation Design for a High-Precision Timing and Ranging Experiment in LEO," *Proceedings of the 33rd AAS/AIAA Space Flight Mechanics Meeting*, Austin, TX, January 2023.
 141. Flood, C., J. Pedersen, P. Axelrad, "A Multi-Platform Clock Ensemble Testbed," *Proceedings of the 54th Annual Precise Time and Time Interval Systems and Applications Meeting*, Long Beach, CA, pp. 223-235, doi: 10.33012/2023.18683, January 2023.
 142. Davies, L. and P. Axelrad, "Arc-Constrained Multi-Target Tracking with Real Radar Observations," *Proceedings of the 45th Annual AAS Rocky Mountain Section Guidance, Navigation, and Control Conference 2023*, Breckenridge, CO, AAS 22-015, 17 pages, February 2023.
 143. Wallace, B., S. Palo, P. Axelrad, J. Marino, N. Rainville, R. Kingsbury, J. Ditomas, M. Shihabi, D. Ogbe, "Development of a Lunar Surface Navigation Pseudolite Testbed," *Proceedings of the 36th International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2023)*, 19 pages, September 2023.
 144. Coll Ibars, S., D. Scheeres, P. Axelrad, "Asteroid gravity field estimation using a gravity gradiometer," AIAA 2024-2274, January 2024.
 145. Axelrad, P., and C. Zuffada, "Forward Looking Reflections on GNSS-R," *Proceedings of the 2024 International Technical Meeting of The Institute of Navigation*, Long Beach, California, January 2024, pp. 68-77. <https://doi.org/10.33012/2024.19578>.
 146. Dobbin, M., A. Hunter, W. Gravel, C. Parker, P. Axelrad. 2024. "Characterizing a Chip Scale Atomic Clock in Low Earth Orbit," *Proceedings of the Small Satellite Conference, Advanced Technologies I, SSC24-IX-01*. <http://digitalcommons.usu.edu/smallsat/2024/all2024/124/>.

Other Publications

1. Axelrad, P., Near-Earth Orbit Determination and Rendezvous Navigation Using GPS, Master's Thesis, MIT, 1986.
2. Parkinson, B.W. and P. Axelrad, "Techniques for Autonomous GPS Integrity Monitoring," AGARDograph No. 314, *Analysis, Design and Synthesis Methods for Guidance and Control Systems*, p. III-1-18, 1990.
3. Axelrad, P., *A Closed-Loop GPS-Based Orbit Trim System for Gravity Probe B*, Ph. D. Dissertation, Stanford University, 1990.
4. Axelrad, P., Invited essay for "Directions'96" Issue of *GPS World* Magazine, p. 50, December, 1995.
5. Online : "Ten Lessons on Navigation" Authored by Jeffery White, Matt Lippis, Mindy Schaefer Zarske, Penina Axelrad, Janet Yowell. <http://www.ion.org/satdiv/education.cfm>
6. Axelrad, P. and K.M. Larson, "GNSS Solutions: Is it true that the GPS satellite geometry repeats every day shifted by 4 minutes?" *InsideGNSS* Magazine, p. 16-17, July/August 2006.
7. Axelrad, P., J. Donna, M. Mitchell, S. Mohiuddin, "Collective Detection - Enhancing GNSS Receiver Sensitivity by Combining Signals from Multiple Satellites," *GPS World* Magazine, p. 58-64, January 2010.
8. Axelrad, P. AIAA Member Spotlight Interview, November 2015.
9. Axelrad, P. and J. Gaebler, "Specialized FISST-based Estimation Methods to Enhance Space Situational Awareness in MEO and GEO Orbits," Technical Report AFRL-RV-PS-TR-2016-0114, August 2016.

10. Strandjord, K.L., P. Axelrad, D. Akos, S. Mohiuddin, "Going Direct: Improved Accuracy from Reflected Signals and Path Predictions," *Inside GNSS Magazine*, <https://insidegnss.com/strandjord/>, April 6, 2020.
11. Flood, C. and P. Axelrad, "Small Satellite Position, Navigation, and Timing Innovations Vol1 – CONTACT Clock Project Testbed," AFRL-RV-PS-TR-2022-0088, <https://apps.dtic.mil/sti/trecms/pdf/AD1201196.pdf>, 2022.
12. Dobbins, M. and P. Axelrad, "Small Satellite Position, Navigation, and Timing Innovations Vol2 - CONTACT CSAC Experiment for MAXWELL CubeSat," AFRL-RV-PS-TR-2022-0088, <https://apps.dtic.mil/sti/trecms/pdf/AD1201197.pdf>, 2022.
13. Flood, C. and P. Axelrad, Small Satellite Position, Navigation, and Timing Innovations Vol3 - Two Way Ranging for Time and Frequency Transfer in LEO Constellations, AFRL-RV-PS-TR-2022-0088, <https://apps.dtic.mil/sti/trecms/pdf/AD1207132.pdf>, 2022.
14. Contributor to National Academies of Sciences, Engineering, and Medicine. 2024. *2022 Assessment of the DEVCOM Army Research Laboratory*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26931>.

Invited Talks, Seminars and Colloquia (since 2000)

1. Invited speaker at the Institute for Mathematics and Its Applications, University of Minnesota, IMA "HOT TOPICS" workshop on Mathematical Challenges in Global Positioning System, "Retrieval of Ocean and Land Surface Characteristics Using Measurements of Reflected GPS Signals," August 18, 2000.
2. Invited lecture at Stanford University, "Remote Sensing of Ocean Surfaces Using Bistatic GPS," February 14, 2001.
3. University of Colorado, Faculty Teaching Excellence Program, "Establishing a Teaching Portfolio," March 2001.
4. University of Colorado, College of Engineering and Applied Science Orientation, Faculty Keynote Address, August 23, 2006.
5. Invited speaker for ZONTA Foothills Club, Amelia Earhart Dinner, "On encouraging young women to study science, math, and engineering," Broomfield, CO, January 28, 2007.
6. Invited tutorial seminar "Introduction to Global Navigation Satellite Systems," at 32nd Annual Time and Frequency Metrology Seminar, NIST, Boulder, CO, June 14, 2007.
7. "GNSS Applications for Science and the Environment," 2nd International Summer School on GNSS, Berchtesgaden, Germany, July 30, 2008.
8. Invited speaker for Stanford University Department of Aeronautics and Astronautics 50th Anniversary Symposium, "Challenges and Opportunities in Aerospace Education," Palo Alto, CA, May 10, 2008.
9. Invited speaker for National Academy of Engineering / Chinese Academy of Sciences GNSS Workshop, "Application of GNSS to Environmental Studies," Shanghai, China, May 2011.
10. Invited speaker for 2nd Smead Fellow Workshop, "GPS Collective Detection – a new approach for making a little signal go a long way," Vail, CO, May 10, 2012.
11. Invited speaker Georgia Institute of Technology, "How GPS Changes Everything," January 31, 2013.
12. Invited speaker at NASA JPL, "University of Colorado Boulder (CU) Overview of Research & Educational Programs in Aerospace Engineering and Sciences," December 17, 2013.
13. Keynote Speaker, GNSS Futures in the Asia-Pacific Region Workshop at UNSW Australia, July 8, 2014.
14. Invited speaker University of Kansas, "How GPS Changes Everything," February 9, 2015.
15. Invited speaker University of Michigan, "How GPS Changes Everything," February 26, 2015.
16. Invited speaker Texas A&M, "How GPS Changes Everything," April 9, 2015.

17. Invited speaker International Technical Symposium on Navigation and Timing (ITSNT), "Space Applications of GNSS," ENAC, Toulouse, November 15, 2016.
18. Invited speaker University of Illinois Urbana-Champaign, "GPS Reflections," November 28, 2016.
19. Invited panel member, EDU-01: Panel Session. Educating the Engineer of the 2030. Wednesday, AIAA SciTech, January 11, 2017.
20. Invited luncheon speaker for ZONTA Foothills Club, "How GPS Changes Everything," Boulder, CO, January 28, 2017.
21. Invited plenary lecture 59th Israel Annual Conference on Aerospace Sciences (IACAS), "Scientific Applications of Global Navigation Satellite Systems," Tel Aviv, Israel, March 6, 2019.
22. Invited speaker University of Texas Austin, "GNSS Reflections – Modeling multipath for space applications and utilizing reflections for remote sensing," Austin, TX, January 30, 2020.
23. Invited speaker Stanford Center for Position, Navigation, and Time (SCPNT) 15th Annual PNT Symposium, "Tracking Clustered CubeSat Deployments," Virtual, October 27, 2021.
24. Invited tutorial, "CSAC for Positioning, Navigation, and Timing in Space," Precise Time and Time Interval Systems and Applications Meeting PTTI 2022, Long Beach, CA, January 26, 2022.
25. Invited speaker, "The Evolution and Impact of Global Navigation Satellite Systems," Purdue Engineering Distinguished Lecture Series, West Lafayette, IN, March 23, 2022.
26. Invited speaker, "Global Navigation Satellite System origins, unexpected applications, and new directions," CU Boulder Physics Department Colloquium, Boulder, CO, November 30, 2022.
27. Invited speaker, "How GPS Changed Everything," CU on the Weekend, Boulder, CO, April 15, 2023.
28. Invited tutorial, "GNSS theory, observation equation, and error sources," UCAR COSMIC's GNSS Remote Sensing Colloquium, Boulder, CO, June 5, 2023.
29. Invited tutorial, "Introduction to Global Navigation Satellite Systems," Annual Time and Frequency Metrology Seminar, NIST, Boulder, CO, July 10, 2023.
30. Invited tutorial, "Space Applications of GNSS," Institute of Navigation, GNSS+ Conference, Denver, CO, September 11, 2023.
31. Invited tutorial, "Introduction to Global Navigation Satellite Systems," Annual Time and Frequency Metrology Seminar, NIST, Boulder, CO, August 15, 2024.
32. Invited tutorial, "Space Applications of GNSS," Institute of Navigation, GNSS+ Conference, Baltimore, MD, September 16, 2024.
33. Yvonne C. Brill Lecture in Aerospace Engineering, "The Evolution and Impact of Global Navigation Satellite Systems," National Academy of Engineering, Washington DC, October 1, 2024.

Conference & Workshop Presentations and Posters (*without papers*)

1. Burkert, J., P. Axelrad, L. Cornman, K Goodrich, Scott Palo, Andrew Weekley, "Turbulence Estimation Techniques for COSMIC Occultation Data," Fourth FORMOSAT-3/COSMIC Data Users Workshop, Boulder, CO, 28 October, 2009.
2. Mashburn, J., P. Axelrad, S. T. Lowe, K. M. Larson, V. Zlotnicki, "An Assessment of the Accuracy of Altimetry Retrievals for the Monterey Bay GNSS+R Experiment", *GNSS+R 2015 Workshop*, Potsdam, Germany.
3. Mashburn, J., P. Axelrad, K. Larson, S. Lowe, "TechDemoSat-1 Land Altimetry and Sea Ice Boundary Detection," USNC-URSI National Radio Science Meeting, Boulder, CO, January 4, 2017.
4. Mashburn, J., P. Axelrad, S. Lowe, and K.M. Larson, "TDS-1 Global Ocean Altimetry and Sea Ice Boundary Zone Detection," *GNSS+R 2017 Workshop*, Ann Arbor, MI, May 25, 2017.
5. Strandjord, K. and P. Axelrad, "Improved Prediction of GPS Satellite Clock Variations Based on Daily Repeat," *ION Joint Navigation Conference*, Dayton, OH, June 6, 2017.

6. Mashburn, J., P. Axelrad, S. T. Lowe, C. Zuffada, D. Masters, "Ocean Surface Altimetry with CYGNSS: A Case Study in Indonesia", *Ocean Surface Topography Science Team Meeting*, poster, Miami, FL, October 23-27, 2017.
7. Mashburn, J., P. Axelrad, S. Lowe, C. Zuffada, D. Masters, "Ocean Surface Altimetry with CyGNSS: An Updated Case Study in Indonesia," American Meteorological Society Annual Meeting, Austin, TX, January 10, 2018.
8. Axelrad, P. and J. Gaebler, "CubeSat Deployment Tracking," FAA COE/CST RA1 Workshop on Space Traffic Management and Space Environment," McLean, VA, February 6, 2018.
9. Mashburn, J., P. Axelrad, K. Larson, C. Zuffada, S. Lowe, "Ocean Surface Altimetry with GNSS-R utilizing data from CyGNSS," 4th International Conference on GPS Radio Occultation, Taipei, Taiwan, April 16, 2018.
10. Mashburn, J., P. Axelrad, C. Zuffada, S. Lowe, G. Hajj, B. Haines, R. Shah, A. O'Brien, E. Loria, "Ocean Surface Altimetry with GNSS-R utilizing data from CyGNSS," CYGNSS Science Team Meeting, Ann Arbor, MI, June 2018.
11. Mutschler, S., P. Axelrad, T. Matsuo, J. Anderson, "An Ensemble Kalman Filtering Approach for Atmospheric Density Estimation Using Orbital Debris," 42nd COSPAR Scientific Assembly, Pasadena, CA, July 2018.
12. E. Loria, J. Mashburn, A. O'Brien, P. Axelrad, and C. Zuffada, "Assessment of a CYGNSS Ocean Altimetry Product Using a Full DDM Approach," 2019 IEEE Specialist Meeting on Reflectometry using GNSS and other Signals of Opportunity, Benevento, Italy, 20-22 May 2019.
13. Mutschler, S., P. Axelrad, T. Matsuo, E. Sutton, "Physics-based Approach to Density Estimation and Prediction using Orbital Debris Tracking Data," (Poster), CEDAR Workshop, Santa Fe, NM, June 2019.
14. Conrad, A., P. Axelrad, C. Zuffada, B. Haines, L. Sparks, A. O'Brien, E. Loria, "CYGNSS Altimetry with Improved Orbits, Re-tracking, and Delay Offsets," CYGNSS Science Team Meeting, Pasadena, CA, January 21, 2020.
15. Klein, V., P. Axelrad, "Simulation and Analysis of GPS Multipath for the GEDI Experiment Onboard the International Space Station," 33rd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2020) Best presentation in session.
16. Axelrad, P., D. Akos, J. Morton, S. Palo, R. Kingsbury, L. Scott, "On Demand PNT (OD-PNT)," *Joint Navigation Conference (JNC) 2021*, Covington, Kentucky, 24-27 August 2021.
17. Littleton-Strand, L., D.M. Akos, P. Axelrad, "Exploring the Potential Role of the Chip Scale Atomic Clock (CSAC) for Low Earth Orbit (LEO) Alternate Position Navigation Timing (AltPNT) Systems," *Joint Navigation Conference (JNC) 2021*, Covington, Kentucky, 24-27 August 2021.
18. Axelrad, P., "Applications of quantum sensing for positioning, navigation, and timing (PNT), *Q-SENSE Convergence Seminar*, Virtual, 30 November, 2021.
19. Axelrad, P., D. Akos, J. Morton, S. Palo, R. Kingsbury, B. Breitsch, H. Bourne, S. Taylor, M. Dobbin, L. Scott, "On Demand PNT (OD-PNT)," *Joint Navigation Conference (JNC) 2022*, San Diego, CA, June 2022.
20. Breitsch, B., S. Taylor, H. Bourne, D. Akos, P. Axelrad, J. Morton, L. Scott, "Receiver processing for LEO-orbiting on-demand navigation satellite signals," *Joint Navigation Conference (JNC) 2022*, San Diego, CA, June 2022.
21. Axelrad, P., D. Akos, J. Morton, S. Palo, R. Kingsbury, B. Breitsch, H. Bourne, S. Taylor, M. Dobbin, L. Scott, "On Demand PNT (OD-PNT) Test Results," *Joint Navigation Conference (JNC) 2023*, San Diego, CA, June 2023.

Courses Taught (*most recent year shown*)

Statistical Estimation of Dynamical Systems ASEN 5044 (University of Colorado, 2023)

Graduate level course on estimation fundamentals including batch least squares and Kalman Filtering

Introduction to Dynamics and Systems ASEN2003/2703 (University of Colorado, 2024)

Sophomore core course on 2-D dynamics, vibrations, and systems. Includes experimental and design laboratories, group problem solving, traditional lecture, and interactive learning classes (5 credits).

Orbital Mechanics and Attitude Dynamics ASEN3200 (University of Colorado, 2022)

Junior core course on two body orbits, attitude dynamics and control. Includes experimental and design laboratories, group problem solving, traditional lecture, and interactive learning classes (4 credits).

Introduction to Global Navigation Satellite Systems ASEN 5090 (University of Colorado, 2022)

Graduate level course introducing key technologies of GPS to Aerospace, Electrical, Civil Engineering and Physics students.

Spacecraft Attitude Dynamics and Control ASEN 5010 (University of Colorado, 2012)

Graduate level course covering attitude representations and estimation, kinematics, dynamics, and control of 3D rigid body motion.

Aerospace Senior Projects ASEN4018/4028 (University of Colorado, 2019)

Senior capstone design course member of Project Advisory Board or Project Sponsor

AY18-19 VANTAGE Team Sponsor - 2nd prize in Frank J. Redd Student Paper Competition

AY19-20 VISION Team Sponsor

Aerospace Graduate Projects ASEN5018/6028 (University of Colorado, AY2021-2022)

Spring 2019-present – Satellite Timing System Testbed, Funded by AFRL Space Vehicles Directorate

Aerospace Electronics and Communications ASEN3300 (University of Colorado, 2003)

Junior core course introducing basics of analog and digital electronics, computer interfacing, and communications, focusing on hands-on learning and use of laboratory instruments. Includes experimental laboratories, traditional lecture, and interactive learning classes (4 credits).

First Year Engineering Projects GEEN1400 (University of Colorado, 1996)

General Engineering freshman level course providing hands-on experiences in analysis, design, and technical writing.

Radio and Inertial Navigation (University of Colorado, Stanford University, 1995)

Graduate level course on technologies and algorithms for navigation and positioning.

Current Students

1. Laura Davies – PhD Student, 8/2020, Preliminary Exam 8/2022
Draper Scholar AY23-24, AY24-25
2. Mikaela Dobbin – PhD Student, 6/2021, Preliminary Exam 8/2022, Comprehensive Exam 11/2024
3. Sergio Coll Ibars – PhD Student, 8/2022 (Co-advised with Prof. Scheeres), Preliminary Exam 8/2024
4. Alex Moody, MS Student, 8/2024
Draper Scholar AY24-25
5. Emily Matteson – MS Student, 8/2023
6. Conner Parker – CU Summer Program for Undergraduate Research (SPUR) student and research assistant, 5/2023
7. Austin Hunter – Undergraduate Discovery Learning Apprentice and research assistant, 8/2023
8. Taylor Luciani - Undergraduate Discovery Learning Apprentice 8/2024
9. Taiyō Takanashi Forbes - Undergraduate Discovery Learning Apprentice 8/2024
10. Samuel Hollrah – Undergraduate research assistant 8/2024

Ph.D. Graduates, University of Colorado Boulder

1. Bruce C. Chesley, 1995 – Boeing Network and Space Systems, El Segundo, CA
Dissertation – *An Integrated GPS Attitude Determination System for Small Satellites*
2. Lisa M. Ward, 1996 – Ball Aerospace, Boulder, CO
Dissertation – *Spacecraft Attitude Estimation Using GPS: Methodology and Results*
3. Christopher J. Comp, 1996 – Maxar Technologies, Westminster, CO
Dissertation – *GPS Carrier Phase Multipath Characterization and a Mitigation Technique Using the Signal-to-Noise Ratio*
4. James L. Garrison, 1997 – Professor of Aeronautics and Astronautics, Purdue University, West Lafayette, IN
Dissertation – *Recursive Nonlinear Estimation for Relative Navigation in Elliptical Orbits*
5. Charles P. Behre, 1997 – ITT, Los Angeles, CA
Dissertation – *GPS Based Attitude Algorithms for Low Cost Satellite Missions*
6. Angela (Reichert) Dorsey, 1999 – NASA Jet Propulsion Laboratory, Pasadena, CA
Dissertation – *Correction Algorithms for GPS Carrier Phase Multipath Utilizing the Signal-to-Noise Ratio and Spatial Correlation*
7. Franklin Ascarunz, 1999 – Founder SpectraDynamics Inc, Louisville, CO
Dissertation – *Timing Errors in Two-Way Satellite Time and Frequency Transfer Using Spread Spectrum Modulation*
8. Dolan Highsmith, 2000 – Aerospace Corporation, Chantilly, VA
Dissertation – *Precise Satellite-to-Satellite GPS Time Transfer in Near Real-Time*
9. Michael Armatys, 2001 – Rockwell Collins, Cedar Rapids, IA
Dissertation – *Estimation of Sea Surface Winds Using Reflected GPS Signals*
NASA GSRP, 1998-2000
10. Michael Moreau, 2001 – NASA Goddard Space Flight Center, Greenbelt, MD
Dissertation – *GPS Receiver Architecture for Autonomous Navigation in High Earth Orbits*
NASA Graduate Student Research Program Fellowship, 1997-2000
11. Premal Madhani, 2002 – Master Engineer with Broadcom, San Jose, CA
Dissertation – *GPS Receiver Algorithms for Suppression of Narrowband and Structured Wideband Interference*
12. Dallas Masters, 2004 – Vice President, Signals of Opportunity Program, Muon Space, Boulder, CO
Dissertation – *Surface Remote Sensing Applications of GNSS Bistatic Radar : Soil Moisture and Aircraft Altimetry*
John A. Vise Student Excellence Award 2003, NASA GSRP 2000-2004
13. Maria Belmonte Rivas, 2007 – Research Scientist, TU Delft, Netherlands
Dissertation – *Bistatic Scattering of Global Positioning System Signals from Arctic Sea Ice*

- Zonta Foundation Amelia Earhart Fellowship 2004/2005, NASA Earth Systems Graduate Researcher 2004 - 2007*
14. Jan-Peter Weiss, 2007 – UCAR Cosmic Program, Boulder, CO
 Dissertation – *Modeling and Analysis of Multipath in Global Navigation Satellite System Ranging Signals*
John A. Vise Student Excellence Award 2007, NSF East Asia and Pacific Summer Institute Fellowship, 2006
 15. Christopher Lane, 2007 – Enterprise Architect, Chick-fil-A, Atlanta, GA
 Dissertation – *Formation Design and Relative Navigation in High Earth Orbits*
AIAA Graduate Student Researcher Award 2006
 16. Jill (Tombasco) Seubert, 2011 – Deep Space Navigator and Founder, Australis Space Navigation
 Dissertation – *Orbit Estimation of Geosynchronous Objects Via Ground-Based and Space-Based Optical Tracking*
Zonta International Foundation Amelia Earhart Fellowship 2010, National Defense Science and Engineering Graduate Fellowship 2007-2010, John A. Vise Student Excellence Award 2011, AIAA Orville and Wilbur Wright Graduate Award 2011, College of Engineering and Applied Science Distinguished Recent Alumni Award 2017
 17. Ben K. Bradley, 2015 – NASA Jet Propulsion Laboratory, Pasadena, CA
 Dissertation - *Numerical Algorithms for Precise and Efficient Orbit Propagation and Positioning*
National Defense Science and Engineering Graduate Fellowship 2010-2012, eSpace Entrepreneurship Award 2012, CU-Boulder Summer Dissertation Fellowship 2014
 18. Steven Gehly, 2016 – Assistant Professor, Astrodynamics and Space Missions, TU Delft
 Dissertation - *Estimation of Geosynchronous Space Objects Using Finite Set Statistics Filtering Methods*
 19. Jake R. Mashburn, 2019 (co-advised with Kristine Larson) Radar and Remote Sensing Product Engineer, Spire, Boulder, CO
 Dissertation – *Analysis of GNSS-R Observations for Altimetry and Characterization of Earth Surfaces*
UCAR Student Travel Grant 2018
 20. John Gaebler, 2020 – Principal Aerospace Engineer, KBR, Maui, HI
 Dissertation – *CubeSat Cluster Deployment Tracking*
AFRL Space Scholar Summers 2016, 2017, 2019, CU Boulder Graduate Student Travel Grant 2017, GAANN Fellowship Fall 2019.
 21. Viliam Klein, 2020 – Southwest Research Institute
 Dissertation - *Advanced GPS Multipath Modeling for Receivers On-Board the International Space Station*
ION GNSS+ 2020 Best Presentation in Session Award
 22. Kirsten Strandjord, 2020 – Assistant Professor, Dept of Aerospace Engineering and Mechanics, University of Minnesota
 Dissertation – *Urban Navigation with Global Satellite Navigation Systems*
Draper Fellow 2018-2020, John A. Vise Graduate Student Excellence Award 2019, Lockheed Martin Corporation Endowed Graduate Fellowship 2019
 23. Damon VanBuren, 2020 (co-advised with Scott Palo) - MITRE
 Dissertation – *Techniques for Precise Timing Onboard Small Satellites*
 24. Shaylah Mutschler, 2022 – Research Scientist, Space Environment Technologies
 Dissertation - *Global Thermospheric Density Estimation using CubeSat GPS Data and a Physics-based Space Environment Model*
H.J. Smead Scholar 2015-2022, AFRL Space Scholar Summer 2016, 2017, NSF Graduate Research Fellowship Program 2017 (Selected but decl), National Defense Science and Engineering Graduate Fellowship 2017-2020, Zonta International Foundation Amelia Earhart Fellowship 2020, John A. Vise Graduate Student Excellence Award 2021
 25. Margaret Rybak, 2022 – Navigation Engineer, NASA Jet Propulsion Laboratory, Pasadena, CA
 Dissertation - *Atomic Clock and Inertial Sensor Applications for Space Navigation*
NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Harriet Jenkins Fellowship, 2016-present, Aerospace Engineering Sciences Outstanding Teaching Assistant AY2016-2017
 26. Alex Conrad, 2023 – Space Technologist II, NASA Jet Propulsion Laboratory, Pasadena, CA
 Dissertation - *Advances in Measurement and Force Modeling for Improved GNSS-based Precise Orbit Determination of CYGNSS and Sentinel-6 MF*
Graduate Assistantship in Areas of National Need (GAANN) Critical aerospace technologies, AY2020-2021
 27. Christopher Flood, 2024 – Senior Navigation Engineer, BAE Systems, Broomfield, CO
 Dissertation - *Time Transfer Architectures for Small Satellite Platforms*

CU College of Engineering and Applied Science Dean's Assistantship AY19-20
NIST PREP Appointment 2023

M.S. Graduates (with thesis), University of Colorado Boulder

1. Anne Theurkauf, 2020 (co-advised with Dana Anderson, Physics) – PhD student CU Boulder
 Thesis - *Control of an Optical Lattice for Atom-Based Inertial Sensing*
Draper Fellow 2018-2020
2. Henry Dixon, 2021 (Mechanical Engineering) – Research Engineer, Integrated Solutions for Systems (IS4S)
 Thesis - *Techniques for Generating a Steered Timing Signal in a Low- Size, Weight, and Power Clock Ensemble*
3. Sergio Coll Ibars – 2023 (co-advised with Daniel Scheeres) – PhD student CU Boulder
 Thesis - *Asteroid gravity field estimation using a gravity gradiometer*

M.S. Graduates (Research but no thesis), University of Colorado Boulder

1. Jiyun Lee, 1999 - Associate Professor, Korea Advanced Institute of Science and Technology
2. Eden (Denton) Speed, 2001 – Lockheed Martin, Boulder, CO
3. Lisa (Reeh) Turner, 2002 – Lockheed Martin, Denver, CO
4. Cove Sturtevant, 2004 – NSF Neon, Boulder, CO
5. Lin Song Stowe, 2006 – MIT Lincoln Laboratory, MA
6. Steven Brown, 2008 – Infinity Systems Engineering, Colorado Springs, CO
7. Julian Greene, 2009 – Blue Origin, Seattle, WA
8. James Burkert, 2010 – Lockheed Martin, Denver, CO
NASA GSRP 2008-2010
9. Bruno Lesage, 2012 – Lockheed Martin, Valley Forge, PA
10. Jeanette Veldman, 2016 – Ball Aerospace, Boulder, CO
11. Jeff Jenkins 2019 – Rincon Research Inc, Tucson, AZ
12. Luciana Schement 2020-2021 – Lockheed Martin Space Systems, Denver, CO
13. Raj Patel 2021-2023 – Orion Space Solutions, Louisville, CO
14. William Gravel 2022-2023 – Ionospheric measurements from GOES-R

Other Graduate Research Students, University of Colorado Boulder

1. Jonah Kisesi, 2010-2012 – GNSS occultations for sensing ionospheric turbulence
NSF GK-12 Fellowship AY2011-12
2. Stephen Phillips, 2012-2013 – Modeling of autonomous rendezvous and docking
3. John Pratt, PhD 2010-2012 – Clock estimation for iGPS
4. Heather LoCrauto, 2013-2014 - Autonomous rendezvous and docking for commercial space transportation
5. Elliot Barlow, 2009-2016 – GPS radio occultation satellites
Department of Education, Graduate Assistantship in Areas of National Need (GAANN) Fellowship 2010-2011,
ION Best Presentation Award 2014.
6. Eric Barron, 2016-2017 – Satellite clock modeling

Undergraduate Research Students, University of Colorado Boulder

1. Samantha Krenning, 2009 – Undergraduate research assistant, Weak Signal Acquisition
2. Jordan Gomez, 2010 – Undergraduate research assistant, Weak Signal Acquisition
3. Jacob Varey, 2010-2011 - Discovery Learning Apprentice and Undergraduate Research Opportunity
4. Nicholas DiOrio, 2011-2012 – Undergraduate research assistant and Discovery Learning Apprentice
5. Zachary Cuseo 2012-2013 – BS/MS Student, Discovery Learning Apprentice and undergraduate research assistant
6. Alex Mault, Spring 2013 - Undergraduate research assistant, GPS acquisition software
7. Isaac Hayden, summer 2013 - Undergraduate research assistant, Picosat positioning
8. David Thomas, summer 2013 - Undergraduate research assistant, Multipath modeling
9. Thomas Green, 2013-2014 - Undergraduate research assistant, GPS bistatic radar data analysis
10. Caleb Lipscomb, 2013-2014 – Undergraduate Discovery Learning Assistant, Image processing for autonomous rendezvous and docking
11. Davis Peterson, 2015-2016 - Undergraduate Discovery Learning Assistant, Long term GPS orbit evolution

12. Michael Greene, Spring 2017 – Undergraduate research assistant, ArcGIS
13. Diana Mata, Summer 2018 – CU Summer Program for Undergraduate Research (SPUR), Simulating Space Object Measurements for Space Situational Awareness
14. Adam Boylston, Summer-Fall 2018 – Undergraduate research assistant, CubeSat image processing for relative position estimation after deployment, *2019 AAS Breckenridge Conference Student Session 2nd Place Award*
15. Connor Ott, 2018-2019 - Undergraduate Discovery Learning Assistant, Visualization tools for space environment situational awareness
16. Stephen Albert, 2020-2021 – Undergraduate Discovery Learning Apprentice, Modeling the effect of space weather on LEO satellite motion using TIE-GCM
17. Caroline Dixon 2020-2021 – Undergraduate research assistant, Maxwell CSAC experiment
18. Brandon DiLorenzo 2021-2022- CU Summer Program for Undergraduate Research (SPUR) and undergraduate research assistant, Modeling atmospheric density using TIE-GCM
19. Christopher Krebs 2021-2022 - Undergraduate Discovery Learning Apprentice, Characterization of Chip Scale Atomic Clock (CSAC) Performance
20. Justin Pedersen 2022-23 – CU Summer Program for Undergraduate Research (SPUR) and undergraduate research assistant, Clock ensemble development and characterization
21. Aidan Baigley 2023 - CU Summer Program for Undergraduate Research (SPUR) optimization of B-Spline orbit representations

Visiting Students, University of Colorado Boulder

1. Estel Cardellach Gali – Visiting PhD student from Institut d'Estudis Espacials de Catalunya (IEEC-CSIC), 2003
2. Lennox Thompson – RESESS Program (UNAVCO), Undergraduate at Coppin State University, Baltimore, MD, 2006
3. Michael Williams – SMART Program, Undergraduate at UC Irvine, 2004
4. Johan Bejeryd – Visiting MS student from the Institute of Technology of Linköping University, Sweden, 2008
5. Joseph Meilen – Visiting High School intern, 4 weeks, Summer 2009
6. Antonella Albuja – SMART Program, Undergraduate at University of Iowa, 2010
7. Fabien Gachet – Visiting MS student from Institut Supérieur de l'Aéronautique et de l'Espace, France, 2011
8. Rene van Aken – MS thesis student from the University of the Federal Armed Forces Munich, 2013
9. Nicholas Sweet – Visiting undergraduate student from Concordia University, Canada, 2013
10. Javier Garcia – Fulbright Fellowship PhD student from National University of La Plata, Argentina, 2014-2015
11. Santiago Ozafrain – Fulbright Fellowship PhD student from National University of La Plata, Argentina, Fall 2018

PhD and MS Thesis Committee Memberships (not tracked prior to 2010)

1. Eric Vinande - Ph.D. AES, 2010, Prof. Akos, *CU Boulder*
2. James McDonald - Ph.D. ECE, 2010, Prof. Filipovic, *CU Boulder*
3. Ravi Inampudi – Ph.D. AES, 2010, Prof. Schaub, *CU Boulder*
4. Marcus Holzinger - Ph.D. AES, 2011, Prof. Scheeres, *CU Boulder*
5. Nicholas Pedatella - Ph.D. AES, 2011, Prof. Larson, *CU Boulder*
6. Robin Blendan – M.S. AES, 2011, Prof. Schaub, *CU Boulder*
7. Samantha Krenning – M.S. AES, 2011, Prof. Schaub, *CU Boulder*
8. Carl Seubert - Ph.D. AES, 2011, Prof. Schaub, *CU Boulder*
9. Erez Falkenstein – Ph.D. ECE, 2011, Prof. Popovic, *CU Boulder*
10. Kohei Fujimoto – Ph.D. AES 2013, Prof. Scheeres, *CU Boulder*
11. Stephanie Jones – M.S. AES, 2013, Prof. Schaub, *CU Boulder*
12. Jian Yao – Ph.D. Physics, 2014, Prof. Levine, *CU Boulder*
13. Rui Sun – Ph.D. Aerospace Engineering, 2014, Prof. Dr. E. Gill, *Technical University of Delft*
14. Erin Griggs – Ph.D. AES, 2015, Prof. Akos, *CU Boulder*
15. Steven O'Keefe – Ph.D. AES, 2015 Prof. Schaub, *CU Boulder*
16. John Pratt – Ph.D. AES, 2015, Prof. Larson, *CU Boulder*
17. Chen Cao – Ph.D. AES, 2016, Prof. Chu, *CU Boulder*
18. Ryan Handzo – Ph.D. Student AES, Prof. Parker, Comprehensive Exam 11/1/13, *CU Boulder*
19. Daniel (Stu) Bryant – Ph.D. AES, 2017 Prof. Jones, *CU Boulder*
20. Jeroen Geeraert – Ph.D. AES, 2017, Prof. McMahon, *CU Boulder*
21. Erin Kahr – Ph.D. Geomatics Engineering, 2017, Prof. K. O'Keefe, *University of Calgary*
22. Sara Hrbek – Ph.D. AES 2019, Prof. Akos, *CU Boulder*
23. Manuel Eichelberger – Ph.D. External Examiner, 2019, Prof. Dr. R. Wattenhofer, *ETH Zurich*

24. William McGrew – Ph.D. Physics 2020, Dr. S. Diddams, *CU Boulder*
25. Joanna Fulton – Ph.D. AES 2020, Prof. Schaub, *CU Boulder*
26. Andrew French – Ph.D. AES 2020, Prof. McMahon, *CU Boulder*
27. Damian Miralles – Ph.D. AES 2021, Prof. Akos, *CU Boulder*
28. Brian Breitsch – Ph.D. AES 2021, Prof. Morton, *CU Boulder*
29. Marielle Pellegrino – Ph.D. AES 2021, Prof. Scheeres, *CU Boulder*
30. Yang Wang – Ph.D. AES 2021, Prof. Morton, *CU Boulder*
31. Yunxiang (Leo) Liu – Ph.D. AES 2021, Prof. Morton, *CU Boulder*
32. Ian Collett – Ph.D. AES 2021, Prof. Morton, *CU Boulder*
33. Youssef Hassan – Ph.D. Candidate Physics, Dr. A. Ludlow, Comprehensive Exam 5/27/21, *CU Boulder*
34. Dawson Beatty – M.S. AES, 2021, Prof. Ahmed, *CU Boulder*
35. Sergei Bilardi – M.S. AES, 2021, Prof. Morton, *CU Boulder*
36. Maya Greenstein – M.S. AES, 2024, Prof. Thayer, *CU Boulder*
37. Brodie Wallace – Ph.D. AES, 2024, Prof. Palo, *CU Boulder*
38. Catherine LeDesma – Ph.D. Physics, 2024, Prof. Holland, *CU Boulder*
39. Anne Theurkauf – Ph.D. Candidate AES, Profs. Lahijanjan and Ahmed, Comprehensive Exam 11/10/23, *CU Boulder*
40. Robert Sasse – Ph.D. Student AES, Prof. Argrow, Comprehensive Exam 10/23, *CU Boulder*