

# Stanford

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## Todd Walter

Professor (Research) of Aeronautics and Astronautics

 Curriculum Vitae available Online

### Bio

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#### BIO

I am the director of the wide-area differential Global Navigation Satellite System(GNSS) laboratory at Stanford University. My work focuses on implementing high-integrity air navigation systems. I am also active in the international standards bodies coordinating the use of GNSS to implement these systems.

#### ACADEMIC APPOINTMENTS

- Professor (Research), Aeronautics and Astronautics

#### HONORS AND AWARDS

- Leadership Award in Signal Design, GPS World Magazine (September, 2015)
- Distinguished Service Award, Institute of Navigation (January, 2012)
- Kepler Award, Institute of Navigation (September, 2010)
- Thurlow Award, Institute of Navigation (January, 2008)
- Fellow of the ION, Institute of Navigation (June, 2006)
- Early Achievement Award, Institute of Navigation (June, 2000)

#### BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, National Space-Based Positioning, Navigation, and Timing Advisory Board (2019 - present)
- Member, IEEE (2014 - present)
- President, Institute of Navigation (2010 - 2012)
- Member, Institute of Navigation (1994 - present)

#### PROFESSIONAL EDUCATION

- Ph.D., Stanford University , Applied Physics (1994)
- M.S., Stanford University , Applied Physics (1990)
- B.S., Rensselaer Polytechnic Institute , Physics (1987)

#### LINKS

- GPS Lab: <https://gps.stanford.edu>

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

High integrity satellite navigation for guiding aircraft, including satellite based augmentation systems (SBAS) and advanced receiver autonomous integrity monitoring (ARAIM).

## Teaching

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### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Keidai Iiyama, Derek Knowles, ADYASHA MOHANTY

#### Doctoral Dissertation Advisor (AC)

Jason Anderson, Anargyros Kriezis, Frank Lai, Zixi Liu, Rebecca Wang

#### Orals Evaluator

Jason Anderson

## Publications

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### PUBLICATIONS

- **Determination of Fault Probabilities for ARAIM** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Walter, T., Blanch, J., Gunning, K., Joerger, M., Pervan, B.  
2019; 55 (6): 3505–16
- **An Overview of Advanced Receiver Autonomous Integrity Monitoring (ARAIM)**  
Walter, T., Inst Navigat  
INST NAVIGATION.2019: 896–914
- **Quantum-resistant authentication algorithms for satellite-based augmentation systems** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Neish, A., Walter, T., Enge, P.  
2019; 66 (1): 199–209
- **Broadband LEO Constellations for Navigation** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Reid, T. R., Neish, A. M., Walter, T., Enge, P. K.  
2018; 65 (2): 205–20
- **Worldwide Vertical Guidance of Aircraft Based on Modernized GPS and New Integrity Augmentations** *PROCEEDINGS OF THE IEEE*  
Walter, T., Enge, P., Blanch, J., Pervan, B.  
2008; 96 (12): 1918-1935
- **Robust Detection of Ionospheric Irregularities** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Walter, T., et al  
2001; 48 (2): 89–100
- **Wide area augmentation of the global positioning system** *PROCEEDINGS OF THE IEEE*  
Enge, P., Walter, T., Pullen, S., Kee, C., Chao, Y. C., Tsai, Y. J.  
1996; 84 (8): 1063-1088
- **Weighted RAIM for precision approach** *8th International Technical Meeting of the Satellite Division of the Institute-of-Navigation (ION GPS-95)*  
Walter, T., Enge, P.  
INST NAVIGATION.1995: 1995–2004
- **Calibration of RFI Detection Levels in a Low-Cost GNSS Monitor**

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- Miguel, N., Chen, Y., Lo, S., Walter, T., Akos, D., IEEE  
IEEE.2023: 520-535
- **An Evaluation of the Advanced RAIM Threat Model**  
Blanch, J., Walter, T., IEEE  
IEEE.2023: 408-413
  - **WAAS and the Ionosphere - A Historical Perspective: Monitoring Storms** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Sparks, L., Altshuler, E., Pandya, N., Blanch, J., Walter, T.  
2022; 69 (1)
  - **Authentication of Satellite-Based Augmentation Systems with Over-the-Air Rekeying Schemes** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Anderson, J., Lo, S., Neish, A., Walter, T.  
2022; 70 (3)
  - **A Framework for GNSS Spoofing Detection Through Combinations of Metrics** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Rothmaier, F., Chen, Y., Lo, S., Walter, T.  
2021; 57 (6): 3633-3647
  - **GNSS spoofing detection through spatial processing** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Rothmaier, F., Chen, Y., Lo, S., Walter, T.  
2021
  - **Performance of 6 Different Global Navigation Satellite System Receivers at Low Latitude Under Moderate and Strong Scintillation** *EARTH AND SPACE SCIENCE*  
de Paula, E. R., Martinon, A. F., Moraes, A. O., Carrano, C., Neto, A. C., Doherty, P., Groves, K., Valladares, C. E., Crowley, G., Azeem, Reynolds, A., Akos, D. M., Walter, T., et al  
2021; 8 (2)
  - **Fast Protection Levels for Fault Detection With an Application to Advanced RAIM** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Blanch, J., Walter, T.  
2021; 57 (1): 55–65
  - **GNSS Spoofing Mitigation in the Position Domain**  
Rothmaier, F., Chen, Y., Lo, S., Walter, T., Inst Navigat  
INST NAVIGATION.2021: 42-55
  - **Ionospheric Scintillation Effects on Satellite Navigation** *IONOSPHERE DYNAMICS AND APPLICATIONS*  
Datta-Barua, S., Altshuler, E., Walter, T., Pullen, S., Huang, C., Lu, G., Zhang, Y., Paxton, L. J.  
2021; 260: 493-510
  - **Message Authentication Candidates for the SBAS Dual Frequency Multi-Constellation Standard**  
Fernandez-Hernandez, I., Walter, T., Mabillean, M., Tosato, L., Chiara, A., Pozza, D., Pozzobon, O., Calabrese, A., Anderson, J., Chatre, E., INST NAVIGAT  
INST NAVIGATION.2021: 443-452
  - **Developing a Practical GNSS Spoofing Detection Thresholds for Receiver Power Monitoring**  
Lo, S., Rothmaier, F., Miralles, D., Akos, D., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 803-815
  - **A FAULT DETECTION AND EXCLUSION ESTIMATOR DESIGNED FOR INTEGRITY**  
Blanch, J., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 1672-1686
  - **GNSS Interference Detection Using Machine Learning Algorithms on ADS-B Data**  
Liu, Z., Lo, S., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 4305-4315
  - **Analysis of GNSS Constellation Performance for Advanced RAIM**  
Blanch, J., Liu, X., Gunning, K., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 1410-1434

- **SBAS Message Schemes to Support Inline Message Authentication**  
Walter, T., Anderson, J., Lo, S., INST NAVIGAT  
INST NAVIGATION.2021: 474-484
- **Ground Monitoring to Support ARAIM for Military Users: Alternatives for Rapid and Rare Update Rates**  
Pullen, S., Lo, S., Katz, A., Blanch, J., Walter, T., Katronick, A., Crews, M., Johnson, R., INST NAVIGAT  
INST NAVIGATION.2021: 1481-1507
- **GNSS Spoofing Detection through Metric Combinations: Calibration and Application of a general Framework**  
Rothmaier, F., Taleghani, L., Chen, Y., Lo, S., Phelts, E., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 4249-4263
- **Providing Continuity and Integrity in the Presence of GNSS Spoofing**  
Rothmaier, F., Chen, Y., Lo, S., Blanch, J., Walter, T., INST NAVIGAT  
INST NAVIGATION.2021: 1828-1842
- **Adopting Neural Networks in GNSS-IMU integration: A Preliminary study**  
Shin, Y., Lee, C., Kim, E., Walter, T., IEEE  
IEEE.2021
- **Reevaluating the Message Loss Rate of the Wide Area Augmentation System (WAAS) in Flight**  
Hirschberger, M. J., Lo, S., Walter, T., Inst Navigat  
INST NAVIGATION.2021: 218-228
- **SBAS message authentication: a review of protocols, figures of merit and standardization plans**  
Fernandez-Hernandez, I., Walter, T., Neish, A. M., Anderson, J., Mabilieu, M., Vecchione, G., Chatre, E., Inst Navigat  
INST NAVIGATION.2021: 111-124
- **Investigation into September 2020 GPS SVN 74 Performance Anomaly**  
Walter, T., Liu, Z., Blanch, J., Pham, K., Mick, J., Wanner, W., Inst Navigat  
INST NAVIGATION.2021: 189-200
- **Assessment of Ionospheric Correction Behavior for Use with Precise Point Positioning (PPP)**  
Walter, T., Blanch, J., de Groot, L., Norman, L., Inst Navigat  
INST NAVIGATION.2021: 616-624
- **ARAIM for Military Users: ISM Parameters, Constellation-Check Procedure and Performance Estimates**  
Katz, A., Pullen, S., Lo, S., Blanch, J., Walter, T., Katronick, A., Crews, M., Jackson, R., Inst Navigat  
INST NAVIGATION.2021: 173-188
- **GAUSSIAN BOUNDING IMPROVEMENTS AND AN ANALYSIS OF THE BIAS-SIGMA TRADEOFF FOR GNSS INTEGRITY**  
Blanch, J., Liu, X., Walter, T., Inst Navigat  
INST NAVIGATION.2021: 703-713
- **An Assessment of GPS Spoofing Detection Via Radio Power and Signal Quality Monitoring for Aviation Safety Operations** *IEEE INTELLIGENT TRANSPORTATION SYSTEMS MAGAZINE*  
Miralles, D., Levigne, N., Bornot, A., Rouquette, P., Akos, D. M., Chen, Y., La, S., Walter, T.  
2020; 12 (3): 136-46
- **Receiver States for SBAS Data Authentication**  
Neish, A., Walter, T., Fernandez-Hernandez, I., Inst Navigat  
INST NAVIGATION.2020: 1059-69
- **BOUNDING TEMPORALLY CORRELATED MEASUREMENT NOISE WITH AN APPLICATION TO GNSS INTEGRITY**  
Blanch, J., Phelts, E., Gunning, K., Walter, T., de Groot, L., Norman, L., Inst Navigat  
INST NAVIGATION.2020: 27-38
- **Characterization of ADS-B Performance under GNSS Interference**  
Liu, Z., Lo, S., Walter, T., Inst Navigat  
INST NAVIGATION.2020: 3581-3591

- **Independent Time Synchronization for Resilient GNSS Receivers**  
Fernandez-Hernandez, I., Walter, T., Neish, A., O'Driscoll, C., Inst Navigat  
INST NAVIGATION.2020: 964–78
- **Stress Testing Advanced RAIM Airborne Algorithms**  
Blanch, J., Walter, T., Inst Navigat  
INST NAVIGATION.2020: 421–39
- **Evaluating the Application of PPP Techniques to ARAIM Using Flight Data**  
Phelts, R., Gunning, K., Blanch, J., Walter, T., Inst Navigat  
INST NAVIGATION.2020: 379–85
- **Design and analysis of a public key infrastructure for SBAS data authentication** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Neish, A., Walter, T., Powell, J. D.  
2019; 66 (4): 831–44
- **Gaussian Bounds of Sample Distributions for Integrity Analysis** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Blanch, J., Walter, T., Enge, P.  
2019; 55 (4): 1806–15
- **Signal Deformation Monitoring for Anomalous Multipath Threats**  
Phelts, R., Walter, T., Inst Navigat  
INST NAVIGATION.2019: 1023–30
- **Development of Advanced RAIM Minimum Operational Performance Standards**  
Blanch, J., Walter, T., Berz, G., Burns, J., Clark, B., Joerger, M., Mabillean, M., Martini, I., Milner, C., Pervan, B., Lee, Y., Inst Navigat  
INST NAVIGATION.2019: 1381–91
- **SBAS Data Authentication: A Concept of Operations**  
Neish, A., Walter, T., Powell, J., Inst Navigat  
INST NAVIGATION.2019: 1812–23
- **Integrity for Tightly Coupled PPP and IMU**  
Gunning, K., Blanch, J., Walter, T., de Groot, L., Norman, L., Inst Navigat  
INST NAVIGATION.2019: 3066–78
- **Going Back for the Future: Large/Mega LEO Constellations for Navigation**  
Reid, T., Gunning, K., Perkins, A., Lo, S., Walter, T., Inst Navigat  
INST NAVIGATION.2019: 2452–68
- **Increasing International Civil Aviation Resilience: A Proposal for Nomenclature, Categorization and Treatment of New Interference Threats**  
Fernandez-Hernandez, I., Walter, T., Alexander, K., Clark, B., Chatre, E., Hegarty, C., Appel, M., Meurer, M., Inst Navigat  
INST NAVIGATION.2019: 389–407
- **SBAS Corrections for PPP Integrity with Solution Separation**  
Gunning, K., Blanch, J., Walter, T., Inst Navigat  
INST NAVIGATION.2019: 707–19
- **Development and Evaluation of Airborne Multipath Error Bounds for L1-L5**  
Blanch, J., Walter, T., Phelts, R., Inst Navigat  
INST NAVIGATION.2019: 53–61
- **Reducing Computational Load in Solution Separation for Kalman Filters and an Application to PPP Integrity**  
Blanch, J., Gunning, K., Walter, T., De Groot, L., Norman, L., Inst Navigat  
INST NAVIGATION.2019: 720–29
- **Safety Analysis of Ranging Biases on the WAAS GEOs**  
Walter, T., Blanch, J., Altshuler, E., Inst Navigat  
INST NAVIGATION.2019: 113–30

- **Paper Trends in ION Conferences from 2007-2018**  
Perkins, A., Walter, T., Inst Navigat  
INST NAVIGATION.2019: 340–48
- **Design and Analysis of a Public Key Infrastructure for SBAS Data Authentication**  
Neish, A., Walter, T., Powell, J., Inst Navigat  
INST NAVIGATION.2019: 964–88
- **Lower Bounds in Optimal Integrity Monitoring**  
Blanch, J., Walter, T., Inst Navigat  
INST NAVIGATION.2019: 915–24
- **SIS Monitoring for ARAIM in the Absence of Precise Clock Estimates**  
Gunning, K., Walter, T., Powell, D., Inst Navigat  
INST NAVIGATION.2019: 785–801
- **Standards for ARAIM ISM Data Analysis**  
Walter, T., Blanch, J., Gunning, K., Inst Navigat  
INST NAVIGATION.2019: 777–84
- **WAAS at 15** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Walter, T., Shallberg, K., Altshuler, E., Wanner, W., Harris, C., Stimmler, R.  
2018; 65 (4): 581–600
- **Validation of the Unfaulted Error Bounds for ARAIM** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Walter, T., Gunning, K., Phelts, R., Blanch, J.  
2018; 65 (1): 117–33
- **Effective GPS Spoofing Detection Utilizing Metrics from Commercial Receivers**  
Manfredini, E., Akos, D. M., Chen, Y., Lo, S., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2018: 672–89
- **Spoofing Detection for Airborne GNSS Equipment**  
Hegarty, C., Odeh, A., Shallberg, K., Wesson, K., Walter, T., Alexander, K., Inst Navigat  
INST NAVIGATION.2018: 1350–68
- **Design and evaluation of integrity algorithms for PPP in kinematic applications**  
Gunning, K., Blanch, J., Walter, T., de Groot, L., Norman, L., Inst Navigat  
INST NAVIGATION.2018: 1910–39
- **A Proposed Concept of Operations for Advanced Receiver Autonomous Integrity Monitoring**  
Blanch, J., Walter, T., Enge, P., Burns, J., Mabillean, M., Martini, I., Boyero, J., Berz, G., Inst Navigat  
INST NAVIGATION.2018: 1084–90
- **Parameter Selection for the TESLA Keychain**  
Neish, A., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2018: 2155–71
- **Effect of Aircraft Banking on ARAIM Performance**  
Phelts, R., Blanch, J., Gunning, K., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2018: 2632–41
- **GNSS Multipath Error Modeling for Automotive Applications**  
Khanafseh, S., Kujur, B., Joerger, M., Walter, T., Pullen, S., Blanch, J., Doherty, K., Norman, L., de Groot, L., Pervan, B., Inst Navigat  
INST NAVIGATION.2018: 1573–89
- **Ionospheric Rates of Change**  
Walter, T., Blanch, J., de Groot, L., Norman, L., Joerger, M., Inst Navigat  
INST NAVIGATION.2018: 4158–70

- **Fixed Subset Selection to Reduce Advanced RAIM Complexity**  
Blanch, J., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2018: 88–98
- **A Formula for Solution Separation without Subset Solutions for Advanced RAIM**  
Blanch, J., Walter, T., Enge, P., IEEE  
IEEE.2018: 316–26
- **GNSS Multipath Detection in Urban Environment Using 3D Building Model**  
Zhang, S., Lo, S., Chen, Y., Walter, T., Enge, P., IEEE  
IEEE.2018: 1053–58
- **WASS at 15**  
Walter, T., Shallberg, K., Altshuler, E., Wanner, W., Harris, C., Stimmler, R., Inst Navigat  
INST NAVIGATION.2018: 301–21
- **Quantum Resistant Authentication Algorithms for Satellite-Based Augmentation Systems**  
Neish, A., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2018: 365–79
- **Protection Levels after Fault Exclusion for Advanced RAIM** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Blanch, J., Walter, T., Enge, P.  
2017; 64 (4): 505–13
- **Improved User Position Monitor for WAAS** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Walter, T., Blanch, J.  
2017; 64 (1): 165–75
- **Theoretical Results on the Optimal Detection Statistics for Autonomous Integrity Monitoring** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Blanch, J., Walter, T., Enge, P.  
2017; 64 (1): 123–37
- **Multi-GNSS Constellation Anomaly Detection and Performance Monitoring**  
Gunning, K., Walter, T., Enge, P., INST NAVIGAT  
INST NAVIGATION.2017: 1051–62
- **Characterization of GLONASS Broadcast Clock and Ephemeris: Nominal Performance and Fault Trends for ARAIM**  
Gunning, K., Walter, T., Enge, P., INST NAVIGAT  
INST NAVIGATION.2017: 170–83
- **Catalog and Description of GPS and WAAS L1 C/A Signal Deformation Events**  
Shallberg, K. W., Ericson, S. D., Phelts, E., Walter, T., Kovach, K., Altshuler, E., INST NAVIGAT  
INST NAVIGATION.2017: 508–20
- **Validation of the Unfaulted Error Bounds for ARAIM**  
Walter, T., Gunning, K., Phelts, R., Blanch, J., Inst Navigat  
INST NAVIGATION.2017: 1–19
- **The Benefit of Low Cost Accelerometers for GNSS Anti-Spoofing**  
Lo, S., Chen, Y., Reid, T., Perkins, A., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2017: 775–96
- **WAAS Signal Deformation Monitor Performance: Beyond the ICAO Threat Model**  
Phelts, R., Shallberg, K., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2017: 713–24
- **A MATLAB Toolset to Determine Strict Gaussian Bounding Distributions of a Sample Distribution**  
Blanch, J., Walter, T., Enge, P., INST NAVIGAT  
INST NAVIGATION.2017: 4236–47

- **Feasibility of fault exclusion related to advanced RAIM for GNSS spoofing detection**  
Kuusniemi, H., Blanch, J., Chen, Y., Lo, S., Innac, A., Ferrara, G., Honkala, S., Bhuiyan, M. H., Thombre, S., Soderholm, S., Walter, T., Phelts, R., Enge, et al  
INST NAVIGATION.2017: 2359–70
- **Orbital representations for the next generation of satellite-based augmentation systems** *GPS SOLUTIONS*  
Reid, T. G., Walter, T., Enge, P. K., Sakai, T.  
2016; 20 (4): 737-750
- **Preliminary availability assessment to support single-frequency SBAS development in the Korean region** *GPS SOLUTIONS*  
Bang, E., Lee, J., Walter, T., Lee, J.  
2016; 20 (3): 299-312
- **GNSS Integrity in The Arctic** *NAVIGATION-JOURNAL OF THE INSTITUTE OF NAVIGATION*  
Reid, T., Walter, T., Blanch, J., Enge, P.  
2016; 63 (4): 469-492
- **Improved Ephemeris Monitoring for GNSS**  
Walter, T., Gunning, K., Blanch, J., Inst Navigat  
INST NAVIGATION.2016: 600–608
- **Determination of Fault Probabilities for ARAIM**  
Walter, T., Blanch, J., Joerger, M., Pervan, B., IEEE  
IEEE.2016: 451–61
- **Improved User Position Monitor for WAAS**  
Walter, T., Blanch, J., Inst Navigat  
INST NAVIGATION.2016: 343–52
- **Mitigation of short duration satellite outages for Advanced RAIM and other integrity systems based on GNSS**  
Blanch, J., Chen, Y., Phelts, R., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2016: 1688–95
- **A Simple Satellite Exclusion Algorithm for Advanced RAIM**  
Blanch, J., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2016: 239–44
- **Leveraging Commercial Broadband LEO Constellations for Navigation**  
Reid, T. R., Neish, A. M., Walter, T. F., Enge, P. K., Inst Navigat  
INST NAVIGATION.2016: 2300–2314
- **Demonstrating ARAIM on UAS using Software Defined Radio and Civilian Signal GPS L1/L2C and GLONASS G1/G2**  
Chen, Y., Perkins, A., Lo, S., Akos, D. M., Blanch, J., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2016: 231–38
- **Satellite Selection for Multi-Constellation SBAS**  
Walter, T., Blanch, J., Kropp, V., Inst Navigat  
INST NAVIGATION.2016: 1350–59
- **A Simple Position Estimator That Improves Advanced RAIM Performance** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Blanch, J., Walter, T., Enge, P., Kropp, V.  
2015; 51 (3): 2485-U960
- **GNSS Multipath and Jamming Mitigation Using High-Mask-Angle Antennas and Multiple Constellations** *IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS*  
Heng, L., Walter, T., Enge, P., Gao, G. X.  
2015; 16 (2): 741-750
- **Aviation Benefits from Satellite Navigation** *NEW SPACE*  
Enge, P., Enge, N., Walter, T., Eldredge, L.  
2015; 3 (1): 19–35



- **Baseline Advanced RAIM User Algorithm and Possible Improvements** *IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS*  
Blanch, J., Walker, T., Enge, P., Lee, Y., Pervan, B., Rippl, M., Spletter, A., Kropp, V.  
2015; 51 (1): 713-732
- **GNSS Integrity in The Arctic**  
Reid, T. R., Walter, T., Blanch, J., Enge, P. K., Inst Navigat  
INST NAVIGATION.2015: 1726-40
- **Progress on Working Group-C Activities on Advanced RAIM**  
Blanch, J., Walter, T., Enge, P., Burns, J., Alexander, K., Boyero, J., Lee, Y., Pervan, B., Joerger, M., Khanafseh, S., Rippl, M., Martini, I., Perea, et al  
INST NAVIGATION.2015: 629-38
- **Validating Nominal Bias Error Limits Using 4 years of WAAS Signal Quality Monitoring Data**  
Phelts, R., Altshuler, E., Walter, T., Inst Navigat  
INST NAVIGATION.2015: 956-63
- **GPS Multi-Frequency Carrier Phase Characterization During Strong Equatorial Ionospheric Scintillation**  
Xu, D., Morton, Y., Akos, D., Walter, T., Inst Navigat  
INST NAVIGATION.2015: 3787-96
- **A Comparative Study of Triple Frequency GPS Scintillation Signal Amplitude Fading Characteristics at Low Latitudes**  
Jiao, Y., Morton, Y., Akos, D., Walter, T., Inst Navigat  
INST NAVIGATION.2015: 3819-25
- **Fast Multiple Fault Exclusion with a Large Number of Measurements**  
Blanch, J., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2015: 696-701
- **Characterization of GPS Clock and Ephemeris Errors to Support ARAIM**  
Walter, T., Blanch, J., Inst Navigat  
INST NAVIGATION.2015: 920-31
- **Airborne Mitigation Of Constellation Wide Faults**  
Walter, T., Blanch, J., Inst Navigat  
INST NAVIGATION.2015: 676-86
- **Future Dual-Frequency GPS Navigation System for Intelligent Air Transportation Under Strong Ionospheric Scintillation** *IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS*  
Seo, J., Walter, T.  
2014; 15 (5): 2224-2236
- **Effects of solar cycle 24 activity on WAAS navigation** *SPACE WEATHER-THE INTERNATIONAL JOURNAL OF RESEARCH AND APPLICATIONS*  
Datta-Barua, S., Walter, T., Bust, G. S., Wanner, W.  
2014; 12 (1): 46-63
- **Architectures for Advanced RAIM: Offline and Online**  
Blanch, J., Walter, T., Enge, P., Pervan, B., Joerger, M., Khanafseh, S., Burns, J., Alexander, K., Boyero, J., Lee, Y., Kropp, V., Milner, C., Macabiau, et al  
INST NAVIGATION.2014: 787-804
- **Crowdsourcing Arctic Navigation Using Multispectral Ice Classification & GNSS** *PROCEEDINGS OF THE 27TH INTERNATIONAL TECHNICAL MEETING OF THE SATELLITE DIVISION OF THE INSTITUTE OF NAVIGATION (ION GNSS 2014)*  
Reid, T., Walter, T., Enge, P., Fowler, A.  
2014: 707-721
- **Scintillation Characterization for WAAS in the Auroral Region**  
Altshuler, E., Shallberg, K., Potter, B. J., Walter, T., Inst Navigat  
INST NAVIGATION.2014: 1126-37
- **Single Antenna GPS Spoof Detection that is Simple, Static, Instantaneous and Backwards Compatible for Aerial Applications**  
McMilin, E., De Lorenzo, D. S., Walter, T., Lee, T. H., Enge, P., Inst Navigat

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INST NAVIGATION.2014: 2233–42

- **Mitigation of Nominal Signal Deformations on Dual-Frequency WAAS Position Errors**  
Wong, G., Chen, Y., Phelts, R., Walter, T., Enge, P., Inst Navigat  
INST NAVIGATION.2014: 3129–47
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