

Todd E. Humphreys

CONTACT INFORMATION

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The University of Texas at Austin
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EDUCATION

Cornell University, Ithaca, New York USA

Ph.D., Aerospace Engineering, January 2008

- Advisors: Mark L. Psiaki (primary) and Paul M. Kintner (co-advisor)
- Dissertation: Modeling Ionospheric Scintillation and its Effects on GPS Carrier Tracking Loops and Two Other Applications of Modeling and Estimation

Utah State University, Logan, Utah USA

M.S., Electrical and Computer Engineering, May 2003

- Thesis: Attitude Determination For Small Satellites With Modest Pointing Constraints

Utah State University, Logan, Utah USA

B.S., Electrical and Computer Engineering, May 2000

- Minors: Mathematics and Spanish

CURRENT AND PREVIOUS ACADEMIC POSITIONS

Associate Professor, The University of Texas at Austin Department of Aerospace Engineering and Engineering Mechanics Director of the Radionavigation Laboratory	September 2015 - present
Assistant Professor, The University of Texas at Austin Department of Aerospace Engineering and Engineering Mechanics Director of the Radionavigation Laboratory	August 2009- August 2015
Adjunct Faculty, Cornell University Instructor for graduate-level course in model-based estimation.	August 2007 - January 2008
Post-Doctoral Researcher, Cornell University	August 2007 - August 2008
Research Assistant, Cornell University	February 2003 - July 2007

OTHER PROFESSIONAL EXPERIENCE

Co-Founder, Radiosense LLC Centimeter-accurate positioning for the mass market.	February 2015 - February 2017
Co-Founder, Coherent Navigation Inc. Exploited Iridium constellation to harden navigation and timing sensors. Acquired by Apple.	August 2008 - August 2009
IONF Satellite Constellation Attitude Determination Lead, Space Dynamics Laboratory	2001 - 2002
MEMS Inertial Sensors Researcher, NASA Jet Propulsion Laboratory	1999 - 2002 (summers)

MEMBERSHIPS IN PROFESSIONAL AND HONORARY SOCIETIES

Fellow, Institute of Navigation (ION)
Fellow, The Royal Institute of Navigation (RIN)
Member, Institute of Electrical and Electronics Engineers (IEEE)

COMMITTEES, BOARDS, AND CONFERENCES ORGANIZED/CHAired

Outside Committees

Land Representative, Institute of Navigation Governing Council, 2012–2014

Conference Activities: Organizer

Lead organizer, Texas Wireless Summit, November 2016
Track chair, IEEE/Institute of Navigation PLANS conference, April 2016
Lead organizer, Texas Wireless Summit, October 2013
Track chair, Institute of Navigation GNSS+ conference, September 2013
Lead organizer, Civil GPS Security Meeting, September 2010

Conference Activities: Session Chair

Session chair, Institute of Navigation GNSS+ conference: GNSS Authentication and Anti-Spoofing, September 2021
Session chair, Institute of Navigation GNSS+ conference: Novel Applications of GNSS in Smartphones, September 2020
Session chair, IEEE/ION PLANSx conference: Autonomous Vehicle Navigation in Challenging Environments, September 2020
Session chair, IEEE/ION PLANS conference: GNSS Resilience, May 2018
Session chair, Institute of Navigation GNSS conference: High Precision GNSS Positioning, September 2016
Session chair, Institute of Navigation GNSS conference: GNSS Vulnerabilities and Anti-Jamming, September 2015
Panel Session chair, Institute of Navigation GNSS conference: Privacy Issues, September 2015
Session chair, Institute of Navigation GNSS conference: GNSS Vulnerabilities 1: Interference, September 2014
Session chair, Institute of Navigation GNSS conference: GNSS Vulnerabilities 2: Spoofing and Authentication, September 2014
Panel Session chair, Institute of Navigation GNSS conference: GNSS Vulnerabilities and Threats, September 2014
Session chair, IEEE/ION PLANS conference: Interference and Robust Navigation, May 2014
Session chair, Institute of Navigation International Technical Meeting: Interference and Spectrum Management, January 2013
Session chair, Institute of Navigation GNSS conference: Spectrum Interference, September 2012
Session chair, IEEE/ION PLANS conference: Receiver and Antenna Technology Session, April 2012
Panel session chair, Institute of Navigation GNSS conference: GNSS Security, September 2011
Session chair, IEEE/ION PLANS conference: Algorithms and Processing, May 2010

Journal Activities

Editor, IEEE Transactions on Wireless Communications, May 2014–January 2017

OTHER PROFESSIONAL HIGHLIGHTS

Congressional Testimony

Invited witness, U.S. House Subcommittee on Homeland Security Oversight hearing on the threat of unmanned aerial systems, March 2015

Invited witness, U.S. House Judiciary Subcommittee on Crime, Terrorism, and Homeland Security field forum on privacy in an age of drones, October 2012

Invited witness, U.S. House Subcommittee on Homeland Security Oversight hearing on drone security, July 2012

Invited Subject Matter Expert

National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, June 2019

National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, June 2015

Department of Homeland Security risk assessment of critical infrastructure dependence on GPS, March-September, 2011

U.S. Patent and Trademark Office briefing on advances in GNSS technology, April 2011

National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, October 2010

Current Review Activities

IEEE Transactions on Aerospace and Electronic Systems

NAVIGATOR, the journal of the Institute of Navigation

Journal of Geodesy

Sensors

AIAA Journal of Guidance, Control, and Dynamics

IEEE Transactions on Instrumentation and Measurement

UNIVERSITY COMMITTEES/ADMINISTRATIVE ASSIGNMENTS

Administrative Assignments

Director, Radionavigation Laboratory, 2009-present

Director, UT SAVES, 2020-2021

Associate Director, UT SAVES, 2016-2020

Faculty advisor, UT student chapter of AIAA, 2010-2019

Faculty advisor, Sigma Gamma Tau Honor Society, 2016-2019

Cockrell School of Engineering

Cockrell School Honors Committee, 2011-2019

College of Engineering Faculty Committee

Department Committees

ASE Chair of Robotics Faculty Search Committee, 2019-2020

ASE Strategic Planning Committee, 2017-2019

ASE Department Faculty Committee, 2009-present

ASE Orbits Area Faculty Committee, 2009-present

ASE Controls, Autonomy, and Robotics Area Faculty Committee, 2014-present

ASE Graduate Studies Committee, 2009-present

ECE Graduate Studies Committee, 2012-present

HONORS AND AWARDS

Royal Institute of Navigation Fellow, 2021

Walter Fried Best Overall Paper Award, IEEE/ION PLANS Conference, 2020 (with student Lakshay Narula)

Institute of Navigation Fellow, 2020

PECASE: Presidential Early Career Award for Scientists and Engineers, 2019

Qualcomm Innovation Fellowship, 2017 (with students Lakshay Narula and Matthew Murrian)

National Science Foundation CAREER Award, 2015

Outstanding Faculty Award, Dept. of Aerospace Engineering and Engineering Mechanics, 2015

Institute of Navigation Thurlow Award, 2014

GPS World Magazine Leadership Award, 2012

University of Texas System Regents' Outstanding Teaching Award, 2012

Cockrell School Dean's Award for Outstanding Teaching by an Assistant Professor, 2012

Walter Fried Best Overall Paper Award, IEEE/ION PLANS Conference, 2012 (with student Jahshan Bhatti)

Best Student Paper Award, IEEE/ION PLANS Conference, 2012 (with student Ken Pesyna)

PUBLICATIONS

Refereed Journal Publications in Rank as Associate Professor

- J1 P. A. Iannucci and T. E. Humphreys, "Fused low-Earth-orbit GNSS," *IEEE Transactions on Aerospace and Electronic Systems*, 2020. Submitted for review. [pdf](#)
- J2 W. A. Lies, L. Narula, P. A. Iannucci, and T. E. Humphreys, "Long-range, low SWaP-C FMCW radar," *IEEE Journal of Selected Topics in Signal Processing*, pp. 1–1, 2021 [pdf](#)
- J3 L. Narula, P. A. Iannucci, and T. E. Humphreys, "Towards all-weather sub-50-cm radar-inertial positioning," *Field Robotics*, 2021. To be published. [pdf](#)
- J4 M. J. Murrian, L. Narula, P. A. Iannucci, S. Budzien, B. W. O'Hanlon, S. P. Powell, and T. E. Humphreys, "First results from three years of GNSS interference monitoring from low Earth orbit," *Navigation, Journal of the Institute of Navigation*, 2021. Submitted for review. [pdf](#)
- J5 T. E. Humphreys, M. J. Murrian, and L. Narula, "Deep-urban unaided precise global navigation satellite system vehicle positioning," *IEEE Intelligent Transportation Systems Magazine*, vol. 12, no. 3, pp. 109–122, 2020 [pdf](#)
- J6 L. Narula, J. M. Wooten, M. J. Murrian, D. M. LaChapelle, and T. E. Humphreys, "Accurate collaborative globally-referenced digital mapping with standard GNSS," *Sensors*, vol. 18, no. 8, 2018 [pdf](#)
- J7 J. N. Gross, C. Kilic, and T. E. Humphreys, "Maximum-likelihood power-distortion monitoring for GNSS-signal authentication," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 1, pp. 469–475, 2018 [pdf](#)
- J8 G. N. Green and T. Humphreys, "Position-domain integrity analysis for generalized integer aperture bootstrapping," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 2, pp. 734–746, 2018 [pdf](#)
- J9 G. N. Green and T. E. Humphreys, "Data-driven generalized integer aperture bootstrapping for high-integrity positioning," *IEEE Transactions on Aerospace and Electronic Systems*, vol. 55, no. 2, pp. 757–768, 2018 [pdf](#)
- J10 L. Narula and T. E. Humphreys, "Requirements for secure clock synchronization," *IEEE Journal of Selected Topics in Signal Processing*, vol. 12, pp. 749–762, Aug. 2018 [pdf](#)

- J11 K. D. Wesson, J. N. Gross, T. E. Humphreys, and B. L. Evans, “GNSS signal authentication via power and distortion monitoring,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 54, pp. 739–754, April 2018 [pdf](#)
- J12 K. M. Pesyna, Jr., T. Novlan, C. Zhang, R. W. Heath, Jr., and T. E. Humphreys, “Exploiting antenna motion for faster initialization of centimeter-accurate GNSS positioning with low-cost antennas,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 3, Aug. 2017 [pdf](#)
- J13 J. Bhatti and T. E. Humphreys, “Hostile control of ships via false GPS signals: Demonstration and detection,” *Navigation*, vol. 64, no. 1, pp. 51–66, 2017 [pdf](#)
- J14 M. L. Psiaki and T. E. Humphreys, “GNSS spoofing and detection,” *Proceedings of the IEEE*, vol. 104, no. 6, pp. 1258–1270, 2016 [pdf](#)
- J15 Z. M. Kassas and T. E. Humphreys, “Receding horizon trajectory optimization in opportunistic navigation environments,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 51, pp. 866–877, April 2015 [pdf](#)
- J16 Z. M. Kassas, A. Arapostathis, and T. E. Humphreys, “Greedy motion planning for simultaneous signal landscape mapping and receiver localization,” *IEEE Journal of Selected Topics in Signal Processing*, vol. 9, pp. 247 – 258, March 2015 [pdf](#)
- J17 C. R. Clauer, H. Kim, K. Deshpande, Z. Xu, D. Weimer, S. Musko, G. Crowley, C. Fish, R. Nealy, T. E. Humphreys, J. A. Bhatti, and A. J. Ridley, “Autonomous adaptive low-power instrument platform (AAL-PIP) for remote high latitude geospace data collection,” *Geoscientific Instrumentation, Methods and Data Systems*, vol. 3, pp. 211–227, 2014 [pdf](#)

Refereed Journal Publications in Rank as Assistant Professor and Earlier

- J18 A. J. Kerns, D. P. Shepard, J. A. Bhatti, and T. E. Humphreys, “Unmanned aircraft capture and control via GPS spoofing,” *Journal of Field Robotics*, vol. 31, no. 4, pp. 617–636, 2014 [pdf](#)
- J19 H. Kim, C. Clauer, K. Deshpande, M. Lessard, A. Weatherwax, G. S. Bust, G. Crowley, and T. E. Humphreys, “Ionospheric irregularities during a substorm event: Observations of ULF pulsations and GPS scintillations,” *Journal of Atmospheric and Solar-Terrestrial Physics*, vol. 114, pp. 1–8, 2014 [link](#)
- J20 K. M. Pesyna, Jr., Z. M. Kassas, R. W. Heath, Jr., and T. E. Humphreys, “A phase-reconstruction technique for low-power centimeter-accurate mobile positioning,” *IEEE Transactions on Signal Processing*, vol. 62, pp. 2595–2610, May 2014 [pdf](#)
- J21 Z. M. Kassas and T. E. Humphreys, “Observability analysis of collaborative opportunistic navigation with pseudorange measurements,” *IEEE Transactions on Intelligent Transportation Systems*, vol. 15, pp. 260–273, Feb. 2014 [pdf](#)
- J22 E. G. Lightsey, T. E. Humphreys, J. A. Bhatti, A. J. Joplin, B. W. O’Hanlon, and S. P. Powell, “Demonstration of a space capable miniature dual frequency GNSS receiver,” *Navigation*, vol. 61, pp. 53–64, Mar. 2014 [pdf](#)
- J23 T. E. Humphreys, “Detection strategy for cryptographic GNSS anti-spoofing,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 49, no. 2, pp. 1073–1090, 2013 [pdf](#)
- J24 B. W. O’Hanlon, M. L. Psiaki, T. E. Humphreys, J. A. Bhatti, and D. P. Shepard, “Real-time GPS spoofing detection via correlation of encrypted signals,” *Navigation, Journal of the Institute of Navigation*, vol. 60, no. 4, pp. 267–278, 2013 [pdf](#)
- J25 M. Psiaki, B. O’Hanlon, J. Bhatti, D. Shepard, and T. Humphreys, “GPS spoofing detection via dual-receiver correlation of military signals,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 49, no. 4, pp. 2250–2267, 2013 [pdf](#)
- J26 K. B. Deshpande, G. S. Bust, C. R. Clauer, H. Kim, J. E. Macon, T. E. Humphreys, J. A. Bhatti, S. B. Musko, G. Crowley, and A. T. Weatherwax, “Initial GPS scintillation results from CASES receiver at South Pole, Antarctica,” *Radio Science*, vol. 47, no. 5, 2012 [pdf](#)

- J27 D. P. Shepard, T. E. Humphreys, and A. A. Fansler, “Evaluation of the vulnerability of phasor measurement units to GPS spoofing attacks,” *International Journal of Critical Infrastructure Protection*, vol. 5, no. 3-4, pp. 146–153, 2012 [pdf](#)
- J28 K. D. Wesson, M. P. Rothlisberger, and T. E. Humphreys, “Practical cryptographic civil GPS signal authentication,” *Navigation, Journal of the Institute of Navigation*, vol. 59, no. 3, pp. 177–193, 2012 [pdf](#)
- J29 T. E. Humphreys, M. L. Psiaki, and P. M. Kintner, “Modeling the effects of ionospheric scintillation on GPS carrier phase tracking,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 46, pp. 1624–1637, Oct. 2010 [pdf](#)
- J30 T. E. Humphreys, M. L. Psiaki, B. M. Ledvina, A. P. Cerruti, and P. M. Kintner, Jr., “A data-driven testbed for evaluating GPS carrier tracking loops in ionospheric scintillation,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 46, pp. 1609–1623, Oct. 2010 [pdf](#)
- J31 T. E. Humphreys, M. L. Psiaki, J. C. Hinks, B. O’Hanlon, and P. M. Kintner, Jr., “Simulating ionosphere-induced scintillation for testing GPS receiver phase tracking loops,” *IEEE Journal of Selected Topics in Signal Processing*, vol. 3, pp. 707–715, Aug. 2009 [pdf](#)
- J32 T. E. Humphreys, M. C. Kelley, N. Huber, and P. M. Kintner, “The semidiurnal variation in GPS-derived zenith neutral delay,” *Geophysical Research Letters*, vol. 32, no. 24, 2005 [pdf](#)
- J33 T. E. Humphreys, M. Psiaki, E. Klatt, S. Powell, and P. M. Kintner, Jr., “Magnetometer-based attitude and rate estimation for a spacecraft with wire booms,” *Journal of Guidance, Control, and Dynamics*, vol. 28, pp. 584–593, July–Aug. 2005 [pdf](#)

Refereed Conference Proceedings

- C1 T. E. Humphreys, R. X. T. Kor, and P. A. Iannucci, “Open-world virtual reality headset tracking,” in *Proceedings of the ION GNSS+ Meeting*, (Online), 2020 [pdf](#)
- C2 J. E. Yoder, P. A. Iannucci, L. Narula, and T. E. Humphreys, “Multi-antenna vision-and-inertial-aided CDGNSS for micro aerial vehicle pose estimation,” in *Proceedings of the ION GNSS+ Meeting*, (Online), 2020 [pdf](#)
Best presentation award in session of 8 papers.
- C3 R. X. Kor, P. A. Iannucci, L. Narula, and T. E. Humphreys, “A proposal for securing terrestrial radio-navigation systems,” in *Proceedings of the ION GNSS+ Meeting*, (Online), 2020 [pdf](#)
- C4 L. Narula, P. A. Iannucci, and T. E. Humphreys, “Automotive-radar-based 50-cm urban positioning,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
Walter Fried overall best paper award.
- C5 L. Narula, D. M. LaChapelle, M. J. Murrian, J. M. Wooten, T. E. Humphreys, J.-B. Lacambre, E. de Toldi, and G. Morvant, “TEX-CUP: The University of Texas Challenge for Urban Positioning,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
- C6 P. A. Iannucci and T. E. Humphreys, “Economical fused LEO GNSS,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
- C7 P. A. Iannucci, L. Narula, and T. E. Humphreys, “Cross-modal localization: Using automotive radar for absolute geolocation within a map produced with visible-light imagery,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
- C8 W. A. Lies, L. Narula, P. A. Iannucci, and T. E. Humphreys, “Low SWaP-C radar for urban air mobility,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
- C9 N. Montalbano and T. Humphreys, “Intercepting unmanned aerial vehicle swarms with neural-network-aided game-theoretic target assignment,” in *Proceedings of the IEEE/ION PLANSx Meeting*, 2020 [pdf](#)
- C10 D. LaChapelle, T. E. Humphreys, L. Narula, P. A. Iannucci, and E. Moradi-Pari, “Automotive collision risk estimation under cooperative sensing,” in *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, (Barcelona, Spain), 2020 [pdf](#)

- C11 M. J. Murrian, L. Narula, and T. E. Humphreys, “Characterizing terrestrial GNSS interference from low earth orbit,” in *Proceedings of the ION GNSS+ Meeting*, Institute of Navigation, Oct. 2019 [pdf](#)
Best presentation award in session of 8 papers.
- C12 L. Narula, M. J. Murrian, and T. E. Humphreys, “Accuracy limits for globally-referenced digital mapping using standard GNSS,” in *2018 21st International Conference on Intelligent Transportation Systems (ITSC)*, pp. 3075–3082, IEEE, 2018 [pdf](#)
- C13 N. Montalbano and T. E. Humphreys, “A comparison of methods for online lever arm estimation in GPS/INS integration,” in *2018 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, pp. 680–687, April 2018 [pdf](#)
- C14 T. E. Humphreys, M. Murrian, and L. Narula, “Low-cost precise vehicular positioning in urban environments,” in *2018 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, pp. 456–471, April 2018 [pdf](#)
- C15 J. Gross and T. E. Humphreys, “GNSS spoofing, jamming, and multipath interference classification using a maximum-likelihood multi-tap multipath estimator,” *Proceedings of the ION International Technical Meeting*, Jan. 2017 [pdf](#)
- C16 L. Narula and T. E. Humphreys, “Requirements for secure wireless time transfer,” in *Proceedings of the IEEE/ION PLANS Meeting*, (Savannah, GA), 2016 [pdf](#)
- C17 G. N. Green, M. King, and T. E. Humphreys, “Data-driven generalized integer aperture bootstrapping for real-time high integrity applications,” in *Proceedings of the IEEE/ION PLANS Meeting*, (Savannah, GA), 2016 [pdf](#)
- C18 M. Murrian, C. Gonzalez, T. E. Humphreys, and T. D. Novlan, “A dense reference network for mass-market centimeter-accurate positioning,” in *Proceedings of the IEEE/ION PLANS Meeting*, (Savannah, GA), 2016 [pdf](#)
- C19 T. E. Humphreys, M. Murrian, K. M. Pesyna, Jr., F. van Diggelen, and S. Podshivalov, “On the feasibility of centimeter-accurate positioning via a smartphone’s antenna and GNSS chip,” in *Proceedings of the IEEE/ION PLANS Meeting*, (Savannah, GA), 2016 [pdf](#)
- C20 G. N. Green, M. King, and T. E. Humphreys, “Fault free integrity of mid-level voting for triplex differential GPS solutions,” in *Proceedings of the ION GNSS+ Meeting*, (Tampa, FL), 2015 [pdf](#)
Best presentation award in session of 8 papers.
- C21 M. L. Psiaki, B. W. O’Hanlon, S. P. Powell, J. A. Bhatti, K. D. Wesson, T. E. Humphreys, and A. Schofield, “GNSS spoofing detection using two-antenna differential carrier phase,” in *Proceedings of the ION GNSS+ Meeting*, (Tampa, FL), Institute of Navigation, 2014 [pdf](#)
- C22 Z. M. Kassas, V. Ghadiok, and T. E. Humphreys, “Adaptive estimation of signals of opportunity,” in *Proceedings of the ION GNSS+ Meeting*, 2014 [pdf](#)
- C23 K. M. Pesyna, Jr., R. W. Heath, Jr., and T. E. Humphreys, “Centimeter positioning with a smartphone-quality GNSS antenna,” in *Proceedings of the ION GNSS+ Meeting*, 2014 [pdf](#)
- C24 T. E. Humphreys, D. P. Shepard, J. A. Bhatti, and K. D. Wesson, “A testbed for developing and evaluating GNSS signal authentication techniques,” in *Proceedings of the International Symposium on Certification of GNSS Systems and Services (CERGAL)*, (Dresden, Germany), July 2014 [pdf](#)
- C25 D. P. Shepard and T. E. Humphreys, “High-precision globally-referenced position and attitude via a fusion of visual SLAM, carrier-phase-based GPS, and inertial measurements,” in *Proceedings of the IEEE/ION PLANS Meeting*, May 2014 [pdf](#)
- C26 A. J. Kerns, K. D. Wesson, and T. E. Humphreys, “A blueprint for civil GPS navigation message authentication,” in *Proceedings of the IEEE/ION PLANS Meeting*, May 2014 [pdf](#)
- C27 K. D. Wesson, B. L. Evans, and T. E. Humphreys, “A probabilistic framework for Global Navigation Satellite System signal timing assurance,” in *Proceedings of Asilomar Conference on Signals, Systems, and Computers*, (Pacific Grove, CA), 2013 [pdf](#)

- C28 K. D. Wesson, B. L. Evans, and T. E. Humphreys, “A combined symmetric difference and power monitoring GNSS anti-spoofing technique,” in *IEEE Global Conference on Signal and Information Processing*, 2013 [pdf](#)
- C29 Z. M. Kassas, J. A. Bhatti, and T. E. Humphreys, “A graphical approach to GPS software-defined receiver implementation,” in *Proceedings of IEEE Global Conference on Signal and Information Processing*, December 2013 [pdf](#)
- C30 Z. Kassas and T. E. Humphreys, “The price of anarchy in active signal landscape map building,” in *Proceedings of IEEE Global Conference on Signal and Information Processing*, December 2013 [pdf](#)
- C31 Z. Kassas, J. A. Bhatti, and T. E. Humphreys, “Receding horizon trajectory optimization for simultaneous signal landscape mapping and receiver localization,” in *Proceedings of the ION GNSS+ Meeting*, September 2013 [pdf](#)
- C32 K. M. Pesyna, Jr., R. W. Heath, Jr., and T. E. Humphreys, “Precision limits of low-energy GNSS receivers,” in *Proceedings of the ION GNSS+ Meeting*, (Nashville, Tennessee), Institute of Navigation, 2013 [pdf](#)
Best presentation award in session of 8 papers.
- C33 Z. M. Kassas and T. E. Humphreys, “Motion planning for optimal information gathering in opportunistic navigation systems,” in *AIAA Guidance, Navigation, and Control Conference (GNC’13)*, (Boston, MA), pp. 4551–4565, Aug. 2013 [pdf](#)
- C34 K. D. Wesson, T. E. Humphreys, and B. L. Evans, “Position paper: Secure time transfer for CPS,” in *NSF/NSA National Workshop on The New Clockwork for Time-Critical Systems*, 2012 [pdf](#)
- C35 D. P. Shepard, K. M. Pesyna, Jr., and T. E. Humphreys, “Precise augmented reality enabled by carrier-phase differential GPS,” in *Proceedings of the ION GNSS Meeting*, (Nashville, Tennessee), Institute of Navigation, 2012 [pdf](#)
- C36 D. P. Shepard, J. A. Bhatti, T. E. Humphreys, and A. A. Fansler, “Evaluation of smart grid and civilian UAV vulnerability to GPS spoofing attacks,” in *Proceedings of the ION GNSS Meeting*, 2012 [pdf](#)
- C37 Z. M. Kassas and T. E. Humphreys, “Observability and estimability of collaborative opportunistic navigation with pseudorange measurements,” in *Proceedings of the ION GNSS Meeting*, (Nashville, Tennessee), Institute of Navigation, 2012 [pdf](#)
- C38 T. E. Humphreys, J. A. Bhatti, D. P. Shepard, and K. D. Wesson, “The Texas Spoofing Test Battery: Toward a standard for evaluating GNSS signal authentication techniques,” in *Proceedings of the ION GNSS Meeting*, 2012 [pdf](#)
- C39 Z. M. Kassas and T. E. Humphreys, “Observability analysis of opportunistic navigation with pseudorange measurements,” in *Proceedings of AIAA Guidance, Navigation, and Control Conference*, Aug. 2012 [pdf](#)
- C40 J. A. Bhatti, T. E. Humphreys, and B. M. Ledvina, “Development and demonstration of a TDOA-based GNSS interference signal localization system,” in *Proceedings of the IEEE/ION PLANS Meeting*, pp. 1209–1220, April 2012 [pdf](#)
Walter Fried overall best paper award.
- C41 K. M. Pesyna, Jr., Z. M. Kassas, and T. E. Humphreys, “Constructing a continuous phase time history from TDMA signals for opportunistic navigation,” in *Proceedings of the IEEE/ION PLANS Meeting*, pp. 1209–1220, April 2012 [pdf](#)
Overall best student paper award.
- C42 D. Shepard, T. E. Humphreys, and A. Fansler, “Evaluation of the vulnerability of Phasor Measurement Units to GPS spoofing,” in *Sixth Annual IFIP WG 11.10 International Conference on Critical Infrastructure Protection*, (Washington, DC), Mar. 2012 [pdf](#)
- C43 A. J. Joplin, E. G. Lightsey, and T. E. Humphreys, “Development and testing of a minaturized, dual-frequency GPS receiver for space applications,” in *Proceedings of the ION International Technical Meeting*, (Long Beach, CA), Jan. 2012 [pdf](#)

- C44 K. D. Wesson, M. P. Rothlisberger, and T. E. Humphreys, “A proposed navigation message authentication implementation for civil GPS anti-spoofing,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2011 [pdf](#)
- C45 D. Shepard and T. E. Humphreys, “Characterization of receiver response to a spoofing attack,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2011 [pdf](#)
- C46 R. Mitch, R. Dougherty, M. Psiaki, S. Powell, B. O’Hanlon, J. Bhatti, and T. Humphreys, “Signal characteristics of civil GPS jammers,” in *Proceedings of the ION GNSS Meeting*, 2011 [pdf](#)
Best presentation award in session of 8 papers.
- C47 M. L. Psiaki, B. W. O’Hanlon, J. A. Bhatti, and T. E. Humphreys, “Civilian GPS spoofing detection based on dual-receiver correlation of military signals,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2011 [pdf](#)
- C48 G. Crowley, G. S. Bust, A. Reynolds, I. Azeem, R. Wilder, B. W. O’Hanlon, M. L. Psiaki, S. Powell, T. E. Humphreys, and J. A. Bhatti, “CASES: A novel low-cost ground-based dual-frequency GPS software receiver and space weather monitor,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2011 [pdf](#)
- C49 B. O’Hanlon, M. Psiaki, S. Powell, J. Bhatti, T. E. Humphreys, G. Crowley, and G. Bust, “CASES: A smart, compact GPS software receiver for space weather monitoring,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), pp. 2745–2753, Institute of Navigation, 2011 [pdf](#)
- C50 K. D. Wesson, D. P. Shepard, J. A. Bhatti, and T. E. Humphreys, “An evaluation of the vestigial signal defense for civil GPS anti-spoofing,” in *Proceedings of the ION GNSS Meeting*, (Portland, OR), 2011 [pdf](#)
Best presentation award in session of 8 papers.
- C51 K. M. Pesyna Jr., Z. M. Kassas, J. A. Bhatti, and T. E. Humphreys, “Tightly-coupled opportunistic navigation for deep urban and indoor positioning,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2011 [pdf](#)
- C52 K. M. Pesyna, Jr., K. D. Wesson, R. W. Heath, Jr., and T. E. Humphreys, “Extending the reach of GPS-assisted femtocell synchronization and localization through tightly-coupled opportunistic navigation,” in *IEEE GLOBECOM Workshop*, 2011 [pdf](#)
- C53 B. O’Hanlon, J. Bhatti, T. E. Humphreys, and M. Psiaki, “Real-time spoofing detection in a narrow-band civil GPS receiver,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2010 [pdf](#)
- C54 T. E. Humphreys, J. Bhatti, and B. Ledvina, “The GPS Assimilator: a method for upgrading existing GPS user equipment to improve accuracy, robustness, and resistance to spoofing,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2010 [pdf](#)
- C55 K. D. Wesson, K. M. Pesyna, Jr., J. A. Bhatti, and T. E. Humphreys, “Opportunistic frequency stability transfer for extending the coherence time of GNSS receiver clocks,” in *Proceedings of the ION GNSS Meeting*, (Portland, Oregon), Institute of Navigation, 2010 [pdf](#)
- C56 T. E. Humphreys, J. Bhatti, T. Pany, B. Ledvina, and B. O’Hanlon, “Exploiting multicore technology in software-defined GNSS receivers,” in *Proceedings of the ION GNSS Meeting*, (Savannah, GA), pp. 326–338, Institute of Navigation, 2009 [pdf](#)
- C57 B. W. O’Hanlon, M. L. Psiaki, P. M. Kintner, Jr., and T. E. Humphreys, “Development and field testing of a DSP-based dual-frequency software GPS receiver,” in *Proceedings of the ION GNSS Meeting*, (Savannah, GA), Institute of Navigation, 2009 [pdf](#)
- C58 T. E. Humphreys, B. M. Ledvina, M. L. Psiaki, B. W. O’Hanlon, and P. M. Kintner, Jr., “Assessing the spoofing threat: Development of a portable GPS civilian spoofer,” in *Proceedings of the ION GNSS Meeting*, (Savannah, GA), Institute of Navigation, 2008 [pdf](#)
- C59 J. C. Hinks, T. E. Humphreys, B. O’Hanlon, M. L. Psiaki, and P. M. Kintner, Jr., “Evaluating GPS receiver robustness to ionospheric scintillation,” in *Proceedings of the ION GNSS Meeting*,

(Savannah, GA), Institute of Navigation, 2008 [pdf](#)

Best presentation award in session of 8 papers.

- C60 S. Mohiuddin, T. E. Humphreys, and M. L. Psiaki, “A technique for determining the carrier phase differences between independent GPS receivers during scintillation,” *Proceedings of the ION GNSS Meeting*, 2007 [pdf](#)

Best presentation award in session of 8 papers.

- C61 M. L. Psiaki, T. E. Humphreys, S. Mohiuddin, S. P. Powell, A. P. Cerruti, and P. M. Kintner, Jr., “Searching for Galileo,” in *Proceedings of the ION GNSS Meeting*, (Fort Worth, TX), Institute of Navigation, 2006 [pdf](#)

Best presentation award in session of 8 papers.

- C62 T. E. Humphreys, B. M. Ledvina, M. L. Psiaki, and P. M. Kintner, Jr., “GNSS receiver implementation on a DSP: Status, challenges, and prospects,” in *Proceedings of the ION GNSS Meeting*, (Fort Worth, TX), pp. 2370–2382, Institute of Navigation, 2006 [pdf](#)

Best presentation award in session of 8 papers.

- C63 T. E. Humphreys, M. L. Psiaki, B. M. Ledvina, and P. M. Kintner, Jr., “GPS carrier tracking loop performance in the presence of ionospheric scintillations,” in *Proceedings of the ION GNSS Meeting*, (Long Beach, CA), Institute of Navigation, Sept. 2005 [pdf](#)

Best presentation award in session of 8 papers.

- C64 T. E. Humphreys, B. M. Ledvina, M. L. Psiaki, and P. M. Kintner, “Analysis of ionospheric scintillations using wideband GPS L1 C/A signal data,” in *Proceedings of the ION GNSS Meeting*, (Long Beach, California), pp. 399–407, Institute of Navigation, 2004 [pdf](#)

- C65 T. E. Humphreys, M. Kelley, and P. M. Kintner, Jr., “GPS-based measurement of atmospheric tides,” in *Proceedings of the ION GNSS Meeting*, (Long Beach, California), pp. 864–880, Institute of Navigation, 2004

- C66 T. E. Humphreys, “Attitude determination for small satellites with modest pointing constraints,” in *Proc. 2002 AIAA/USU Small Satellite Conference*, (Logan, Utah), 2002

Other Major Publications

- M1 M. J. Murrian, L. Narula, T. E. Humphreys, B. W. O’Hanlon, and S. Budzien, “Characterizing GNSS interference from low-earth orbit,” *Inside GNSS*, vol. 15, no. 1, pp. 54–59, 2020

- M2 M. J. Murrian, C. W. Gonzalez, T. E. Humphreys, K. M. P. Jr., D. P. Shepard, and A. J. Kerns, “Low-cost precise positioning for automated vehicles,” *GPS World*, vol. 27, pp. 32–39, September 2016

- M3 M. L. Psiaki and T. E. Humphreys, “Attackers can spoof navigation signals without our knowledge. here’s how to fight back GPS lies,” *IEEE Spectrum*, vol. 53, pp. 26–53, August 2016

- M4 T. E. Humphreys, “Statement on the security threat posed by unmanned aerial systems and possible countermeasures,” *United States House of Representatives Committee on Homeland Security: Subcommittee on Oversight and Management Efficiency*, Mar. 2015

- M5 K. M. Pesyna, Jr, R. W. Heath, Jr., and T. E. Humphreys, “Accuracy in the palm of your hand: Centimeter positioning with a smartphone-quality GNSS antenna,” *GPS World*, vol. 26, pp. 16–31, Feb. 2015

- M6 M. L. Psiaki, B. W. O’Hanlon, S. P. Powell, J. A. Bhatti, T. E. Humphreys, and A. Schofield, “GNSS lies, GNSS truth: Spoofing detection with two-antenna differential carrier phase,” *GPS World*, vol. 25, pp. 36–44, Feb. 2014

- M7 K. D. Wesson and T. E. Humphreys, “Hacking drones,” *Scientific American*, vol. 309, no. 5, pp. 54–59, 2013

- M8 D. P. Shepard, J. A. Bhatti, and T. E. Humphreys, “Drone hack: Spoofing attack demonstration on a civilian unmanned aerial vehicle,” *GPS World*, Aug. 2012

- M9 D. P. Shepard, T. E. Humphreys, and A. A. Fansler, “Going up against time: The power grid’s vulnerability to GPS spoofing attacks,” *GPS World*, Aug. 2012
- M10 T. E. Humphreys, “Statement on privacy issues related to the domestic use of unmanned aerial vehicles,” *United States House of Representatives Committee on the Judiciary: Subcommittee on Crime, Terrorism, and Homeland Security: Field Forum*, Oct. 2012
- M11 T. E. Humphreys, “Statement on the vulnerability of civil unmanned aerial vehicles and other systems to civil GPS spoofing,” *United States House of Representatives Committee on Homeland Security: Subcommittee on Oversight, Investigations, and Management*, July 2012
- M12 T. E. Humphreys, “The GPS dot and its discontents: Privacy vs. GNSS integrity,” *Inside GNSS*, vol. 7, Mar./Apr. 2012
- M13 R. Mitch, R. Dougherty, M. Psiaki, S. Powell, B. O’Hanlon, J. Bhatti, and T. E. Humphreys, “Know your enemy: Signal characteristics of civil GPS jammers,” *GPS World*, Jan. 2012
- M14 K. D. Wesson, D. P. Shepard, and T. E. Humphreys, “Straight talk on anti-spoofing: Securing the future of PNT,” *GPS World*, Jan. 2012
- M15 T. E. Humphreys, J. Bhatti, and B. M. Ledvina, “The GPS Assimilator: Upgrading receivers via benign spoofing,” *Inside GNSS*, vol. 5, pp. 50–58, June 2010
- M16 P. M. Kintner, Jr., T. E. Humphreys, and J. Hinks, “GNSS and ionospheric scintillation: How to survive the next solar maximum,” *Inside GNSS*, vol. 4, pp. 22–30, July 2009
- M17 P. Y. Montgomery, T. E. Humphreys, and B. M. Ledvina, “A multi-antenna defense: Receiver-autonomous GPS spoofing detection,” *Inside GNSS*, vol. 4, pp. 40–46, April 2009
- M18 T. E. Humphreys, B. M. Ledvina, M. L. Psiaki, B. W. O’Hanlon, and P. M. Kintner, Jr., “Assessing the spoofing threat,” *GPS World*, vol. 20, pp. 28–38, Jan. 2009
- M19 T. E. Humphreys, *Modeling Ionospheric Scintillation and its Effects on GPS Carrier Tracking Loops and Two Other Applications of Modeling and Estimation*. PhD thesis, Cornell University, Ithaca, New York, 2008
- M20 T. E. Humphreys, L. Young, and T. Pany, “Considerations for future IGS receivers,” in *Position Paper of the 2008 IGS Workshop*, 2008
- M21 M. L. Psiaki, T. E. Humphreys, S. Mohiuddin, S. P. Powell, A. P. Cerruti, and J. Paul M. Kintner, “Searching for Galileo: Reception and analysis of signals from GIOVE-A,” *GPS World*, vol. 17, pp. 66–72, June 2006
- M22 T. E. Humphreys, “Attitude determination for small satellites with modest pointing constraints,” Master’s thesis, Utah State University, Logan, Utah, 2003

Book Chapters

- B1 M. L. Psiaki and T. E. Humphreys, *Position, Navigation, and Timing Technologies in the 21st Century: Integrated Satellite Navigation, Sensor Systems, and Civil Applications*, vol. 1, ch. Civilian GNSS Spoofing, Detection, and Recovery, pp. 655–680. Wiley-IEEE, 2020
- B2 T. E. Humphreys, *Interference*, pp. 469–503. Springer International Publishing, 2017

ORAL PRESENTATIONS

- O1 June 24, 2021, “Global GNSS Interference Activity,” (invited presentation) International Technical Symposium on Navigation and Timing, ENAC, Toulouse, France (virtual). [video](#)
- O2 February 26, 2021, “GNSS Spoofing, Jamming, and Tomfoolery,” SpaceX Seminar (virtual).
- O3 December 3, 2020, “Radionavigation and Wireless Communications,” (invited presentation) NSF SII Workshop on Challenges and Opportunities for 6G and Navigation (virtual).
- O4 July 10, 2020, “Cooperative Sensing for Automated Vehicles,” Semiautonomous Seminar, U.C. Berkeley. [video](#)

- O5 March 10, 2020, “All-Weather 50-cm Localization for Self-Driving Cars,” Hexagon/NovAtel, Calgary, Canada. [video](#)
- O6 December 13, 2019, “Belt-and-Suspenders PNT for Automated Vehicles,” Joby Aviation, Santa Cruz, CA.
- O7 November 19, 2019, “GNSS Radio Frequency Interference Detection from Low Earth Orbit,” (keynote presentation) Royal Institute of Navigation International Navigation Conference, Edinburgh, Scotland.
- O8 November 18, 2019, “Adding Resilience: Secure Perception for Autonomous Systems,” (invited presentation) Royal Institute of Navigation International Navigation Conference, Edinburgh, Scotland.
- O9 October 16, 2019, “Collaborative Sensing for Self-Driving Cars: Security Implications,” NSF Assured Autonomy Workshop, Washington, D.C.
- O10 September 19, 2019, “Belt-and-Suspenders PNT for Self-Driving Cars and Air Taxis,” (invited panel presentation) ION GNSS+ Conference, Miami, FL.
- O11 September 18, 2019, “Insights from Two Years of GNSS Interference Observations from Space,” (invited panel presentation), ION GNSS+ Conference, Miami, FL.
- O12 July 10, 2019, “Automated Vehicle Control based on Secure Collaborative Sensing,” (invited presentation) American Control Conference: NSF CAREER awardee session, Philadelphia, PA.
- O13 June 6, 2019, “GNSS Radio Frequency Interference Detection from LEO,” National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, Washington, DC.
- O14 March 22, 2019, “The GPS Interference and Countermeasures Arms Race,” Utah State University ECE Seminar, Logan, UT.
- O15 January 15, 2019, “Deep Urban Unaided Precise GNSS Vehicle Positioning,” West Virginia University.
- O16 October 17, 2018, “Deep Urban Unaided Precise GNSS Vehicle Positioning,” Technical University of Munich (TUM), Munich, Germany.
- O17 October 16, 2018, “Bracing for the Future: Next-Generation Demands in PNT,” German Aerospace Center (DLR), Munich, Germany.
- O18 April 20, 2018, “Collaborative All-Weather Sensing for Automated Vehicles,” Engineering Seminar, UT San Antonio.
- O19 March 15, 2018, “Collaborative All-Weather Sensing for Automated Vehicles,” Engineering Seminar, Tufts University.
- O20 March 2, 2018, “Bracing for the Future: Next-Generation Demands in PNT,” Aero-Astro seminar, Stanford University.
- O21 March 1, 2018, “Collaborative All-Weather Sensing for Automated Vehicles,” Apple Inc., special projects division.
- O22 Dec. 15, 2017, “Collaborative All-Weather Sensing for Automated Vehicles,” Apple Inc.
- O23 Nov. 14, 2017, “Robust and secure perception for automated vehicles,” (keynote presentation) International Technical Symposium on Navigation and Timing, ENAC, Toulouse, France.
- O24 Oct. 9, 2017, “Robust and secure perception for automated vehicles,” Engineering Seminar, Virginia Tech.
- O25 Sept. 28, 2017, “Counter UAV challenges: Is GNSS spoofing effective,” (invited panel presentation) ION GNSS+ panel session on hostile MAV threats, detection and countermeasures, Portland, OR.
- O26 Sept. 28, 2017, “Assured navigation and timing,” (invited panel presentation) ION GNSS+ panel session on assured navigation and timing, Portland, OR.
- O27 Sept. 27, 2017, “Robust precise location,” (invited panel presentation) ION GNSS+ panel session on ubiquitous navigation, Portland, OR.
- O28 Feb. 18, 2017, “Secure Perception for Automated Vehicles,” Hack the Machine, Austin, TX.

- O29 Feb. 7, 2017, “Protecting Drivers and their Data,” Texas Transportation Forum, Austin, TX.
- O30 Dec. 15, 2016, “Trusted Automated Vehicles,” IEEE Computer Society and COMSOC/SP Joint Chapters Meeting, Austin, TX.
- O31 Dec. 5, 2016, “Robust and secure perception for automated vehicles,” Nokia Bell Laboratories.
- O32 Dec. 4, 2016, “Robust and secure perception for automated vehicles,” (keynote presentation) Globecom location workshop, Washington D.C.
- O33 Nov. 14, 2016, “Robust and secure perception for automated vehicles,” Engineering Seminar, UCLA.
- O34 Sept. 26, 2016, “Robust and secure perception for automated vehicles,” Engineering Seminar, UC Riverside.
- O35 April 25, 2016, “Low-cost precise positioning for automated vehicles,” Hyundai Distinguished Lecture, UC Berkeley.
- O36 February 9, 2016, “Precise Positioning for the Mass Market,” (keynote presentation) International GNSS Service Workshop, Sydney, Australia. [video](#)
- O37 October 13, 2015, “Low-Cost Precise Positioning and Perception Security,” Google[X], Mountain View, CA.
- O38 October 29, 2015, “Low-Cost Centimeter-Accurate Mobile Positioning,” (keynote presentation) Texas GIS Forum, Austin, TX.
- O39 October 1, 2015, “Low-Cost Centimeter-Accurate Mobile Positioning,” University of Minnesota Roadway Safety Institute, Minneapolis, MN. [video](#)
- O40 July 15, 2015, “Secure Perception for Autonomous Systems,” (keynote presentation) International GNSS Conference, Gold Coast, Australia.
- O41 June 11, 2015, “Toughening Techniques for GPS Receivers: Navigation Message Authentication,” National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, Washington, DC.
- O42 March 18, 2015, “Unmanned aerial system threats: Exploring security implications and mitigation technologies,” U.S. House Subcommittee on Homeland Security Oversight hearing, Washington, DC. [link](#)
- O43 February 25, 2015, “Navigation Under Threat,” (keynote presentation) International Navigation Conference, Manchester, UK.
- O44 November 21, 2014, “Drones: Myths, Facts, Hacks, and the Future,” Hot Science Cool Talks, The University of Texas at Austin Environmental Science Institute. [link](#)
- O45 April 15, 2014, “Secure Perception for Autonomous Systems,” University of Texas Student Engineering Council Symposium, Austin, TX.
- O46 March 13, 2014, “Secure Perception for Autonomous Systems,” University of Illinois at Urbana-Champaign, Urbana, IL.
- O47 March 6, 2014, “Secure Perception for Autonomous Systems, (keynote presentation) Cornell Sibley Graduate Research Symposium, Ithaca, NY.
- O48 March 7, 2014, “Location Deception,” (invited) SXSW Interactive, Austin, TX. [audio](#)
- O49 November 14, 2013, “Secure PNT for Autonomous Systems,” Stanford PNT Symposium, Stanford University, Stanford, CA.
- O50 September 26, 2013, “Maritime Navigation Security,” International Hydrographic Organisation & Professional Yachters Association Sea Changes Seminar, Monaco.
- O51 March 8, 2013, “Extreme GPS,” SXSW Interactive, Austin, TX.
- O52 March 6, 2013, “Drones in the Classroom,” SXSW Edu, Austin, TX.
- O53 February 13, 2013, “Secure Navigation and Timing,” (keynote presentation) Royal Institute of Navigation Interference Conference, Teddington, UK.

- O54 February 12, 2013, "UAV Integration: Privacy and Security Hurdles," Royal Institute of Navigation UAV Conference, Teddington, UK.
- O55 February 7, 2013, "GPS Vulnerabilities and Implications for Telecom," international webinar.
- O56 December 5, 2012, "Navigation and Timing Security," U.S. Air Force GPS Directorate, Los Angeles, CA.
- O57 November 15, 2012, "Future Directions in GNSS Research," international GPS World webinar.
- O58 October 25, 2012, "Privacy Issues Related to the Domestic Use of Unmanned Aerial Vehicles," statement to the U.S. House Judiciary Subcommittee on Crime, Terrorism, and Homeland Security field forum, Houston, TX. [pdf](#)
- O59 October 17, 2012, "Secure Civil Navigation and Timing," Sandia National Laboratory, Albuquerque, NM.
- O60 September 17, 2012, "Receiver Certification for Hardening Against Spoofing," Civil GPS Service Interface Committee, Nashville, TN.
- O61 September 10, 2012, "Secure Civil Navigation and Timing," Aerospace Corporation research seminar, virtual from Austin, TX.
- O62 July 20, 2012, "Secure Civil Navigation and Timing," MITRE corporation and government customers, McLean, VA.
- O63 July 19, 2012, "Radionavigation Robustness and Security," Office of Naval Research, Arlington, VA.
- O64 July 19, 2012, "The vulnerability of civil unmanned aerial vehicles and other systems to civil GPS spoofing," U.S. House Subcommittee on Homeland Security Oversight hearing on drone security, Washington, DC. [video](#), [pdf](#)
- O65 June 6, 2012, "Privacy vs. GPS Integrity," Civil GPS Service Interface Committee (CGSIC) Meeting, Austin, TX.
- O66 February 22, 2012, "PVT Security: Privacy and Trustworthiness," (keynote presentation) Royal Institute of Navigation Conference on GNSS Vulnerability: Present Dangers, Future Threats 2012, Teddington, UK.
- O67 February 11, 2012, "How to fool a GPS," TEDxAustin, Austin, TX. [video](#)
- O68 December 2, 2011, "Radionavigation Robustness and Security," Draper Laboratory, Cambridge, MA.
- O69 December 1, 2011, "Cubesat-Sized Radio Occultation Experiments," Massachusetts Institute of Technology Aeronautics and Astronautics Department, Cambridge, MA.
- O70 April 4, 2011, "State of the art and future trends in radionavigation," US Patent and Trademark Office, virtual presentation from Austin, TX.
- O71 March 10, 2011, "Briefing to DHS and DOD on GPS Security and Integrity," Austin, TX.
- O72 October 4, 2010, "Spoofing the timing signal: What else is vulnerable?" National Executive Committee on Position Navigation and Timing, Advisory Board Meeting, Washington, DC.
- O73 June 25, 2010, "Advances in GNSS Equipment," 2010 IGS Workshop, International GNSS Service, Newcastle upon Tyne, UK.
- O74 January 12, 2010, "Riding out the rough spots: Scintillation-robust GNSS carrier tracking," 2010 Air Force Orion Conference, Dayton, OH.
- O75 March, 2009, "Assessing the GPS spoofing threat," Cornell University, Ithaca, NY.
- O76 June 5, 2008, "Considerations for future IGS receivers," 2008 IGS Workshop, International GNSS Service, Miami Beach, FL.
- O77 March, 2006, "The semidiurnal variation in GPS-derived zenith neutral delay," 2006 IGS Workshop, Darmstadt, Germany.

Patents

- P1 W. J. Bencze, C. E. Cohen, B. T. Galusha, T. E. Humphreys, B. M. Ledvina, and M. L. Psiaki, “Practical method for upgrading existing GNSS user equipment with tightly integrated nav-com capability,” July 12 2011. US Patent 7,978,130
- P2 K. J. Hayworth, K. V. Shcheglov, T. E. Humphreys, and A. D. Challoner, “Electrostatic spring softening in redundant degree of freedom resonators,” Nov. 30 2004. US Patent 6,823,734

Software

- W1 T. E. Humphreys, J. A. Bhatti, D. P. Shepard, and M. Murrian, “General radionavigation interfusion device (GRID) software suite (GSS),” 2019. UTA Tech ID 7417 HUM
- W2 T. E. Humphreys, J. A. Bhatti, D. P. Shepard, A. J. Kerns, and K. M. P. Jr., “The precise positioning engine,” 2019. UTA Tech ID 7245 HUM
- W3 T. E. Humphreys, J. A. Bhatti, and D. P. Shepard, “Radionavigation security testbed software,” 2012. UTA Tech ID 6199 HUM
- W4 T. E. Humphreys, J. A. Bhatti, and D. P. Shepard, “General radionavigation interfusion device (GRID) software suite (GSS),” 2010. UTA Tech ID 5900 HUM

RESEARCH TOPICS

Application of optimal detection and estimation techniques to problems in secure, collaborative, and high-integrity perception, with an emphasis on navigation, collision avoidance, and precise timing.

CONSULTING

U.S. Department of Homeland Security Risk Assessment, March - September, 2011 Coherent Navigation, August 2009 - August 2012

PH.D. SUPERVISIONS COMPLETED

1. L. Narula, *Towards Secure and Robust PNT for Automated Systems*. PhD thesis, The University of Texas at Austin, Dec. 2020. Current position: Amazon Lab126.
2. G. N. Green, *Advanced Techniques for Safety-of-Life Carrier Phase Differential GNSS Positioning with Applications to Triplex Architectures*. PhD thesis, The University of Texas at Austin, Dec. 2017. Current position: Senior engineer at CTSi and **Adjunct Professor, Electrical Engineering, LeTourneau University**
3. J. Bhatti, *Sensor Deception Detection and Radio-Frequency Emitter Localization*. PhD thesis, The University of Texas at Austin, Aug. 2015. Current position: Lead navigation engineer at Joby Aviation.
4. K. M. Pesyna, Jr., *Advanced Techniques for Centimeter-Accurate GNSS Positioning on Low-Cost Mobile Platforms*. PhD thesis, The University of Texas at Austin, Dec. 2015. Primary supervisor: Humphreys; Co-Supervisor: Robert Heath (ECE). **2015 Marconi Society Young Scholar Award**. Current position: Senior engineer at Apple, Inc.
5. Z. M. Kassas, *Analysis and Synthesis of Collaborative Opportunistic Navigation Systems*. PhD thesis, The University of Texas at Austin, May 2014. Primary supervisor: Humphreys; Co-supervisor: Aristotle Arapostathis (ECE). Current position: **Associate Professor, Mechanical and Aerospace Engineering, U.C. Irvine**.
6. K. Wesson, *Secure Navigation And Timing Without Local Storage Of Secret Keys*. PhD thesis, The University of Texas at Austin, May 2014. Primary supervisor: Humphreys; Co-supervisor: Brian Evans (ECE). Current position: Regulatory Engineer at Swarm Technologies.

M.S. SUPERVISIONS COMPLETED

1. R. X. T. Kor, “A comprehensive proposal for securing radionavigation systems,” Master’s thesis, The University of Texas at Austin, 2021
2. W. Lies, “Extending the range of low SWaP-C FMCW radar,” Master’s thesis, The University of Texas at Austin, 2021
3. Tucker Haydon, 2019
4. Connor Brashar, 2018
5. Greg Anders, 2017
6. Andrew Kerns, 2015
7. D. Shepard, “Fusion of carrier-phase differential GPS, bundle-adjustment-based visual slam, and inertial navigation for precisely and globally-registered augmented reality,” Master’s thesis, The University of Texas at Austin, May 2013.
8. M. W. Bright, “GPS L2C signal survey and the development of the emergent MATLAB L2C (EMAL2) receiver,” Master’s report, The University of Texas at Austin, Aug. 2012. Primary supervisor: Humphreys; Co-supervisor: Bob Schutz.
9. A. J. Joplin, “Development and testing of a miniaturized, dual-frequency, software-defined GPS receiver for space applications,” Master’s thesis, The University of Texas at Austin, Dec. 2011. Primary supervisor: Glenn Lightsey; Co-supervisor: Humphreys.

PH.D. SUPERVISION IN PROGRESS

1. Nick Montalbano
2. Daniel Lachapelle
3. Matthew J. Murrian
4. Zach Clements
5. Andrew Graff

M.S. SUPERVISION IN PROGRESS

1. James Yoder
2. Hailey Nichols

POST-DOCTORAL FELLOW SUPERVISION

1. Peter Iannucci, 2019-present

OTHER STUDENT RESEARCH COMMITTEES (Current)

Ph.D. Defense Committees - 1
M.S. Committees - 0

OTHER RESEARCH SUPERVISION

Ph.D. Qualifying Committees

Kien Trung Truong, Kumar Appaiah, Thomas Novlan, Vidur Bhargava, Ehab Hussein Hassan, Yousof Mortazavi, Drew Jones, Jaegan Ko, Jing Lin, Chao Jia, Yezhou Wang

M.S. Report Committees

Constance McDaniel Wyman

Undergraduate Honors Projects

Daniel Shepard, Shubhodeep Mukherji, Siddarth Kaki, Tung To, James Yoder

Other Undergraduate Research Supervised

Vatsa Gandhi, Saura Elghonimi, Vish Selvakumar, Shaurya Gupta, Luciana Schement, Paige Whittington, Anum Aslam, Andrew Higdon, Sydney Norrell, Reese Shetrone, Zachary Tschirhart