Georgia Institute of Technology
Georgia Tech Research Institute

BIOGRAPHICAL SKETCH

WILLIAM DALE BLAIR
Principal Research Scientist
Sensors and Electromagnetic Applications Laboratory
Air Missile and Defense Division

Education

Ph.D., Electrical Engineering University of Virginia	1998
Master of Science, Electrical Engineering Tennessee Technological University	1987
Bachelors of Science, Electrical Engineering Tennessee Technological University	1985

Employment History

Principal Research Engineer, Georgia Institute of Technology	2001-Present
Senior Research Engineer, Georgia Institute of Technology	1997-2001
Senior Electrical Engineer, Naval Surface Warfare Center, Dahlgren Division	1996-1997
Electrical Engineer, Naval Surface Warfare Center, Dahlgren division	1990-1996
Electrical Engineer, FMC Corporation, Naval Systems Division	1987-1990

Experience Summary

William Dale Blair, Ph.D., joined the General Faculty of the Georgia Institute of Technology as a Senior Research Engineer in 1997. Dr. Blair is a recognized expert in the area of multitarget-multisensor tracking that includes optimal estimation, statistical signal processing, decision theory, radar resource allocation, radar signal processing, and radar systems modeling and simulation. Dr. Blair is co-editor of the Multitarget-Multisensor Tracking: Applications and Advances III. He has co-authored 18 refereed journal articles, 16 refereed conference papers, 67 papers and reports, and two book chapters. Dr. Blair's creative contributions range from his reformulation of the kinematic constraint for tracking constant speed, maneuvering targets in 1991 to an innovative technique for radar and multisensor resource allocation in 1994 to his more recently developed techniques for monopulse processing for tracking closely-spaced and possibly unresolved targets. Dr. Blair directed a real-time experiment that demonstrated that modern tracking algorithms can be used to improve the efficiency of phased array radars. Dr. Blair is internationally recognized for conceptualizing and developing benchmarks for comparison and evaluation of target tracking algorithms. A tracking benchmark is a computer simulation program that includes the salient features of the sensor system of interest and provides a "level playing field" for the evaluation and comparison of tracking algorithms. Dr. Blair developed NSWC Tracking Benchmarks I and II and originated ONR/NSWC Tracking Benchmarks III and IV. NSWC Tracking Benchmark II has been used in the United Kingdom, France, Italy, and throughout the United States, and the results of the benchmark have been presented in numerous conference and journal articles. Dr. Blair was invited to serve (and currently serves) as the technical lead of the multi-organizational development team for the Joint Composite Tracking Network (JCTN) Tracking and Ballistic Missile Defense (BMD) Benchmarks for multiplatform-multisensor-multitarget tracking. Dr. Blair was also invited to serve as a technical expert in a panel discussion on the future directions of data fusion at the 2nd International Conference on Information Fusion in Paris, France in 2000. He has been invited to give seminars in the United Kingdom; University of Buffalo; University of Virginia; University of Connecticut, and Atlanta Chapter of the IEEE AESS. He has been invited to contribute papers to multiple conferences and give talks at multiple workshops. He serves or has served as a consultant for the Applied Physics Laboratory of the Johns Hopkins University, Raytheon Systems Company, Numerica Corporation, and SPARTA Corporation. Recognition of Dr. Blair as a technical expert has lead to selection as the 2001 IEEE Young Radar Engineer of the Year, his election to Fellow of the IEEE, appointments of Editor for Radar Systems and Editor-In-Chief of the IEEE Transactions on Aerospace and Electronic Systems (AES) for 1997-2004, and

election to the Board of Governors of the IEEE AES Society, 1998-2003. Dr. Blair is also the originator, coordinator, and primary lecturer in short course *Target Tracking in Sensor Systems* that is offered annually through the Department of Professional Education and Distance Learning at the Georgia Institute of Technology.

Current Fields of Interest

Multitarget-multisensor tracking, modeling simulation of stochastic systems, sensor system design, optimal estimation, and statistical signal processing.

PUBLICATIONS/TECHNICAL ACCOMPLISHMENTS

Published Books and Parts of Books

1. Bar-Shalom, Y., and Blair, W. D., editors, Multitarget-Multisensor Tracking: Applications and Advances III, Norwood, Massachusetts: Artech House (2000).
2. Blair, W. D., and Keel, B. M., "Radar Systems Modeling for Tracking," in Multitarget-Multisensor Tracking: Applications and Advances III (Y. Bar-Shalom and W. D. Blair, editors), Norwood, Massachusetts: Artech House (2000).
3. Moore, J. R., and Blair, W. D., "Practical Aspects of Multisensor Tracking," in Multitarget-Multisensor Tracking: Applications and Advances III (Y. Bar-Shalom and W. D. Blair, editors), Norwood, Massachusetts: Artech House (2000).

Published Journal Papers (refereed)

1. Ogle, T. L., and Blair, W. D. Blair, "Fixed-Lag Alpha-Beta Filter for Target Trajectory Smoothing," submitted to *EEE Transactions Aerospace Electronic Systems*.

2. Blair, W. D., and Brandt-Pearce, M., "Monopulse DOA Estimation for Two Unresolved Rayleigh Targets," *IEEE Transactions Aerospace Electronic Systems*, Vol. AES-37, No. 2, April 2001, pp. 452-469. Blair completed of the work as part of his dissertation for the Ph.D.
3. Wong, W., and Blair, W. D., "Steady-State Tracking with LFM Waveforms," *IEEE Transactions Aerospace Electronic Systems*, Vol. AES-36, No. 2, April 2000, pp. 701-709. Blair directed Ms. Wong as a GRA while pursuing her M.S. in electrical engineering at Georgia Institute of Technology.
4. Blair, W. D., Watson, G. A., Kirubarajan, T., and Bar-Shalom, Y., "Benchmark for Radar Resource Allocation and Tracking Targets In the Presence of ECM," *IEEE Transactions Aerospace Electronic Systems*, October 1998, pp. 1097-1114. Blair developed the concept for the tracking benchmark and guided its development.
5. Kirubarajan, T., Bar-Shalom, Y., Blair, W. D., and Watson, G. A., "IMMPDAF Solution To Benchmark for Radar Resource Allocation and Tracking In the Presence of False Alarms and ECM," *IEEE Transactions Aerospace Electronic Systems*, October 1998, pp. 1115-1134. Blair developed the core techniques for using the IMM estimator for adapting the radar revisit time.
6. Blair, W. D., and Brandt-Pearce, M., "Statistical Description of Monopulse Parameters for Tracking Rayleigh Targets," *IEEE Transactions Aerospace Electronic Systems*, April 1998, pp. 597-611. Blair completed most of the work as part of his dissertation for the Ph.D.
7. Blair, W. D., and Brandt-Pearce, M., "Detection of the Presence of Unresolved Rayleigh Targets Using Monopulse Measurements," *IEEE Transactions Aerospace Electronic Systems*, April 1998, pp. 543-552. Blair completed most of the work as part of his dissertation for the Ph.D.
8. Groves, G. W., Blair, W. D., and Chow, W. C., "Probability Distribution of the Complex Monopulse Ratio With Arbitrary Correlation Between the Channels," *IEEE Transactions Aerospace Electronic Systems*, October 1997. Blair provided guidance to Dr. Groves, who completed most of the work.
9. Daeipour, E., Blair, W. D., and Bar-Shalom, Y., "Bias Compensation and Target Elevation Tracking with Monopulse Radars in the Presence of Multipath," in *IEEE Transactions Aerospace Electronic Systems*, July 1997. Blair formulated original approach and provided guidance to Dr. Daeipour, a Ph.D. candidate at the University of Connecticut.

10. Helmick, R. E., Blair, W. D., and Hoffman, R. A., "Interacting Multiple Model Approach to Fixed-Interval Smoothing," IEEE Transactions on Information Theory, November 1995, pp. 1485-1855. Blair collaborated with Dr. Helmick on the derivation of the fixed-interval smoother.
11. Blair, W. D., and Bar-Shalom, Y., "Tracking Maneuvering Targets with Multiple Sensors: Does More Data Always Mean Better Estimates?" *IEEE Transactions Aerospace Electronic Systems*, January 1996, pp. 450-456. Blair conducted the work with some consulting with Dr. Bar-Shalom.
12. Helmick, R. E., Blair, W. D., and Hoffman, S. A., "One Step Fixed-Lag Smoothers for Markovian Switching Systems," *IEEE Transactions on Auto. Conference*, July 1996, pp. 1051-1056. Blair collaborated with Dr. Helmick on the derivation of the fixed-lag smoothers.
13. Watson G. A., and Blair, W. D., "Interacting Acceleration Compensation Algorithm for Tracking Maneuvering Targets," *IEEE Transactions Aerospace Electronic Systems*, July 1995, pp. 1152-1159. Blair worked out the original derivation of the IAC algorithm and provided guidance to Mr. Watson, who conducted the simulations and wrote the paper.
14. Bar-Shalom, Y., Blair, W. D., and Groves G. W., "Tracking Maneuvering Targets in the Presence of Multipath Propagation," *IEEE Transactions Aerospace Electronic Systems*, 1994, pp. 973-929. Blair consulted with Dr. Bar-Shalom and directed the work of Dr. Groves.
15. Hoffman, S. A., and Blair, W. D., "Comments on The Alpha-Beta-Gamma Tracking Filter With a Noisy Jerk as the Maneuver Model'," *IEEE Transactions Aerospace Electronic Systems*, July 1994, pp. 925-928. Blair guided Mr. Hoffman in completion of the work as a career development project for new employees at NSWCDD.
16. Blair, W. D., "Fixed-Gain Two-Stage Estimators for Tracking Maneuvering Targets," *IEEE Transactions Aerospace Electronic Systems*, July 1993, pp. 1004-1014.
17. Blair, W. D., Conte, J. E., and Rice, T. R., "An Instructive Example of Homomorphic Signal Processing," *IEEE Transactions Education*, August 1995, pp. 211-216. Blair worked out the original derivations, wrote the paper, and guided the contributions of Conte and Rice.
18. Alouani, A. T., Rice, T. R., and Blair, W. D., "Optimality of Two-Stage State Estimation in the Presence of Random Bias," *IEEE Transactions Automatic Control*, August 1993, pp. 1279-1283. Blair assisted with computer simulations and was responsible for addressing practical issues of the estimator in the paper.
19. Alouani, A. T., and Blair, W. D., "Use of Kinematic Constraint in Tracking Constant Speed, Maneuvering Targets," *IEEE Transactions Automatic Control*, July 1993, pp. 1107-1111. Blair was responsible for reformulating the kinematic constraint, the key contribution of the paper, and writing the paper.

Published Papers (non-refereed)

1. Blair, W. D., and Brandt-Pearce, M., Monopulse Processing for Tracking Unresolved Targets, Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-97/167, September 1997.
2. Blair, W. D., Watson, G. A., Lepp, A., Curry, J., Pilson, G., Jeleniewski, Y., Do, T., Strock, M., Information-Based Radar Resource Allocation: FY 96 Test-Of-Concept Experiment (TOCE), Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-97/22, February 1997.
3. Groves, G. W., Conte, J. E., and Blair, W. D., Low Elevation Monopulse Radar and Tracking Simulation *(LEMRATS),* Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-97/30, March 1997.
4. Blair, W. D., and Watson, G. A., *Benchmark Problem for Radar Resource Allocation and Target Tracking in Presence of ECM,* Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-96/10, September 1996.
5. Hoffman S. A., and Blair W. D., *Target Tracking Filter Study for Command-All-the-Way Intercepts,* Naval Surface Warfare Center Dahlgren Division, NSWCDD/ TR-94/343, December 1994.
6. Hoffman S. A., and Blair, W. D., *Analysis of Track Filtering for AEGIS Command-All-the-Way Intercepts,* Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-94/341, December 1994 (Confidential).
7. Groves, G. W. Conte, J. E., and Blair, W. D., *Preliminary Analysis of Vertical-Motion Detection for Low Elevation Targets with Doppler Processing at W-Band*, Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-94/351, October 1994.

8. Groves, G. W., and Blair, W. D., *Statistical Studies of the Monopulse Ratio,* Naval Surface Warfare Center Dahlgren Division, NSWCDD/TR-94/97, July 1994.
9. Hilton, D., Martin, D. A., and Blair, W. D., *Tracking With Time-Delayed Data in Multisensor Systems,* Naval Surface Warfare Center, NSWCDD/TR-93/351, August 1993.
10. Groves, G. W., Blair, W. D., and Gray J. E., *Some Concepts for Target Trajectory Prediction,* Naval Surface Warfare Center, NSWCDD/TR-93/445, October 1993.
11. Blair, W. D., *Fixed-Gain Two-Stage Estimators for Tracking Maneuvering Targets,* Naval Surface Warfare Center, NSWCDD/TR-92/297, July 1992.
12. Lambertson, H., and Blair, W. D., *Ship Motion-Induced Range Rate Correction for AEGIS/SARTIS,* Naval Surface Warfare Center, NSWCDD/TN-92/211, September 1992.
13. Helmick, R. E., Blair, W. D., Fennemore, C., and Rice, T. R., "Multi-Sensor Integration and Data Fusion in the Surface Navy," Naval Surface Warfare Center Technical Digest, Vol. 2, No. 1, September 1992, pp. 36-49.
14. Blair, W. D., "Target State Estimation and Prediction for Tactical Weapons Fire Control," *Naval Surface Warfare Center Technical Digest*, Vol. 1, No. 1, September 1991, pp. 72-83.
15. Blair, W. D., Watson, G. A., and Alouani, A. T., *Use of Kinematic Constraint in Tracking Constant Speed, Maneuvering Targets*, Naval Surface Warfare Center, NAVSWC TR 91-561, November 1991.
16. Parker, J. D., and Blair, W. D., *Use of Target-Oriented Process Noise in Tracking Targets,* Naval Surface Warfare Center, NAVSWC TR 91-701, November 1991.
17. Alouani, A. T., Rice, T. R., and Blair, W. D., *Two-Stage Kalman Estimator for State Estimation in the Presence of Random Bias and for Tracking Maneuvering Targets*, Naval Surface Warfare Center, NAVSWC TR 91-256, May 1991.
18. Blair, W. D., and Ross, S., *Preliminary Study of the Performance of PHALANX Close-In Weapon System (CIWS) with Electro -Optical Tracking (U),* Naval Surface Warfare Center, NSWCDD TR 90-77, March 1990.
19. Blair, W. D., and Price, E. L., *Some Alternatives in Fire Control Processing for PHALANX CIWS (U),* Naval Surface Warfare Center, NSWC TR 88-143, 1988.
20. Blair, W. D., "Mathematical Modeling of the Hitachi HPR10II Process Robot," Masters Thesis, Tennessee Technological University, March 1987.
21. Blair, W. D., and Anderson, J. N., "Identification of the Kinematic, Dynamic, and Actuator Models for the Hitachi HPR10II Process Robot," Technical Report Eng-MC-87-1, Center for Manufacturing Research, Tennessee Technological University, January 1987.

Invited Conference Presentations

1. Wong, W., and Blair, W. D., "Steady-State Tracking with LFM Waveforms," *Proceedings of 32nd IEEE Southeastern Symposium on System Theory*, Tallahassee, Florida, March 5-7, 2000, pp. 69-73.
2. Blair, W. D., "Filtering Settling for Radar Tracking with LFM Waveforms," *Proceedings of 31st IEEE Southeastern Symposium on System Theory*, Auburn, Alabama, March 21-23, 1999, pp. 300-304.
3. Blair, W. D., "NNJPDA for Possibly Merged Monopulse Measurements," *Proceedings of 31st IEEE Southeastern Symposium on System Theory*, Auburn, Alabama, March 21-23, 1999, pp. 295-299.
4. Blair, W. D., Watson, G. A., and Brandt-Pearce, M., "Monopulse Processing for DOA Estimation of Two Unresolved Rayleigh Targets With Known Relative RCS," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.
5. Blair, W. D., and Brandt-Pearce, M., "On the Probability Distribution of Monopulse Measurements of Low-Elevation Targets in the Presence of Sea-Surface Induce Multipath," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.
6. Groves, G. W., and Blair, W. D., "Simulation of Narrow-Band Monopulse Measurements of Closely-Spaced Targets," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.

7. Chen, R. and Blair, W. D., "Aeolotropic Filter Design and Measurement Gating for Remote Tracking With Gridlock Error," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.
8. Blair, W. D., and Brandt-Pearce, M., "Discrimination of Target and RGPO Echoes Using Frequency Diversity," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.
9. Blair, W. D. and Brandt-Pearce, M., "Statistical Description of Monopulse Parameters for Tracking Rayleigh Targets," *Proceedings of 29th IEEE Southeastern Symposium on System Theory*, Cookeville, Tennessee, March 1997.
10. Blair, W. D., and Brandt-Pearce, M., "Detection of Multiple Unresolved Rayleigh Targets Using Quadrature Monopulse Measurements," *Proceedings of 28th IEEE Southeastern Symposium on System Theory*, Baton Rouge, Louisiana, April 1996, pp. 285-289.
11. Blair, W. D., and Brandt-Pearce, M., "Estimation and Discrimination for Swerling Targets," *Proceedings of 28th IEEE Southeastern Symposium on System Theory*, Baton Rouge, Louisiana, April 1996, pp. 280-284.
12. Blair, W. D., Watson, G. A., Gentry, G. L., and Hoffman, S. A., "Benchmark Problem for Beam Pointing Control of Phased Array Radar Against Maneuvering Targets In the Presence of False Alarms and ECM," *Proceedings of 1995 American Control Conference*, Seattle, Washington, June 1995.
13. Groves, G. W., and Blair, W. D., "Some Concepts for Target Trajectory Prediction for Ship Self Defense," *Proceedings of 1995 American Control Conference*, Seattle, Washington, June 1995.
14. Blair, W. D., Watson, G. A., and Hoffman, S. A., "Benchmark Problem for Beam Pointing Control of Phased Array Radar Against Maneuvering Targets," *Proceedings of 1994 American Control Conference*, Baltimore, Maryland, June 1994, pp. 2071-2075.
15. Blair, W. D., and Kazakos, D., "Tracking Maneuvering Targets with Multiple, Intermittent Sensors," *Proceedings of 27th Annual Asilomar Conference on Signal, Systems, and Computers*, Pacific Grove, California, November 1993.
16. Blair, W. D., and Watson, G. A., "A Two-Stage Alpha, Beta, Gamma, Lambda Estimator for Tracking Constant Speed, Maneuvering Targets," *Proceedings of 1992 American Control Conference*, Chicago, Illinois, June 1992.

Conference Presentations with Proceedings (refereed)

1. Kaplan, L. M., and Blair, W. D., "Assignment Costs for Multiple Sensor Track-to-Track Association," *Proceedings of the 7th International Conference on Information Fusion*, Stockholm, Sweden, June 28-July 1, 2004.
2. Burns, P.D., and Blair, W. D., "Optimal Phased Array Radar Beam Pointing For MTT," *Proceedings of the 2004 IEEE Aerospace Conference*, Big Sky, Montana, March 6-12, 2004.
3. Hoffman, S. A., and Blair, W. D., Tracking, Guidance, and Sensor Resource Management for Command-All-the-Way Intercepts, *Proceedings of 34th IEEE Conference on Decision and Control*, New Orleans, Louisiana, December 1995.
4. Helmick, R. E., Blair, W. D., and Hoffman, S. A., "One Step Fixed-Lag Smoothers for Markovian Switching Systems," *Proceedings of 1994 American Control Conference*, Baltimore, Maryland, June 1994, pp. 782-786.
5. Blair, W. D. and Kazakos, D., "Estimation and Detection for Systems with Second Order Markovian Switching Coefficients," *Proceedings of 1994 American Control Conference*, Baltimore, Maryland, June 1994, pp. 1427-1428.
6. Watson, G. A., and Blair, W. D. "Revisit Time Calculation and Waveform Control for a Multifunction Radar," *Proceedings of 32nd IEEE Conference on Decision and Control*, San Antonio, Texas, December 1993.
7. Helmick, R. E., Blair, W. D., and Hoffman, S. A., "Interacting Multiple Model Approach to Fixed-Interval Smoothing," *Proceedings of 32nd IEEE Conference on Decision and Control*, San Antonio, Texas, December 1993.

8. Watson, G. A., and Blair, W. D., "Tracking Performance of a Phased Array Radar with Revisit Time Controlled Using the IMM Algorithm," *Proceedings of IEEE 1994 National Radar Conference*, Atlanta, Georgia, March 1994.
9. Blair, W. D., Groves, G. W., Bar-Shalom, Y. and Daeipour, E., "Frequency Agility and Fusion for Tracking Targets in the Presence of Multipath Propagation," *Proceedings of IEEE 1994 National Radar Conference*, Atlanta, Georgia, March 1994.
10. Blair, W. D. and Kazakos, D., "Second Order Interacting Multiple Model Algorithm for System with Markov Switching Coefficients," *Proceedings of 1993 American Control Conference*, San Francisco, California, June 1993.
11. Watson, G. A., and Blair, W. D., "Interacting Acceleration Compensation Algorithm for Tracking Maneuvering Targets," *Proceedings of 1993 IEEE National Radar Conference*, Boston, Massachusetts, April 1993.
12. Blair, W. D., and Watson, G. A., "Interacting Multiple Bias Model Algorithm With Application to Tracking Maneuvering Targets," *Proceedings of 31st IEEE Conference on Decision and Control*, Tucson, Arizona, December 1992.
13. Blair, W. D., "A Two-Stage Alpha, Beta, Gamma Estimator for Tracking Maneuvering Targets," *Proceedings of 1992 American Control Conference*, Chicago, Illinois, June 1992.
14. Alouani, A. T., Rice, T. R., and Blair, W. D., "Two-Stage Estimator for State Estimation in the Presence of Dynamical Stochastic Bias," *Proceedings of 1992 American Control Conference*, Chicago, Illinois, June 1992.
15. Dela Cruz, E. J., Alouani, A. T., Blair, W. D., and Rice, T. R., "Estimation of Tilt Errors in Multisensor Systems," *Proceedings of IEEE Southeastcon' 92*, Birmingham, Alabama, April 1992.
16. Dela Cruz, E. J., Alouani, A. T., Rice, T. R., and Blair, W. D., "Estimation of Sensor Bias in Multisensor Systems," *Proceedings of IEEE Southeastcon' 92*, Birmingham, Alabama, April 1992.
17. Alouani, A. T., Xia, P., Rice, T. R., and Blair, W. D., "A Two-Stage Kalman Estimator for State Estimation in the Presence of Random Bias and Tracking Maneuvering Targets," *Proceedings 30th IEEE Conference on Decision and Control*, Brighton, United Kingdom, December 1991, pp. 2059-2062.
18. Alouani, A. T., and Blair, W. D., "Use of Kinematic Constraint in Tracking Constant Speed, Maneuvering Targets," *Proceedings 30th IEEE Conference on Decision and Control*, Brighton, United Kingdom, December 1991, pp. 2055-2058.

Conference Presentations with Proceedings (non-refereed)

1. Kerce, J. C., Blair, W. D., and Brown, G. C. "Modeling Refraction Errors for Simulation Studies for Multisensor Tracking," *Proceedings of 36th IEEE Southeastern Symposium on System Theory*, Atlanta, Georgia, March 14-16, 2004, pp. 97-101.
2. Ogle, T L., Blair, W. D., Levin, T.J., and Harrigan, K. W., "Multiplatform-Multisensor Tracking with Surveillance Radars," *Proceedings of 36th IEEE Southeastern Symposium on System Theory*, Atlanta, Georgia, March 14-16, 2004, pp. 190-194.
3. Chiarfair, D., Blair, W. D., and West, P. D., "Implementation of a 3-D Assignment Algorithm in Matlab," *Proceedings of 36th IEEE Southeastern Symposium on System Theory*, Atlanta, Georgia, March 14-16, 2004, pp. 200-204.
4. Blair, W. D., and Brandt-Pearce, M., "Effects of Diffuse Multipath on Monopulse Measurements," to appear in *Proceeding of 2001 IEEE Radar Conference,* Atlanta, Georgia, May 2001.
5. Brown, G. C., Blair, W. D., and Diaz, D. A., "Track Management Technique for Electronically Scanned Radars," in *Signal and Data Processing for Small Targets 2000, SPIE 4048*, Orlando, Florida, pp. 203-210 (2000).
6. Blair, W. D., and Brandt-Pearce, M., "Monopulse DOA Estimation for Two Unresolved Rayleigh Targets," in *Signal and Data Processing for Small Targets 1990, SPIE 3809*, Denver, Colorado, pp. 396-408 (1999).
7. Blair, W. D., and Brandt-Pearce, M., "Statistics of Monopulse Measurements for Tracking Targets in the Presence of Sea-Surface Induced Multipath," *Proceedings of 1998 IEEE Aerospace Conference,* Snowmass, Colorado, March 1998.

8. Blair, W. D., and Brandt-Pearce, M. “Tracking Multiple Unresolved Rayleigh Targets With a Monopulse Radar,” in *Signal and Data Processing for Small Targets 1996, SPIE 2759*, Orlando, Florida, pp. 465-476 (1996).
9. Blair, W. D., and Brandt-Pearce, M., “Radar Waveform Requirements for Reliable Detection of an Aircraft-Launched Missile,” in *Acquisition, Tracking, and Pointing X, SPIE 2739*, Orlando, Florida, pp. 145-155 (1996).
10. Chen, R. and Blair, W. D., “Optimal Measurement Scheduling for Track Accuracy Control for Cued Target Acquisition,” in *Signal and Data Processing for Small Targets 1996, SPIE 2759*, Orlando, Florida, pp. 406-417, (1996).
11. Blair, W. D., and Brandt-Pearce, M., “Signal Amplitude Conditioned Density Function for Monopulse Measurements of Fixed-Amplitude Targets,” *Proceedings 1996 IEEE National Radar Conference*, Ann Arbor, Michigan, May 13-16,1996, pp. 374-379.
12. Conte, J. E., Groves, G. W., and Blair, W. D., “Low Elevation Monopulse Radar and Tracking Simulation (LEMRATS),” in *Acquisition, Tracking, and Pointing X, SPIE 2739*, Orlando, Florida, pp. 133-144 (1996).
13. Watson G. A., and Blair, W. D., “Solution To Second Benchmark Problem for Tracking Maneuvering Targets In the Presence of False Alarms and ECM,” in *Signal and Data Processing of Small Targets 1995, SPIE 2561*, San Diego, California, pp. 263-274 (1995).
14. Groves, G. W., Blair, W. D., and Conte, J. E., “Simultaneous Estimation of the Specular Sea Reflection Coefficient and Tracking for Low-Elevation Targets,” in *Signal and Data Processing of Small Targets 1995, SPIE 2561*, San Diego, California, pp. 287-298 (1995).
15. Watson G. A., and Blair, W. D., “Revisit Control of a Phased Array Radar for Maneuvering Targets In the Presence of False Alarms Using the IMM-IPDAF,” in *Proceedings of the Acquisition, Tracking, and Pointing IX, SPIE 2468*, Orlando, Florida, pp. 318-329 (1995).
16. Hoffman S. A., and Blair, W. D., “Interacting Multiple Model Algorithm for Tracking Maneuvering Targets With a Phased Array Radar for Command-All-The-Way Intercepts,” *Proceedings of 1994 National Fire Control Symposium*, Boulder, Colorado, August 1994.
17. Blair, W. D., “Toward the Integration of Tracking and Signal Processing for Phased Array Radar,” in *Signal and Data Processing for Small Targets 1994, SPIE 2235*, Orlando, Florida, pp. 303-316 (1994).
18. Watson, G. A., and Blair, W. D., “Revisit Control of a Phased Array Radar for Tracking Maneuvering Target When Supported by a Precision ESM Sensor,” in *Signal and Data Processing for Small Targets 1994, SPIE 2235*, Orlando, Florida, pp. 448-459 (1994).
19. Helmick, R. E., Conte, J. E., Hoffman, S. A., and Blair, W. D., “One-Step Fixed-Lag IMM Smoothing for Alignment of Asynchronous Sensors,” in *Signal and Data Processing for Small Targets 1994, SPIE 2235*, Orlando, Florida, pp. 507-518 (1994).
20. Watson, G. A. and Blair, W. D., “IMM Algorithm for Solution To Benchmark Problem for Tracking Maneuvering Targets,” in *Proceedings of the Acquisition, Tracking, and Pointing IX, SPIE 2221*, Orlando, Florida, pp. 476-488 (1994).
21. Watson, G. A., and Blair, W. D., “Comparison of Track Loss Performance of Single and Multiple Model Tracking Algorithms,” in *Proceedings of the Acquisition, Tracking, and Pointing IX, SPIE 2221*, Orlando, Florida, pp. 489-500 (1994).
22. Watson, G. A., and Blair, W. D., “ Tracking Performance of a Phased Array Radar Control With Revisit Time Controlled Using the IMM Algorithm,” *Proceedings of IEEE 1994 National Radar Conference*, Atlanta, Georgia, March 1994.
23. Helmick, R. E., Blair, W. D., and Hoffman, S. A., “Trajectory Reconstruction Using Fixed-Interval Smoothers for Systems with Markovian Switching Coefficients,” *Proceedings of 1993 Symposium on Command and Control Research*, National Defense University, Ft. NcNair, Washington, DC, June 1993.
24. Watson, G. A., and Blair, W. D., “Multiple Model Estimation for Control of a Phased Array Radar,” in *Signal and Data Processing of Small Targets 1993, SPIE 1954*, Orlando, Florida, pp. 275-286 (1993).
25. Watson, G. A., and Blair, W. D., “Tracking with Multiple Sensors Using the Interacting Multiple Model Algorithm,” in *Signal and Data Processing of Small Targets 1993, SPIE 1954*, Orlando, Florida, pp. 438-449, (1993).

26. Blair, W. D., and Watson, G. A., “Tracking Maneuvering Targets with the Second Order Multiple Model Algorithm,” in *Signal and Data Processing of Small Targets 1993, SPIE 1954*, Orlando, Florida, pp. 518-529 (1993).

27. Groves, G. W., Blair, W. D., and Gray, J. E., “Some Concepts for Trajectory Prediction for Maneuvering Targets,” *Proceedings of 1992 Symposium on Command and Control Research*, Monterey, California, June 1992.

28. Blair, W. D., and Watson, G. A., “The IMM Algorithm and Periodic Data,” in *Acquisition, Tracking, and Pointing VI, SPIE 1697*, Orlando, Florida, pp. 83-91 (1992).

29. Blair, W. D., Rice, T. R., McDole, B. S., and Sproul, E. M., “A Least-Squares Approach to Asynchronous Data Fusion,” in *Acquisition, Tracking, and Pointing VI*, SPIE 1697, Orlando, Florida, pp. 130-141 (1992).

30. Watson, G. A., and Blair, W. D., “The IMM Algorithm for Tracking Targets That Maneuver Through Coordinated Turns,” in *Signal and Data Processing of Small Targets 1992, SPIE 1698*, Orlando, Florida, pp. 236-247 (1992).

31. Dela Cruz, E. J., Alouani, A. T., Rice, T. R., and Blair, W. D., “Sensor Registration in Multisensor Systems,” in *Signal and Data Processing of Small Targets 1991, SPIE 1698*, pp. 382-393 (1992).

32. Alouani, A. T., Xia, P., Rice, T. R., and Blair, W. D., “Two-Stage Kalman Estimator for Tracking Maneuvering Targets,” *Proceedings of 1991 IEEE International Conference on Systems, Man, and Cybernetics*, Charlottesville, Virginia, October 1991, pp. 761-766.

33. Blair, W. D., and Parker, J. D., “Use of Target-Oriented Process Noise in Tracking Maneuvering Targets,” *Proceedings of 29th Allerton Conference on Communication, Control and Computing*, Monticello, Illinois, October 1991.

34. Blair, W. D.,“A Two-Stage Alpha, Beta, Gamma Estimator,” *Proceedings of 29th Allerton Conference on Communication, Control and Computing*, Monticello, Illinois, October 1991.

35. Blair, W. D., and Boyd, M. D., “Two-Stage Alpha, Beta, Gamma Estimator for Tracking Maneuvering Targets With a Radar,” *Proceedings of 1991 Symposium on Command and Control Research*, National Defense University, Ft. NcNair, June 1991.

36. Alouani, A. T., Blair, W. D., and Rice, T. R., “On Multi-Sensor Data Fusion,” *Proceedings of The International Association the Science and Technology of Development (IASTED), International Symposium on Manufacturing and Robotics*, Lugano, Switzerland, June 1991.

37. Blair, W. D., Watson, G. A., and Rice, T. R., “Interacting Multiple Model Filter for Tracking Maneuvering Targets in Spherical Coordinates,” *Proceedings of IEEE Southeastcon'91*, Williamsburg, Virginia, April 1991, pp. 1055-1059.

38. Blair, W. D., Rice, T. R., Alouani, A. T., and Xia, P., “Asynchronous Data Fusion for Target Tracking with a Multi-Tasking Radar and Optical Sensor,” in *Acquisition, Pointing, and Tracking V, SPIE 1482*, Orlando, Florida, pp. 234-245 (1991).

39. Blair, W. D., Watson, G. A., and Rice, T. R., “Tracking Maneuvering Targets with an Interacting Multiple Model Filter Containing Exponentially-Correlated Acceleration Models,” *Proceedings of 23rd Southeastern Symposium on System Theory*, Columbia, South Carolina, March 1991, pp. 224-228.

40. Blair, W. D., Gray, J. E., and Boyd, M. D., “Design Analysis for Two-Stage Alpha, Beta, Gamma Estimator,” *Proceedings of IEEE Southeastcon'91*, Williamsburg, Virginia, April 1991, pp. 1049-1054.

41. Blair, W. D., Watson, G. A., and Alouani, A. T., “Tracking Constant Speed Targets Using a Kinematic Constraint,” *Proceedings of 23rd Southeastern Symposium on System Theory*, Columbia, South Carolina, March 1991, pp. 233-238.

42. Alouani, A. T., Blair, W. D., and Watson, G. A., “Bias and Observability Analysis of Target Tracking Filters Using a Kinematic Constraint,” *Proceedings of 23rd Southeastern Symposium on System Theory*, Columbia, South Carolina, March 1991, pp. 229-232.

43. Watson, G. A., and Blair, W. D., “Constant Speed Prediction for Maneuvering Targets Using a Three Dimensional Turning Rate,” *Proceedings of 23rd Southeastern Symposium on System Theory*, Columbia, South Carolina, March 1991, pp. 239-243.

44. Blair, W. D., Conte, J. E., and Rice, T. R., "Distortion Analysis of Signals Recovered Using Cepstral Processing," *Proceedings of 1991 Conference on Information Sciences and Systems*, March 1991.
45. Rice, T. R., Gray, J. E., and Blair, W. D., "Signal Distortions That Result from Minimum Phase Signal Recovery Using Cepstral Processing," *Proceedings of 23rd Southeastern Symposium on System Theory*, Columbia, South Carolina, March 1991.
46. Blair, W. D., Boyd, M. D., and Gray, J. E., "Target Tracking for Multi-Radar Target Modulation Identification," *Proceedings of 1990 U.S. DoD Joint Service Combat Systems Identification Conference*, Monterey, California, December 1990.
47. Blair, W. D., and Anderson, J. N., "Kinematic, Dynamic, and Actuator Model Definitions for the Hitachi HPR10II Process Robot," *Proceedings of SDRC I-DEAS Users' Conference*, October 1987, pp. 39-51.
48. Blair, W. D., and Anderson, J. N., "Identification of the Kinematic, Dynamic, and Actuator Parameters for the Hitachi HPR10II Process Robot," *Proceedings of 19th Southeastern Symposium on System Theory*, March 1987, pp. 447-452.

Conference Presentations without Proceedings

1. "Multiplatform-Multisensor Tracking Architectures and Technical Issues," Third ONR/GTRI Workshop on Target Tracking and Sensor Fusion, Atlanta, Georgia 2000.
2. "Technical Issues and Recent Advances in Target Tracking," Second ONR/GTRI Workshop on Target Tracking and Sensor Fusion, Atlanta, Georgia 1999.
3. "NSWC Tracking Benchmark II: Radar Resource Allocation and Tracking Maneuvering Targets in the Presence of ECM," ONR/GTRI Workshop on Target Tracking and Sensor Fusion, Atlanta, Georgia 1998.
4. "Technical Issues in Target Tracking," Office of Naval Research Workshop on Target Tracking, Dahlgren, Virginia, 1997.
5. "Technical Issues in Target Tracking," Office of Naval Research Workshop on Target Tracking, San Diego, California, 1995.
6. "Use of Kinematic Constraints in Tracking Maneuvering Targets through Coordinated Turns," Office of Naval Research Workshop on Target Tracking, China Lake, California, 1994.
7. Second Navy Research and Development (R&D) Information Exchange Conference, Naval Weapons Center, China Lake, California, 1991.

Evidence of Technical Accomplishment

US Navy Direction to Contractors: Formulated the concept and directed the development of the hardware/software and execution of a real-time experiment, documented in Section F (Published Papers (non-refereed) #2) that resulted in the US Navy directing the contractors of a new phased array radar to use the advanced algorithms demonstrated in the experiment.

Software: Formulated the concept and directed the implementation of the software for the NSWC Tracking Benchmark II, documented in Section F (Published Papers (non-refereed) #4) and Section E (Published Papers (refereed) #3). Approximately 100 requests from throughout the world have been made for the software.

Research Recognition Awards

2001 IEEE Young Radar Engineer of the Year, 2001.

Outstanding Independent Exploratory Development Project, Naval Surface Warfare Center, Dahlgren Division, 1994.

Nominated, *1992 NSWC Science and Technology Award*, Naval Surface Warfare Center, Dahlgren Division, 1992.

Technical Excellence Award, "Significant, original contributions made in the field of target tracking and trajectory prediction which will enable a naval fire control system to better engage fast, highly maneuvering targets," Naval Surface Warfare Center, Dahlgren Division, July 1991.

TEACHING/INSTRUCTION/STUDENT DEVELOPMENT

A. Continuing Education Courses Taught

Lecturer, *Target Tracking in Sensor Systems,* Georgia Institute of Technology, September 2002-2004.

Lecturer, *Principles of Modern Radar,* Continuing Education, Georgia Institute of Technology, November 1998-2003.

Lecturer, *Space-Based Radar,* Continuing Education, Georgia Institute of Technology, 2000-2003.

Lecturer, *Phased-Array Radar System Design,* Continuing Education, Georgia Institute of Technology, April 2000-2003.

Lecturer, *Surveillance, Low Observables, and Tracking: Algorithm Selection and Real Data Applications,* UCLA Extension, University of California, Los Angeles, California, January 1998.

Lecturer, *Surveillance, Tracking, and Fusion: Algorithms and Real Data Applications,* UCLA Extension, University of California, Los Angeles, California, January 1993-1994.

B. Curriculum and/or Short Course Development

Organizer and Coordinator, *Target Tracking in Sensor Systems,* Georgia Institute of Technology, September 2002-2004.

D. Individual Student Guidance/Development

1. Graduate Research Assistants and/or Co-op students trained.

Winnie Wong, MS in EE, GRA

Winnie conducted theoretical analysis of stochastic systems and developed closed-form expressions for the steady-state Kalman filter gains for tracking LFM radar waveforms. She also conducted a first-order analysis of the radar requirements for autonomous landing of an aircraft on an aircraft carrier. A technical memorandum on the landing problem was written and included in the final report to the US Navy. Publications include Section H (Invited Conference Paper #1) and Section E (Journal Paper (referred) #2).

Daniel A. Diaz, BS in Computer Engineering, Co-op

Danny developed the Composite Track Plotter and software tools for the JCTN Benchmark Software that is distributed to numerous companies and laboratories throughout the defense industry. Danny also made significant contributions to the testing of advanced tracking techniques. Publication is given by Section J (Conference Presentations with Proceedings (non-refereed) #2).

SERVICE

A. Professional Activities

Member, Institute of Electrical and Electronics Engineers,
- Student Member, 1982-1986
- Member, 1987-1997
- Senior Member, 1997-2001
- Fellow Member, 2001-Present

Member, IEEE Aerospace and Electronic Systems Society, 1991-Present
Member, IEEE Information Theory Society, 1994-Present
Member, IEEE Control Systems Society, 1985-1999
Member, IEEE Engineering Education Society, 1991-Present
Member, Association of Old Crows, 1994-2000
Member, Board of Directors, International Society for Information Fusion, 2004-2006.
President, International Society for Information Fusion, 2005.
General Chair, 36th IEEE Southeastern Symposium on Systems Theory, 2004.
Steering Chair, Fifth International Conference on Information Fusion, 2002.
Co-Chair, Technical Program Committee, IEEE Radar Conference, 2001

Member, Technical Program Committee, IEEE Southeastern Symposium on Systems Theory, 1997

Member, Technical Program Committee, IEEE Conference on Decision and Control, 1995

Organizer and Coordinator NSWCDD Estimation and Control Working Group, 1992-93

Committee, Technical Program Committee Member, NSWCDD Data Fusion Symposium, 1994

B. On-Campus Committees

Graduate Advisory Committee, Jenelle Armstrong Piepmeier, Ph.D. in ME, "A Dynamic Quasi-Newton Method for Model Independent Visual Servoing," Georgia Institute of Technology, 1999.

C. Outside Professional Activities/Consulting

Engineering consultant in the area of multitarget-multisensor target tracking, Applied Physics Laboratory of The Johns Hopkins University, 1998-Present

Engineering consultant in the area of multitarget-multisensor target tracking, Raytheon Systems Company, 1999-Present.

Graduate Committee Member, P. Xia, MS in EE, Tennessee Technological University, 1994.

Graduate Committee Member, E. J. Dela Crus, MS in EE, Tennessee Technological University, 1994.

D. Civic Activities

Coach, U-6 Soccer, Southwest Cobb Soccer League, Spring and Fall, 2000.

Coach, U-10 Basketball, Northwest Cobb YMCA, Winter, 2002.

Coach, U-8 and U-12, Basketball, Northwest Cobb YMCA, Winter, 2004.

OTHER CONTRIBUTIONS

A. Seminar Presentation

1. "Multiplatform-Multisensor Tracking," DERA Portsdown, Portsmouth, United Kingdom, September 2000.
2. "Derivation of the Interacting Multiple Model Algorithm for Systems with Markovian Switching Coefficients," Applied Physics Laboratory, The Johns Hopkins University, Laurel Maryland, September 1999.
3. "Derivation of the Probabilistic Data Association Filter," Applied Physics Laboratory, The Johns Hopkins University, Laurel Maryland, September 1999.
4. "Information-Based Radar Resource Allocation," Atlanta Chapter of the IEEE Aerospace and Electronic Systems Society, Smyrna, Georgia, November 1997.
5. "Recent Accomplishments and Future Directions in Target Tracking," *Fall 1998 EE Eminent Speaker Series,* University of Buffalo, State University of New York, December 1998.
6. "Tracking Maneuvering Targets Through Coordinated Turns," Electrical and Systems Engineering Department Colloquium, University of Connecticut, Storrs, Connecticut, September 1991.

B. Special Activities

Founder/Coordinator of the ongoing series of the *ONR/GTRI Workshop on Target Tracking and Sensor Fusion.* Under the sponsorship of ONR, GTRI host the first three of these workshops at the Cobb County Facility. The *Fourth ONR/GTRI Workshop on Target Tracking and Sensor Fusion* was hosted by Naval Post Graduate School in Monterey, California. The *Fifth ONR/GTRI Workshop on Target Tracking and Sensor Fusion* was hosted by Naval Underwater Warfare Center in Newport, Rhode Island. The *Sixth ONR/GTRI Workshop on Target Tracking and Sensor Fusion* was hosted in San Diego, California. The *Seventh ONR/GTRI Workshop on Target Tracking and Sensor Fusion* will be hosted in Key West, Florida.

V. NATIONAL AND INTERNATIONAL PROFESSIONAL RECOGNITION

A. Honors and Awards

Panel Member, *Future Directions in Data Fusion*, Plenary Session, 2nd International Conference on Information Fusion, Paris, France, July 2000.

Senior Member, Institute of Electrical Engineer, 1997

B. Invited Conference Session Chairmanships

Co-Organizer, Co-Chair, Invited Session,
32nd Southeastern Symposium on Systems Theory, 2000
31st Southeastern Symposium on Systems Theory, 1999
1995 American Control Conference
1994 American Control Conference
1992 American Control Conference

C. Patents

1. Alouani, A. T., Blair, W. D., and Rice, T. R., Two-Stage Target Tracking System, No. 5,214,433, May 25, 1993.
2. Blair, W. D., Watson, G. A., and Rice, T. R., Interacting Multiple Bias Model Filter System for Tracking Maneuvering Targets, No. 5,325,098, June 28, 1994.

D. Editorial and Reviewer Work for Technical Journals

Founding Editor-in-Chief, Journal of Advances in Information Fusion, 2005-Present.

Editor-in-Chief, IEEE Transactions on Aerospace and Electronic Systems, 1999-2006.
Deputy Editor-in-Chief, IEEE Transactions on Aerospace and Electronic Systems, 1998
Editor for Radar Systems, IEEE Transactions on Aerospace and Electronic Systems, 1997-1999

E. Technical Reviewer

IEEE Transactions on Automatic Control, 1993, 1995, 1996
IEEE Transactions on Aerospace and Electronic Systems, 1993-2000
IEEE Conference on Decision and Control, 1994-98
IEEE Conference on Decision and Control, 1991-92

F. Membership on Boards National Committees. etc,

Board of Governors, IEEE Aerospace and Electronic Systems Society, 1998-2003.

VI. PROFESSIONAL DEVELOPMENT

Short courses attended:

Military Data Fusion, 2000
Theater Missile Defense, 1998
Spread Spectrum Communications, 1996
Electronic Warfare, 1996
Introduction C Programming, 1996
Phased Array Radar Systems, 1995
Monopulse Radar, 1994
Coherent Radar Performance Estimation, 1993
Passive Surveillance and Target Tracking, 1991
Multitarget/Multisensor Tracking, 1987