

**Mark A. Richards**  
**Principal Research Engineer and Adjunct Professor**  
**School of Electrical and Computer Engineering**

**EDUCATIONAL BACKGROUND:**

Degree	Year	University	Field
Ph.D.	1982	Georgia Institute of Technology	Electrical Engineering
M.S.	1976	Stanford University	Electrical Engineering
B.E.E.	1974	Georgia Institute of Technology	Electrical Engineering

**EMPLOYMENT HISTORY:**

Title	Organization	Years
Principal Research Engineer and Adjunct Professor	Georgia Institute of Technology, School of Electrical and Computer Engineering	2002-present
Principal Research Engineer and Adjunct Professor, ECE	Georgia Institute of Technology, Georgia Tech Research Institute	1993-2001
Program Manager	U.S. Defense Advanced Research Projects Agency (IPA assignment from Georgia Tech)	1993-1995
Senior Research Engineer	Georgia Institute of Technology, Georgia Tech Research Institute	1988-1993
Senior Scientist	Lockheed Aeronautical Systems Company	1985-1988
Research Engineer II	Georgia Institute of Technology, Georgia Tech Research Institute	1982-1988
Member of the Technical Staff	ESL, Inc.	1975-1976

**CURRENT FIELDS OF INTEREST:**

Radar signal processing, high performance embedded computing, and digital signal processing.

**QUALIFICATION STATEMENT:**

Dr. Richards is currently a Principal Research Engineer and Adjunct Professor in the School of Electrical and Computer Engineering (ECE), Georgia Institute of Technology, engaged in academic and continuing education teaching and course development in the fields of digital signal processing and radar signal processing; research in radar signal processing and high performance embedded computing; and research market development and analysis. Prior to joining ECE, he was a Principal Research Engineer and Chief of the Radar Systems Division (2000-2001) and Head of the Signal Processing Branch (1995-1999) in the Sensors and Electromagnetic Applications Laboratory of the Georgia Tech Research Institute. As Radar Systems Division Chief, Dr. Richards managed a group of approximately 40 engineers, scientists, technicians, and administrative personnel. From 1993 to 1995, he served under the Intergovernmental Personnel Act (IPA) program as a Program Manager for Advanced Signal Processing in the Electronic Systems Technology Office of the Advanced Research Projects Agency (ARPA) with responsibility for direction of the \$150 million Rapid Prototyping of Application Specific Signal Processors (RASSP) program, an ARPA/Tri-Service effort to develop new computer-aided design (CAD) tools,

processor architectures, and design and manufacturing methodologies for embedded signal processors. Responsibilities included obtaining, defending, and managing program budget; determining program technical direction and strategy; solicitation and evaluation of research proposals; management of the tri-Service support team; and development of new program concepts for ARPA. From 1988 to 1993, Dr. Richards was Head of the Signal Processing Branch in the Modeling and Analysis Laboratory of the Georgia Tech Research Institute, involved in internal and external research in digital signal processing for radar systems. Research topics included Doppler beam sharpening and deconvolution-based radar resolution enhancement techniques, real-aperture imaging radar for landing systems, airborne MTI, airborne windshear detection by radar, radar processor architecture, and sonar signal classification using fractal techniques. The windshear processor work led to a NASA Group Achievement Award in 1993. At Lockheed from 1985-1988, he developed a data acquisition system for tower testing of an imaging MMW radar and radiometer, developed novel techniques for obtaining superresolution with noncoherent or forward-looking sensors, and led the architectural design team for a VHSIC-class fast Fourier transform VLSI chip. He also chaired the Lockheed Corporate Signal Processing Task Force in 1987. At Georgia Tech during the period 1982-1985, Dr. Richards was project manager for a series of contracts related to millimeter wave seeker systems. He also developed signal processor loss budgets and waveform requirements for a large ground-based phased array radar system, and evaluated high resolution stationary target identification algorithms and analyzed Doppler spectrum characteristics of moving ground targets for identification potential. From 1975-1976 he was at ESL, Inc., where he updated and revised simulations of emitter classification algorithms and developed computer models of RF activity environments.

Dr. Richards is the editor-in-chief of the text *Principles of Modern Radar, volume 1: Basic Principles* (SciTech Publishing, 2010), and the author of the text *Fundamentals of Radar Signal Processing* (McGraw-Hill, 2005), as well as co-editor or contributor to four other books. He is the co-developer and lecturer of ECE6272, “Fundamentals of Radar Signal Processing” as well as the co-developer of and lecturer in the Georgia Tech short courses “Fundamentals of Radar Signal Processing” and “Fundamentals of Synthetic Aperture Radar Signal Processing”, and the sole developer of the short course “Signal Processing Refresher”. Dr. Richards served as Finance Chair of the 2006 IEEE International Conference on Image processing and previously served as General Chair of the IEEE 2001 Radar Conference. He is a past Associate Editor of the IEEE *Transactions on Image Processing* and the IEEE *Transactions on Signal Processing*. Dr. Richards is also a past Chairman of the Atlanta Section of the IEEE.

## **I. RESEARCH AND CREATIVE SCHOLARSHIP**

### **A. Research Program Development**

Since 1995, Dr. Richards has developed and maintained a continuing program of research and development of metrics and software standards for embedded high performance signal processors and computers. The effort began with benchmarking for the US Navy Tactical Advanced Signal Processor program in 1995. This led to participation in development and maintenance of the Vector-Signal-Image Processing Library (VSIPL) open standard and participation in the development of the Morphware Stable Interface standards under DARPA’s Polymorphous Computing Architectures program. This work subsequently expanded to include programming approaches for heterogeneous embedded machines and application of graphical processing units and multicore processors to defense applications. More recently, it has evolved into a significant role in a series of DARPA-sponsored planning effort sfor future “extreme scale” computing hardware and software. Much of this research is conducted jointly with the Georgia Tech Research Institute. In the early 1990’s, Dr. Richards led the initial research at GTRI into the effects of coherent radar countermeasures and the development of appropriate counter-countermeasures, especially as regards imaging radars. This area has since grown into and continues as a significant ongoing GTRI experimental and analytical research program.

## B. Research Proposals and Contracts/Grants Funded (PI)

*Note: Records no longer available for proposals prior to 1990*

Title	Sponsor	Date Submitted	Co-PIs	Amount Requested	Result	Funding Level
<i>External Proposals</i>						
Windshear Radar and Signal Data Processor, Phase II	NASA LaRC	1991		\$110,556	Funded	\$110,556
SAR Vulnerability	AFRL	1991		\$150,000	Funded	\$150,000
Windshear Phase III	NASA LaRC	1991		\$134,786	Funded	\$134,786
NASA MMW Task Force	NASA LaRC			\$25,028	Funded	\$25,028
Windshear Supplement	NASA LaRC	1992		\$9,000	Funded	\$9,000
Windshear Modification	NASA LaRC	1992		\$50,000	Funded	\$50,000
Expert Science – Signal Processing	AFRL – Rome	1992		\$3.3M ceiling task order contract	Procurement cancelled	
SAR Surveillance Technology Assessment		1992		\$149,876	Rejected	
IPA Assignment for Mark Richards	ARPA	1993		\$278,700	Funded	\$278,700
DSP Benchmarking	NAVSEA	1995		\$200,000	Funded	\$200,000
TASP	NAVSEA	1996		\$400,00	Funded	
AART	AFRL	1997		\$1,500,000	Funded	\$1,260,000
AART Modification	AFRL	1998		\$1,272,000	Rejected	
MMW Targeting & Imaging Sensor	Northrop-Grumman (DARPA prime)	Aug 98		\$35,000	Funded	\$35,000
Research in EM Systems	NASA LaRC	Nov. 98	Byron Keel	Task order contract, \$8M ceiling	Awarded	
STC Tech	DARPA	Dec. 98		Task order contract	Awarded	
TASP/VSIP FY00 Support	NAVSEA	2000		\$32K	Funded	\$32K
TASP/VSIP FY01 Support	NAVSEA	2000		\$176K	Funded	\$176K
Polymorphous Computing Architectures Morphware Stable Interface Facilitation	DARPA	2001		\$478K	Funded	\$478K
ERFT/SAD	AFRL	2001		\$522K	Funded	\$522K
High Performance Embedded Computing Software Initiative Support	MIT/LL (HPCMO prime)	2001		\$69K	Funded	\$69K

<b>Title</b>	<b>Sponsor</b>	<b>Date Submitted</b>	<b>Co-PIs</b>	<b>Amount Requested</b>	<b>Result</b>	<b>Funding Level</b>
Polymorphous Computing Architectures Morphware Stable Interface Facilitation, Phase II	DARPA	2003	Dan Campbell	\$600K	Funded	\$600K
DURIP proposal, "RAPIDLY RECONFIGURABLE HIGH PERFORMANCE COMPUTING CLUSTER"	AFOSR	2003		\$186K	Funded	\$186K
Living Framework Forum Facilitation Planning	DARPA	2004	Dan Campbell	\$200K	Funded	\$200K
Programming Methodology for High Performance Applications on Tiled Architectures	DARPA	2005	Dan Campbell	\$425K	Funded	\$425K
Network Centricity for Weapon Locating Radar	Techrizon	2007		\$145K	Funded	\$145K
ExaScale Computing Study (with 3 subsequent additions)	DARPA	2007 - 2009	Dan Campbell	\$3.1M	Funded	\$3.1M
Nontraditional Clutter Rejection in Weapon Locating Radar	Techrizon	2008		\$157K	Funded	
Signal & Image Processing (with GPUs)	SAIC	2009	Dan Campbell	\$60K	Funded	\$60K
Extreme Scale Applications Study	DARPA	2010	Dan Campbell	\$500K + \$300K option	Funded	\$500K
<b><i>Internal Proposals</i></b>						
GIT/DARPA Research Promotion	Georgia Tech Vice-Provost for Research & GTRI/BDO	Annually, FY 1995 – 2009 (15 years)	Bill Ballard (since 1997)	Varied from \$85K to \$119K	Funded	Varied from \$85K to \$119K

**C. Research Contracts/Grants (Contributor)**

*Note: Records no longer available for proposals prior to 1990*

<b>Title</b>	<b>Sponsor</b>	<b>Date Submitted</b>	<b>PI</b>	<b>Amount Requested</b>	<b>Result</b>	<b>Funding Level</b>
<b><i>External Proposals</i></b>						
HBCU CECOM BAA	US Army CECOM	1991	CAU	\$23,000	Funded	\$23,000
SAR ECCM PRDA	AFRL	1992		\$86,500	Funded	\$86,500
Synthetic Vision Flight Test	FAA	1991	Walter Horne	\$309,558	Funded	\$309,558
Periscope Detection	US Navy	1991	Michael Tuley	\$718,779	Rejected	
High Resolution Sonar	NCSS	1992	Chris Barnes	\$239,232	Funded	\$239,232

Title	Sponsor	Date Submitted	PI	Amount Requested	Result	Funding Level
Air-to-Air Mocomp	AFRK	1995		\$75,000	Funded	\$75,000
ASIC Verification	USAF WRALC	1995	Linda Harkness	\$600,000	Funded	
Target Chips	DARPA	1996	James Sangston	\$700,000	Funded	
RF Tags	Northrop-Grumman (DARPA prime)	1998	Jay Saffold	\$510,000	Funded	\$160,000
NASA Langley Task Order Contract rebid	NASA LaRC	2001	Glenn Hopkins	\$22.6M ceiling	Awarded	
High Performance Embedded Computing Software Initiative (HPEC-SI) Support	CACI (HPCMO Prime)	2002	Dan Campbell	\$69K	Funded	\$69K
DURIP proposal, "RAPIDLY RECONFIGURABLE HIGH PERFORMANCE COMPUTING CLUSTER"	DoD	2002	Dan Campbell	\$187K	Rejected	
High Performance Embedded Computing Software Initiative (HPEC-SI) Support	MIT/LL (HPCMO prime)	2003	Dan Campbell	\$80K	Funded	\$80K
High Performance Embedded Computing Software Initiative (HPEC-SI) Support	MIT/LL (HPCMO prime)	2004	Dan Campbell	\$80K	Funded	\$80K
GPU SVM	AFRL	2005	Dan Campbell	\$129K	Funded	\$129K
<b>Internal Proposals</b>						
Focused Research Program in Critical Systems	Georgia Tech Vice-Provost for Research	1997	Sudha Yalamanchili	\$53,000	Funded	\$53,000
Focused Research Program in Critical Systems Renewal	Georgia Tech Vice-Provost for Research	May 98	Sudha Yalamanchili	\$27,500	Funded	\$27,500

#### **D. Published Books and Parts of Books**

1. "Signal Processor Architecture for Pulse Train Processors," Section 11.7 in F. E. Nathanson, *Radar Design Principles*, 2<sup>nd</sup> edition. McGraw-Hill, New York, 1991.
2. "Nonlinear Effects in Fourier Transform Processing," Chapter 6 in *Coherent Radar Performance* (J. A. Scheer and J. L. Kurtz, editors). Artech House, Norwood, Massachusetts, 1993.
3. "Motion Compensation Fundamentals," Chapter 7 in *Coherent Radar Performance* (J. A. Scheer and J. L. Kurtz, editors). Artech House, Norwood, Massachusetts, 1993.
4. "Doppler Processing," Chapter 8 in G. V. Morris and L. L. Harkness, editors, *Airborne Pulsed Doppler Radar*, 2<sup>nd</sup> edition, Artech House, Norwood, Massachusetts, 1996.

5. "Synthetic Aperture Processing," Chapter 10 in G. V. Morris and L. L. Harkness, editors, *Airborne Pulsed Doppler Radar*, 2<sup>nd</sup> edition, Artech House, Norwood, Massachusetts, 1996.
6. *Rapid Prototyping of Application Specific Signal Processors*, Kluwer Academic Publishers, 1997. (edited, with A. J. Gadiant and G. A. Frank).
7. *Fundamentals of Radar Signal Processing*, McGraw-Hill, 2005.
8. Editor-in-chief, author of 5 chapters, and co-author of 2 chapters, M. A. Richards, J. A. Scheer, and W. A. Holm, editors, *Principles of Modern Radar, volume 1: Basic Principles*, vols. 1 and 2, SciTech Publications, Raleigh, NC, 2010.

#### **E. Published Journal Papers (refereed)**

1. "Constrained Iterative Restoration Algorithms," *Proc. of the IEEE*, vol. 69(4), pp. 432-450, April 1981 (with R. W. Schafer and R. M. Mersereau) (invited)
2. "Application of Deczky's Program for Recursive Filter Design to the Design of Recursive Decimators," *IEEE Trans. on Acoustics, Speech & Signal Processing*, vol. ASSP-30(5), pp. 811-814, October 1982
3. "Helium Speech Enhancement Using the Short-Time Fourier Transform," *IEEE Trans. on Acoustics, Speech & Signal Processing*, vol. ASSP-30(6), pp. 841-853, December 1982
4. "An Iterative Deconvolution Algorithm with Quadratic Convergence," *J. Optical Soc. of America*, series 2, vol. 4(1), pp. 200-207, Jan. 1987 (with C. E. Morris and M. H. Hayes)
5. "Fast Reconstruction of Linearly Distorted Signals," *IEEE Trans. Acoustics, Speech, & Sig Proc.*, pp. 1017-1025, July 1988. (with C. E. Morris & M. H. Hayes)
6. "On the Hardware Implementation of the Split-Radix FFT," *IEEE Trans. Acoustics, Speech, & Sig. Proc.*, vol 36(10), pp. 1575-1581, October 1988.
7. "Interferometric height estimation of the seafloor via synthetic aperture sonar in the presence of motion errors", *IEE Proceedings - Radar, Sonar, and Navigation*, vol. 147, no.6, pp. 322-330, Dec. 2000 (with W. W. Bonifant, Jr. and J. H. McClellan). Awarded the Clarke Griffiths Memorial Premium prize by IEE, July 2002.
8. "Coherent Integration Loss due to White Gaussian Phase Noise," *IEEE Signal Processing Letters*, vol. 10, no. 7, pp. 208-210, July 2003.
9. "A Beginner's Guide to Interferometric SAR Concepts and Signal Processing," *IEEE Aerospace and Electronics Systems Magazine*, Tutorial Issue IV, vol. 22, no. 9, pt. 2, pp. 5-29, September 2007.

#### **F. Submitted Journal Papers**

1. "Chips, Architectures and Algorithms: Reflections on the Exponential Growth of Digital Signal Processing Capability," submitted to *IEEE Spectrum*, November 2005. (with G. A. Shaw)

#### **G. Published Papers and Reports (non-refereed)**

1. "Helium Speech Enhancement Using the Short-Time Fourier Transform," Ph.D. Thesis, Georgia Institute of Technology, March 1982
2. "Battlefield Target Classification and Identification Program (U)," Final Technical Report, DELCS-TR-81-0136-F, Contract DAAK20-81- C-0136, Georgia Institute of Technology, Engineering Experiment Station, October 1982 (with J. D. Echard, L. L. Harkness, and M. Shannon) SECRET
3. "Battlefield Target Classification and Identification Program (U)," Final Technical Report No. 2, Contract DAAK20-81-C-0136, Georgia Institute of Technology, Engineering Experiment Station, December 1982 (with J. D. Echard, L. L. Harkness, and E. O. Rausch) SECRET
4. "Basic Synthetic Aperture Radar Equations for General Geometry," Final Technical Report, Contract DAAH01-A013-0027, Georgia Institute of Technology, Engineering Experiment Station, January 1984.

5. "Radar Seeker Signal Processing Evaluation Methodology," Final Technical Report, Contract DAAH01-83-D-1012-0027, Georgia Institute of Technology, Engineering Experiment Station, January 1984, (with A. H. Green, Jr., R. A. McGee, A. J. Hunton, J. D. Echard, and N. F. Ezquerra) LIMITED
6. "Millimeter Wave Seeker Trade Study and Concept Definition," Final Technical Report, Contract V469-RA-459316, Georgia Institute of Technology, Engineering Experiment Station, May 1984 (with P. P. Britt)
7. "Millimeter-Wave Calibration, Reduction, and Analysis: Analysis of Terrain Countermeasures Effectiveness (U)," Final Technical Report, Contract F08635-82-C-0444, Georgia Institute of Technology, Engineering Experiment Station, July 1984 (with W. A. Holm and E. F. Greneker) SECRET
8. "Non-Cooperative Target Recognition (NCTR) Facility Design Plan: Appendix B: Moving Target ID Algorithm Assessment (U)," Contract DAAK20-83-C-0168, Georgia Institute of Technology, Engineering Experiment Station, August 1984 (with M. N. Cohen and J. D. Echard) SECRET
9. "Large Bandwidth Waveform Considerations and Receiver Loss Budgets for a Phased Array Radar," Special Technical Report No. 4, TIRST.MAR/09254.004, Contract DASG60-83-C-0116, Georgia Institute of Technology, Engineering Experiment Station, September 1984
10. "System Loss Budget Considerations for a Candidate Instrumentation Terminal Imaging Radar (U)," Final Technical Report, Contract DASG60-83-C-0116, Georgia Institute of Technology, Engineering Experiment Station, September 1984 (with C. H. Cash, W. A. Cochrane, L. E. Corey, H. P. Cotten, T. B. Elfe, G. W. Ewell, and E. A. Nelson) SECRET
11. "A Second-Generation Helium Speech Unscrambler Yields Lifelike Sound," *Sea Technology*, vol. 25(12), pp. 25ff., December 1984 (with E. O. Belcher)
12. "Simulation Methodology for Radar Detection of Stationary Targets," Final Technical Report, Contract DAAH01-84-D-A029-0001, Georgia Institute of Technology, Georgia Tech Research Institute, January 1985 (with G. H. Lunsford)
13. "Modeling of Synthetic Aperture Radar for General Geometry," Final Technical Report, Contract DAAH01-83-D-A013-0050, Georgia Institute of Technology, Georgia Tech Research Institute, January 1985 (with G. H. Lunsford, J. D. Echard, and N. F. Ezquerra) LIMITED
14. "Methodology for Assessment and Evaluation of Signal Processing Techniques for Millimeter Wave Radar Seekers," Final Technical Report, Contract DAAH01-83-D-A013-0043, Georgia Institute of Technology, Engineering Experiment Station, July 1984 (with A. H. Green, Jr., A. J. Hunton, R. A. McGee, J. D. Echard, and N. F. Ezquerra). Also published as Guidance and Control Information Analysis Center Report GACIAC SR85-01, Illinois Institute of Technology, January 1985
15. "Millimeter-Wave Calibration, Reduction, and Analysis (Terrain Countermeasures Analysis)," Final Technical Report, Contract F08635-82-C-044, Georgia Institute of Technology, Georgia Tech Research Institute, January 1985 (with J. L. Kaplan)
16. "Design Analysis of an Airborne Instrumentation System," Final Technical Report, Contract DAAH01-88-D-0004-0021, Georgia Institute of Technology, Georgia Tech Research Institute, January 1989 (with J. L. Kurtz, J. A. Scheer, R. G. Pauley, and W. L. Cassaday)
17. "Hardware Limitations on Doppler Beam Sharpening Performance in a Millimeter Wave Seeker," Final Technical Report, Contract DAAH01-88-D-0004, Delivery Order 0009, Georgia Institute of Technology, Georgia Tech Research Institute, January 1989 (with J.A. Saffold, J. A. Scheer, and C. L. Belcher) SECRET
18. "Millimeter Wave Data Reduction and Analysis for Support of System Evaluation (U)," Final Technical Report, Contract DAAH01-87-D-0082-0088, Georgia Institute of Technology, Georgia Tech Research Institute, March 1990. (with C. L. Belcher and P. M. Alexander) SECRET
19. "JSTARS Core System Baseline Description (U), Volumes 1 and 2," Final Technical Report, Contract DAAL01-89-D-0922-0001, Georgia Tech Research Institute *et al*, April 1990. (with N. T. Alexander *et al*) SECRET
20. "Millimetre Wave Data Reproducibility, Comparability and Blending," NATO Defence Research Group Technical Report AC/243 (Panel 3)TR/5, 18 June 1990 (with twelve co-authors) NATO UNCLASSIFIED
21. "Coherent Radar System Performance Theory," Final Technical Report, Senior Technology Guidance Council Project E8904-001, Georgia Tech Research Institute, Georgia Institute of Technology, June 1990 (with J. A. Scheer *et al*)
22. "Airborne Digital Signal Processor Selection," Final Technical Report, Contract 1-414U-4500 TA3, Georgia Institute of Technology, Georgia Tech Research Institute, August 1990.

23. "Real-Time Signal Processor Development," Final Report RTI/4500/02-01F, Contract NAS1-18925, Task 2, Research Triangle Institute, September 1990.
24. "Superresolution in Low Signal-to-Clutter Ratios for Millimeter Wave Seekers," Final Technical Report, Contract F08635-89-C-0271, Georgia Institute of Technology, Georgia Tech Research Institute, June 1990. (with C. F. Barnes, C. L. Belcher, and B. M. Keel). Also published as U.S. Air Force Armament Laboratory Technical Report AFATL-TR-90-62, October 1990.
25. "'Total Recall' Signal Processing," Final Technical Report, Senior Technology Guidance Council Project E8904-040, Georgia Tech Research Institute, Georgia Institute of Technology, November 1990 (with C. F. Barnes, M. J. T. Smith, and M. Kossentini)
26. "Combat Identification Support: Common Non-Cooperative Target Recognition (NCTR) Processor Feasibility Study (U)," Final Technical Report, Contract DAAB07-87-D-P008-0011, Georgia Tech Research Institute, Georgia Institute of Technology, November 1990. (with W. E. VanderMeer, D. B. Merriman, M. N. Cohen, and N. F. Warner) SECRET
27. "Data Management Plan to Support the Posttest Analysis (POTA) of the Radio Electronic Combat Vulnerability Analysis (RVAN) Susceptibility Testing of the Joint STARS Radar," Interim Technical Report, Contract DAAL01-89-D-0922-0001, Georgia Tech Research Institute, December 1990. SECRET
28. "Prime Item Development Specification for the F-15 Radar AN/APG-63(M)," Draft Technical Report, Contract F09603-89-G-0077-0015, Georgia Tech Research Institute, Georgia Institute of Technology, February 1991 (with six co-authors) SECRET
29. "Image Sensor Test Support," Final Technical Report, Lear-Siegler Management Service Corp. Purchase Order A51771-1, Georgia Tech Research Institute, Georgia Institute of Technology, March 1991 (with B. H. Hudson and J. A. Smart)
30. "Critical Item Development Specification for the F-15 Radar Processor AN/APG-63(M)," Draft Technical Report, Contract F09603-89-G-0077-0015, Georgia Tech Research Institute, Georgia Institute of Technology, April 1991 (with L. L. Harkness and E. S. Sjoberg) SECRET
31. "AN/UYS-2 Expanded Application Preliminary Study," Final Technical Report, Contract N60921-87-D-A315, Task 0118, Georgia Tech Research Institute, Georgia Institute of Technology, May 1991 (with W. F. Horne *et al*).
32. "Conventional and Unconventional Electronic Countermeasures to Synthetic Aperture Radars," Final Technical Report, Contract F33615-89-C-1035, Georgia Tech Research Institute, Georgia Institute of Technology, March 1992 (with M. H. Smith and R. Maier).
33. "Updated RVAN Accessibility Test Plan for the Joint STARS Radar," Interim Technical Report, Contract DAAL01-90-D-0037-0006, Georgia Tech Research Institute, Georgia Institute of Technology, December 1992 (with N. T. Alexander, M. S. Clinard, and W. A. Cochrane).
34. "Hardware Limitations on Conventional Moving Target Indication Processing," Final Technical Report, Contract OSP-91-10-668-002, Georgia Tech Research Institute, Georgia Institute of Technology, January 1993 (with F. M. Nesci).
35. "Advanced Microwave Sensing Technology Study for Civil Aviation Atmospheric Hazards," Research Triangle Institute Final Report RTI/4500-023-01F, Contract NAS1-18925, February 1993 (with R. E. Marshall, J. A. Galliano, and J. Montoya). Incorporates Final Report "Need/Benefit Study for Advanced Microwave Sensing Technology for Civil Aviation," Contract 1-414U-4500-TA6, Georgia Tech Research Institute, Georgia Institute of Technology, January 1993 (with J. Galliano).
36. "STAFF In-Process Review Report," Final Technical Report, Contract DAAA21-90-D-0020-0021, Georgia Tech Research Institute, Georgia Institute of Technology, February 1993 (with N. C. Currie, S. O. Piper, J. A. Scheer, and C. R. Barrett, Jr.). SECRET
37. "Radar Hardware Development Analysis," Interim Technical Report, Contract DASG60-92-C-0032, Georgia Tech Research Institute, Georgia Institute of Technology, March 1993 (with M. L. Belcher, J. T. Nessmith, M. A. Mitchell, R. L. Howard, E. A. Nelson, T. V. Wallace, H. M. Harris, and J. A. Saffold).
38. "Computer-Aided Simulation Software for JSTARS MTI Susceptibility Analysis," Final Technical Report, Contract DAAL01-90-D-0037-0006, Georgia Tech Research Institute, Georgia Institute of Technology, March 1993 (with B. M. Keel, M. S. Clinard, and M. H. Smith), SECRET
39. "Fractal Geometry Techniques Applied to Low Frequency Active Sonar Technology," Interim Technical Report, Contract N00039-89-C-0001, Subcontract 605770-0, Georgia Tech Research Institute, Georgia Institute of Technology, August 1993 (with M. J. Willis, J. D. Echard, and J. I. Gostin), SECRET



40. "Wind Shear Radar Signal and Data Processor," vols. I ("Requirements and Preliminary Design") and II ("Hardware and Software Design"), Final Report, NASA contract NAS1-18925, Research Triangle Institute report RTI/4500/018-01F and RTI/4500/018-02F, December 1993 (with J. H. White and M. C. Brinkmann).
41. "Summary of the Joint ARPA/DLA Workshop on Next Generation Technology for Management of Electronic Parts Obsolescence," March 1994 (with J. Christensen).
42. "Simulation Libraries for System-Level Design," *Hot Topics* column, *IEEE Computer*, pp. 76-77, February 1995.
43. "Advances In Rapid Prototyping of Digital Systems," guest editorial, *IEEE Design and Test of Computers*, pp. 9-11, Fall 1996. (with V. K. Madiseti)
44. "The RASSP Program: Origin, Concepts, and Status: An Introduction to the Issue," *J. VLSI Signal Processing*, vol. 15, nos. 1 & 2, pp. 7-27, Jan. 1997 (with A. J. Gadiant, G. A. Frank, and R. Harr).
45. *Report of the Governor's Task Force on Warning and Communication*, Georgia Emergency Management Agency, June 1, 1998 (with 39 co-contributors).
46. "Mobile Artillery Tracking Radar System Concept Design," Final Technical Report, GTRI Project A-5244-500, July 1998 (with J. A. Scheer, R. S. Janka, B. Perry, and T. Spangler).
47. "Affordable Adaptive Radar Technology for Airborne and Space-Based Radars," Annual Tutorial Report, Contract F33615-97-D-1095, Delivery Order 0001, GTRI project number A5573-100, Georgia Tech Research Institute, Georgia Institute of Technology, October 1998 (with W. L. Melvin, F. L. Cox, W. G. Ballard, and B. L. Stevens, T. T. Nguyen and P. A. Day).
48. "Aviation Weather Data Product Investigation," Interim Technical Report, Contract NAS1-99073-1002, GTRI project number A-5990, Georgia Tech Research Institute, Georgia Institute of Technology, August 1999 (with B. M. Keel, C. E. Stancil, C. A. Eckert, and S. M. Brown).
49. "Aviation Weather Data Information Requirements Investigation," Interim Technical Report, Contract NAS1-99073-1002, GTRI project number A-5990, Georgia Tech Research Institute, Georgia Institute of Technology, October 1999 (with B. M. Keel, C. E. Stancil, C. A. Eckert, and S. M. Brown).
50. "An Investigation of Sensor System Uses, Needs, and Requirements for Aviation Weather Information Collection", Interim Technical Report, Contract NAS1-99073-1002, GTRI project number A-5990, Georgia Tech Research Institute, Georgia Institute of Technology, November 1999 (with B. M. Keel and G. G. Gimmestad).
51. "EWxP/AWIN Sensors & Phenomenology Simulation Capability Survey," Informal Technical Report, Contract NAS1-99073-1003, GTRI Project A-6087, Georgia Tech Research Institute, Georgia Institute of Technology, November 1999 (with E. H. Braselman, V. B. Sylvester, W. R. Owens, and W. G. Ballard).
52. "Aviation Weather Information Requirements Study," NASA Contractor Report NASA/CR-2000-210288, Contract NAS1-99073-1003, GTRI Project A-6087, Georgia Tech Research Institute, Georgia Institute of Technology, June 2000 (with B. M. Keel, C. E. Stancil, C. A. Eckert, S. M. Brown, and G. G. Gimmestad).
53. "Radar-Based Tornado Detection Research: Phase 1", Georgia Fiscal Year 2000 Report, GTRI Projects A-5888-300, I-7000-102, & C-5801-200, Severe Storms Research Center, Georgia Tech Research Institute, Georgia Institute of Technology, July 2000 (with J. A. Bruder and V. B. Sylvester)
54. "Naval Radar Electronic Protection Assessment Analysis", Final Technical Report, Contract F33615-95-D-1616-0006, GTRI Project No. A-5243, Tri-Service Electronic Protection Assessment Analysis Program, September 2000 (with S. O. Piper, D. P. Campbell, W. A. Holm, R. S. Janka, A. A. Partizian, K. J. Sangston, J. A. Scheer, and P. D. West)
55. "Radar Electronic Protection (EP) Assessment Analysis", Final Technical Report, Contract F33615-95-D-1616-0012, GTRI Project No. A-5592, Tri-Service Electronic Protection Assessment Analysis Program, Volume I, September 2000, AFRL-SN-WP-TR-2001-1043. (with S. O. Piper, D. P. Campbell, D. G. Erickson, L. L. Gostin, R. A. Maier, A. A. Partizian, E. O. Rausch, K. J. Sangston, G. A. Showman, T. L. Spangler, and P. D. West)
56. "Affordable Adaptive Radar Technology for Airborne and Space-Based Radars", Final Technical Report, Contract F33615-97-D-1095, Delivery Order 0001, GTRI Project No. A-5573, July 2001. (with W. S. Marshall, G. A. Showman, W. L. Melvin, W. G. Ballard, D. A. Leatherwood, F. L. Cox, B. L. Stevens, M. J. Gary, and L. L. Gostin)

57. "Network Centricity for Weapon Locating Radar (WLR)", Final Technical Report, Subcontract 2007-002/01 to Techrizon, GT Project 210667O, December 2007 (with F. F. Shah, A. Kerr, J. H. McClellan, and W. D. Blair).
58. "Nontraditional Clutter Suppression for Weapon Locating Radar", Final Technical Report, Subcontract 2007-002/02 to Techrizon, GT Project 2106AAK, May 2009 (with J. R. Crawford and W. Tinsley)

#### **H. Invited Conference Presentations**

1. "The Rapid Prototyping of Application Specific Signal Processors (RASSP) Program," NASA Strategic Avionics Technology Working Group Meeting, Houston, Texas, July 20-22, 1993. (invited)
2. "Overview and Status of the Rapid Prototyping of Application Specific Signal Processors (RASSP) Program," 1993 Defense Manufacturing Conference, San Francisco, California, November 29 - December 2, 1993. (invited)
3. "Overview of the Rapid Prototyping of Application Specific Signal Processors (RASSP) Program," pp. 385 - 388, *Digest of Papers*, 1994 Government Microcircuit Applications Conference (GOMAC), New Orleans, Louisiana, November 2 - 4, 1993. (invited)
4. "The Rapid Prototyping of Application Specific Signal Processors (RASSP) Program: Overview and Status," pp. 1 - 6, *Proceedings* of the Fifth Intl. Workshop on Rapid System Prototyping, Grenoble, France, June 20 - 23, 1994. (invited)
5. "The Morphware Stable Interface: A Software Framework for Polymorphous Computing Architectures," *Proceedings GOMACTech-03*, vol. 1, pp. 382-385, March 31 - April 3, 2003, Tampa, Florida (invited) (with D. P. Campbell and K. M. Mackenzie).

#### **I. Conference Presentations with Proceedings (refereed)**

1. "An Experimental Study of the Effects of Noise on a Class of Iterative Deconvolution Algorithms," *Proc. IEEE Int. Conf. on Acoustics, Speech & Signal Processing (ICASSP 79)*, pp. 401-403, April 1979 (with R. W. Schafer and R. M. Mersereau)
2. "A System for Helium Speech Enhancement Using the Short-Time Fourier Transform," *Proc. IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 1097-1100, April 1981
3. "Doppler Spectrum Features in STARTLE Data (U)," *Proc. Second Tri-Service Combat Identification Systems Conf., (CISC-83)*, February 1983 (with L. L. Harkness, J. D. Echard, and E. Frost) SECRET
4. "An Experiment in the Use of Karhunen-Loeve Features for Stationary Target Identification (U)," *Proc. Second Tri-Service Combat Identification Systems Conf.*, February 1983 (with J. D. Echard) SECRET
5. "Performance Evaluation of a Polarimetric Millimeter-Wave Seeker (U)," *Proc. Second Workshop on Polarimetric Radar Technology*, May 1983 (with W. A. Holm and L. Wright) SECRET
6. "A Comparative Evaluation of a New Method for Helium Speech Unscrambling," *Proc. OCEANS '83*, pp. 456-459, August 1983 (with E. O. Belcher)
7. "Acoustic Tube Analysis of Formant Bandwidths and Frequencies in Helium Speech," *Proc. IEEE 1984 Int. Conf. on Acoustics, Speech & Signal Processing*, pp. 36.7.1-36.7.5, March 1984 (with R. W. Schafer)
8. "Iterative Deconvolution in Noncoherent Systems," *Proc. 1985 IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 434-437, March 1985
9. "Modeling of Synthetic Aperture Radar for Nonconventional Geometry," *Record IEEE 1985 Int. Radar Conf.*, pp. 366-371, May 1985 (with G. H. Lunsford and A. H. Green, Jr.)
10. "Iterative Enhancement of Noncoherent Radar Data," *Proc. 1986 IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 1929-1932, April 1986 (with C. E. Morris and M. H. Hayes)
11. "An Iterative Deconvolution Algorithm with Exponential Convergence," *Digest of the Topical Meeting on Signal Recovery & Synthesis II*, Optical Society of America, pp. 112-115, April 1986 (with C. E. Morris and M. H. Hayes)
12. "A Generalized Fast Iterative Deconvolution Algorithm," *Proc. 1987 IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 1553-1556, April 1987 (with C. E. Morris and M. H. Hayes)
13. "On the Efficient Implementation of the Split-Radix FFT," *Proc. 1987 IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 1801-1804, April 1987

14. "A CMOS/SOS Digital Signal Processing Chip for Front-End Sensor Processing," *Digest of Papers*, 1987 Government Microcircuit Applications Conference, pp. 305-308, October 1987 (with C. E. Morris *et al.*)
15. "Iterative Noncoherent Angular Superresolution," *Proc. IEEE 1988 National Radar Conference*, pp. 100-105, April 1988
16. "A Functional Minimization Interpretation of Fast Iterative Reconstruction Algorithms," *Proc. 1990 IEEE Int. Conf. on Acoustics, Speech, & Signal Processing*, pp. 1543-1546, April 1990.
17. "Amplitude, Phase, and Mismatch Errors in Discrete Fourier Transform Processing," *Conference Record*, Southcon '90, pp. 39-44, April 1990.
18. "Superresolution," *Proc. Workshop on Detection, Discrimination, and Classification of Targets in Clutter*, Huntsville, Alabama, November 1990. (with E. D. D'Anna).
19. "A Radar Angular Resolution Improvement Technique for Multispectral Sensor Beam Registration," *Proc. 4th National Sensor Fusion Symposium*, Orlando, Florida, April 2-4, 1991 (with E. D. D'Anna).
20. "Millimeter Wave Imaging Sensor for Autonomous Landing Guidance" abstract in *Proc. Progress in Electromagnetics Research Symposium (PIERS)*, Cambridge, Massachusetts, July 1-5, 1991. (with B. H. Hudson and J. Smart).
21. "Rapid Prototyping for Embedded Signal Processors," *Digest of Papers*, 1994 Government Microcircuit Applications Conference (GOMAC), San Diego, California, November 7 - 10, 1994. (with J. Pridmore, W. Schaming, A. Bard, and R. Reitmeyer).
22. "Introduction to ARPA's Rapid Prototyping of Application Specific Signal Processors (RASSP) Program," *Proceedings 1995 IEEE Intl. Conf. on Acoustics, Speech, & Signal Processing*, May 1995 (with J. Corley and V. Madisetti).
23. "RASSP: Methods and Tools for Rapid Signal Processor Development, Upgrading, and Life Cycle Support," *Proceedings 1995 IEEE Intl. Conf. on Acoustics, Speech, & Signal Processing*, May 1995 (with R. Reitmeyer, A. Bard, and G. Michael).
24. "Test Results of an Electronic Protection Technique to Counter Digital RF Memory (DRFM) Jamming of Synthetic Aperture Radar," *Proceedings 42nd Tri-Service Radar Symposium*, June 1996 (with G. V. Morris, L.L. Gostin, A. A. Partizian, K. J. Sangston, and F. D. Moorefield). SECRET
25. "Correction of Artifacts in Turntable Inverse Synthetic Aperture Radar Images," *Proceedings SPIE Aerosense*, April 1997 (with G. A. Showman, K. J. Sangston, and F. L. Moorefield).
26. "A Simple Post-Range Compression SAR Electronic Protection Technique," *Proceedings 43rd Tri-Service Radar Symposium*, June 24-26, 1997 (with C. F. Barnes and K. J. Sangston). SECRET
27. "Correction of Artifacts in 2-D and 3-D Turntable Inverse Synthetic Aperture Radar Images of Targets of Military Interest," *Proceedings 43rd Tri-Service Radar Symposium*, June 24-26, 1997 (with G. A. Showman, K. J. Sangston, and F. L. Moorefield). SECRET
28. "Comparison of Two Algorithms for Correcting Zero-Doppler Clutter in Turntable ISAR Imagery," *Proceedings 36th Asilomar Conference on Signals, Systems, and Computers*, Nov. 1 - 4, 1998 (with G. A. Showman and K. J. Sangston).
29. "An Analysis of the Effect of Motion and Phase Errors on the Implementation of Interferometric Processing by Synthetic Aperture Sonar," *Proceedings 33rd Asilomar conference on Signals, Systems, and Computers*, Oct. 24-27, 1999, Pacific Grove, California (with W. W. Bonifant, Jr., and J. H. McClellan).
30. "Interferometric Height Estimation of the Seafloor via Synthetic Aperture Sonar," *Proceedings 1999 Intl. Conference on Signal Processing Applications and Technology (ICSPAT 99)*, Nov. 1-4, 1999, Orlando, Florida (with W. W. Bonifant, Jr., and J. H. McClellan).
31. "Algorithms for High-Precision Two-Dimensional ISAR Imaging on an Outdoor Turntable Range," *Proceedings Antenna Measurement and Techniques Association (AMTA) 22nd Meeting and Symposium*, pp. 69-74, Philadelphia, Pennsylvania, October 16-20, 2000 (with G. A. Showman)
32. "VSIPL: An Object-Based Open Standard API for Vector, Signal, and Image Processing," *Proceedings IEEE Conf. On Acoustics, Speech, and Signal Processing*, vol. 2, pp. 949-952, 2001 (with R. Janka, R. Judd, J. Lebak, and D. P. Campbell)
33. "Analytical and Computer Model of a Doppler Weather Radar System," *Proceedings IEEE Radar Conference*, pp. 438-444, Long Beach, CA, 2002 (with R. K. Hersey and J. H. McClellan).
34. "An Inverse Polar Format Algorithm for Turntable Spotlight ISAR Imaging Systems Using Stepped Frequency Waveforms," *Proceedings IEEE Radar Conference*, Philadelphia, PA, 2004 (with S. D. Fisher and G. A. Showman).

35. "An Efficient Wavefront Curvature Correction Algorithm For Turntable Spotlight ISAR Systems Using Stepped Frequency Waveform," *Proceedings IEEE International Radar Conference*, pp. 306-309, Washington, DC, 2005 (with S. D. Fisher and J. H. McClellan).
36. "Obtaining a 35x Speedup in 2D Phase Unwrapping Using Commodity Graphics Processors", *Proceedings IEEE Radar Conference*, 2007, Boston, MA, pp. 574-578 (with P. A. Karasev and D.P. Campbell).
37. "Data Collection Eclipsing Effects in the Inverse Polar Format Algorithm (IPFA) for Turntable Spotlight Inverse Synthetic Aperture Radar (ISAR) Imaging", *Proceedings IEEE Radar Conference*, 2007, Boston, MA, pp. 805-810 (with S. D. Fisher and J. H. McClellan).
38. "GPU Performance Assessment with the HPEC Challenge", *Proceedings 2008 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 23-25, 2008. (with A. R. Kerr and D. P. Campbell)
39. "GPU VSIPL: High-Performance VSIPL Implementation for GPUs", *Proceedings 2008 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 23-25, 2008. (with A. R. Kerr and D. P. Campbell)
40. "QR Decomposition on GPUs", *Proceedings 2<sup>nd</sup> Workshop on General-Purpose Computation on Graphics Processing Units (GPGPU)*, Washington, DC, March 8, 2009. (with A. R. Kerr and D. P. Campbell)
41. "GPU VSIPL: Core and Beyond", *Proceedings 2009 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 22-24, 2009. (with A. R. Kerr and D. P. Campbell)

#### **J. Conference Presentations with Proceedings (non-refereed)**

1. "NASA Experimental Airborne Doppler Radar and Real Time Processor for Windshear Detection," Fourth Combined Manufacturers' and Technologists' Airborne Windshear Review Meeting, Williamsburg, Virginia, April 14-16, 1992. (with P. Schaffner *et al.*).
2. "Characteristics of Civil Aviation Atmospheric Hazards," Fifth Combined Manufacturers' and Technologists' Airborne Windshear Review Meeting, Hampton, Virginia, September 28-30, 1993. (with R. Marshall, J. Montoya, and J. Galliano).
3. "The Rapid Prototyping of Application Specific Signal Processors (RASSP) Program: Overview and Accomplishments," *Proceedings of the First Annual 1993 RASSP Conference*, Arlington, Virginia, August 15 - 18, 1994.

#### **K. Conference Presentations without Proceedings**

1. "An Iterative Deconvolution Algorithm with  $P$ th-Order Convergence," IEEE 1986 Digital Signal Processing Workshop, pp. 4.8.1-4.8.2, Oct. 1986 (with C. E. Morris and M. H. Hayes)
2. "RASSP: An Advanced Technology Demonstration of Integrated Product and Process Development," in "ARPA Manufacturing Science and Technology," National Technological University video broadcast, November 15, 1993.
3. "Rapid Prototyping of Application Specific Signal Processors (RASSP) Tools," ARPA Advanced Vision System (AVIS) Workshop, Pasadena, California, March 22, 1994. (invited)
4. "VHDL in the The Rapid Prototyping of Application Specific Signal Processors (RASSP) Program," in "Electronics and System Design in the 21st Century" panel session at the VHDL Intl. User's Forum Spring 1994 Conference, Oakland, California, May 1 - 4, 1994.
5. "Space-Time Adaptive Processing Architecture," panel session at the Mass. Inst. of Technology Lincoln Laboratory Adaptive Sensor Array Processing (ASAP) Workshop, Lexington, Massachusetts, May 16, 1994.
6. "RASSP Through the Use of Concurrent Engineering CAD Tools and Frameworks," IEEE Intl. Electronics Manufacturing Technology Symp., La Jolla, California, September 12 - 14, 1994. (with J. Saultz, J. Welsh, and R. Reitmeyer)
7. "The Rapid Prototyping of Application Specific Signal Processors (RASSP) Program: Overview and Accomplishments," 1994 Society of Automotive Engineers (SAE) Avionics Systems Division Meeting and Exposition, Orlando, Florida, October 30 - November 3, 1994.
8. "Test Results of an EP Technique to Counter DRFM Jamming of SAR," 9<sup>th</sup> EP Workshop, Oct. 28-31, 1996, Atlanta, GA (with G. V. Morris, L. L. Gostin, A. A. Partizian, and K. J. Sangston) SECRET

9. "Advanced Wideband Radar Signal Processing Algorithms," Wideband RF Science & Technology Workshop, Office of Naval Research, Orlando, Florida, April 8-11, 1997.
10. "An Approach to 'Benchmarking Multiprocessor DSP Subsystems,'" High Performance Embedded Computing Workshop, MIT Lincoln Laboratory, September 17-18, 1997.
11. "Improved SAR Image Formation Algorithms for Simulation and Evaluation of SAR Electronic Protection Techniques," 10<sup>th</sup> Annual Electronic Protection Technical Interchange Meeting, Georgia Tech Research Institute, Atlanta, GA, October 29-30, 1997 (with C. F. Barnes, G. A. Showman, F. Moorefield, and K. J. Sangston)
12. "IPSART Coherent Threat Jammer Simulation," 10<sup>th</sup> Annual Electronic Protection Technical Interchange Meeting, Georgia Tech Research Institute, Atlanta, GA, October 29-30, 1997 (with J. M. Baden, M. H. Smith, M. S. Clinard, J. A. Toussaint, and M. Yager)
13. "The RASSP Benchmarking Experience: Early Edition" and "Vector/Signal/Image Processing Library (VSIPL) Update," 1999 Signal and Image Processing (SIP) Forum: High Performance Computing in Signal and Image Processing, Gulfport, MS, May 25-26, 1999.
14. "API and Product Status of the v1.0 Vector, Signal, and Image Processing Library (VSIPL)," *Proceedings 1999 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 22-24, 1999 (with R. S. Janka, R. Judd, J. Lebak, and D. Schwartz)
15. "Aviation Weather Information Requirements Study," NASA Aviation Safety Program (AvSP) Weather Accident Prevention Project Annual Review, Hampton, VA, May 23-25, 2000 (with B. M. Keel)
16. "The Vector, Signal, and Image Processing Library (VSIPL): Emerging Implementations and Further Development," *Proceedings 2000 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 20-21, 2000 (with R. S. Janka, R. Judd, and J. Lebak)
17. "Status of the Vector, Signal, and Image Processing Library (VSIPL)," *Proceedings 2001 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, November 27-29, 2001 (with R. Judd, J. Lebak, R. Pancoast, and D. Campbell)
18. "Emerging Software Frameworks for Polymorphous Computing Architectures," *Proceedings 17th Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA 2002)*, November 2002. (with D. P. Campbell and K. A. MacKenzie).
19. "Sustaining the Exponential Growth of Embedded Digital Signal Processing Capability," *Proceedings 2004 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 28-30, 2004. (with G. A. Shaw)
20. "Software Architecture for Morphing in Polymorphous Computing Architectures," *Proceedings 2004 High Performance Embedded Computing Workshop*, MIT Lincoln Laboratory, September 28-30, 2004. (with D. P. Campbell, D. M. Cattel, and R. R. Judd)

#### **L. Evidence of Technical Accomplishment**

Contributor to the Vector-Signal-Image Processing Library (VSIPL) open standard for a vendor-neutral signal processing software library. See [www.vsipl.org](http://www.vsipl.org).

Minor contributor to the GPU-VSIPL library implementation of VSIPL for graphical processing units. See [gpu-vsipl.gtri.gatech.edu/](http://gpu-vsipl.gtri.gatech.edu/).

Chairman of the Morphware Forum, developer of open software standards for the Morphware Stable Interface. See [www.morphware.org](http://www.morphware.org).

#### **M. Research Recognition Awards**

1. NASA Group Achievement Award, for "Contributions to Windshear Radar Real-Time Processor Development and Flight Integration Team," 1993
2. Commendation for "Contributions to the Governor's Task Force on Warning and Communications," Hon. Zell Miller, Governor of Georgia, 12 June 1998
3. NASA "Turning Goals Into Reality" award, Aviation Safety Objective, for "Contributions to Aviation Weather Information and Communications Research Team," 2002

4. IEE 2000/2001 Clarke Griffiths Memorial Premium prize for the paper “Interferometric height estimation of the seafloor via synthetic aperture sonar in the presence of motion errors”, IEE *Proceedings - Radar, Sonar, and Navigation*, vol. 147, no.6, pp. 322-330, Dec. 2000 (with W. W. Bonifant, Jr. and J. H. McClellan), July 2002

## II. TEACHING/INSTRUCTION/STUDENT DEVELOPMENT

### A Academic Courses Taught

<u>Term</u>	<u>Course Number and Title</u>	<u>Number of Students</u>
Fall 1995	EE 6413, Digital Filters (special section at Lockheed site)	6
Winter 1996	EE 6425, Fundamentals of Radar Signal Processing (new course)	11
Fall 1997	EE 6413, Digital Filters	57
Winter 1997	EE 6425, Fundamentals of Radar Signal Processing	18
Winter 1998	EE 6425, Fundamentals of Radar Signal Processing	17
Winter 1999	EE 6425, Fundamentals of Radar Signal Processing	21
Spring 2000	EE 6272, Fundamentals of Radar Signal Processing	16 on campus 9 distance learning
Spring 2001	ECE 4270, Fundamentals of Digital Signal Processing	41
Spring 2002	ECE 6272, Fundamentals of Radar Signal Processing	14 on campus 13 distance learning
Summer 2002	ECE 4270, Fundamentals of Digital Signal Processing	45
Spring 2003	ECE 4271, Applications of Digital Signal Processing	20
Summer 2003	ECE 4270, Fundamentals of Digital Signal Processing	31
Fall 2003	ECE 2025, Introduction to Signal Processing (two recitation sections)	36
Spring 2004	ECE 6272, Fundamentals of Radar Signal Processing	25 on campus 10 distance learning
Fall 2004	ECE 6272, Fundamentals of Radar Signal Processing	10 on campus 8 distance learning
Fall 2005	ECE 2025, Introduction to Signal Processing (one recitation section)	17
Spring 2006	ECE 4271, Applications of Digital Signal Processing	11
Fall 2006	ECE 6272, Fundamentals of Radar Signal Processing	22 on campus 8 distance learning
Spring 2007	ECE 2025, Introduction to Signal Processing (two recitation sections)	23
Spring 2008	ECE 4271, Applications of Digital Signal Processing	4
Fall 2007 - present	ECE 8022, three lectures per term on research and proposal development. Organizer since Fall 2009.	Typically 50+
Fall 2008	ECE 6272, Fundamentals of Radar Signal Processing	32

<u>Term</u>	<u>Course Number and Title</u>	<u>Number of Students</u>
Fall 2009	ECE 2025, Introduction to Signal Processing (two recitation sections)	44
Fall 2010	ECE 6272, Fundamentals of Radar Signal Processing	TBD

**B. Continuing Education Courses Taught (not course Director)**

Lecturer annually in the following Georgia Tech short courses:

“Elements of Phased Array Radar System Design”	1985-1990
“Airborne Pulsed Doppler Radar”	1988-present
“Principles of Modern Radar”	1989-present
“Coherent Radar Performance Analysis”/“Radar Performance”	1989-2009
“Space-Based Radar”	1998-present
“Continuous Wave Radar”	1998-present
“Principles of Enhanced Resolution Radar”	2000-2004
“Principles of Imaging and Enhanced Resolution Radar”	2004-present
“Space-Time Adaptive Processing Applications to Radar”	2005-present
“Radar Waveforms: Properties, Analysis, Design, and Application”	2007-present
“Fundamentals of Earth Remote Sensing”	2008-present

Lecturer in National Technological University Video Seminar Series on Manufacturing Science and Technology, 1993

**C. Curriculum and/or Short Course Development**

With Mel Belcher of GTRI, developed the short course “Radar Signal Processing”, offered annually since at least 1987. Sole course director beginning in 2003.

With Jim Echard of GTRI, developed ECE 6272, “Fundamentals of Radar Signal Processing” (formerly EE 6425). This course has now been taught since at least 1991. Dr. Richards has taught the course solo since 2000.

With Chris Barnes of Georgia Tech Savannah/ECE, developed the short course “Modern Synthetic Aperture Imaging” offered annually from 1999 through 2002.

With Greg Showman of GTRI, developed the short course “Fundamentals of Synthetic Aperture Radar Signal Processing”, offered annually.

With Chris Barnes of Georgia Tech Savannah /ECE, developed and gained approval for a special topics course in “Radar Imaging”, taught initially by Prof. Barnes in Summer 2003 as ECE 8803.

Developed the short course “Signal Processing Refresher”, taught annually since 2006.

**D. Individual Student Guidance/Development**

**1. PhD students supervised (in process as well as graduated).**

<u>Student</u>	<u>Publications Resulting</u>
Scott D. Fisher	<ul style="list-style-type: none"> <li>S. D. Fisher, M. A. Richards, and G. A. Showman, “An Inverse Polar Format Algorithm for Turntable Spotlight ISAR Imaging Systems</li> </ul>

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Using Stepped Frequency Waveforms,” *Proceedings IEEE Radar Conference*, Philadelphia, PA, 2004.

- S. D. Fisher, M. A. Richards, and J. H. McClellan, “An Efficient Wavefront Curvature Correction Algorithm For Turntable Spotlight ISAR Systems Using Stepped Frequency Waveform,” *Proceedings IEEE International Radar Conference*, pp. 306-309, Washington, DC, 2005.
- S. D. Fisher, M. A. Richards, and J. H. McClellan, “Data Collection Eclipsing Effects in the Inverse Polar Format Algorithm (IPFA) for Turntable Spotlight Inverse Synthetic Aperture Radar (ISAR) Imaging”, *Proceedings IEEE Radar Conference*, 2007, Boston, MA, pp. 805-810.

**2. MS students supervised.**

<i>Student</i>	<i>Publications Resulting</i>
William W. Bonifant	<ul style="list-style-type: none"> <li>• M.S. thesis, “Interferometric Synthetic Aperture Sonar Processing,” July 1999.</li> <li>• W. W. Bonifant, Jr., J. H. McClellan, and M. A. Richards, “An Analysis of the Effect of Motion and Phase Errors on the Implementation of Interferometric Processing by Synthetic Aperture Sonar,” <i>Proceedings 33<sup>rd</sup> Asilomar conference on Signals, Systems, and Computers</i>, Oct. 24-27, 1999, Pacific Grove, California.</li> <li>• W. W. Bonifant, Jr., J. H. McClellan, and M. A. Richards, “Interferometric Height Estimation of the Seafloor via Synthetic Aperture Sonar,” <i>Proceedings 1999 Intl. Conference on Signal Processing Applications and Technology (ICSPAT 99)</i>, Nov. 1-4, 1999, Orlando, Florida.</li> <li>• W. W. Bonifant, Jr., J. H. McClellan, and M. A. Richards, “Interferometric height estimation of the seafloor via synthetic aperture sonar in the presence of motion errors”, <i>IEE Proceedings - Radar, Sonar, and Navigation</i>, vol. 147, no.6, pp. 322-330, Dec. 2000. Awarded the Clarke Griffiths Memorial Premium prize by IEE, July 2002.</li> </ul>
Daniel A. Cook	<ul style="list-style-type: none"> <li>• M.S. thesis, “Synthetic Aperture Sonar Motion Estimation and Compensation,” May 2007.</li> </ul>

**2. Special Problems students supervised.**

<i>Term</i>	<i>Student</i>	<i>Course Number and Topic</i>
Summer 2003 and Fall 2003	Michael Hagen	• ECE 4903, “Stripmap SAR Simulator”
Summer 2003	Abdul Malik Khan	• ECE 8903, “Analysis of DFT Frequency Estimation Errors in Low Signal-to-Noise Ratios”
Spring 2004	Anders Roos	• ECE 8903, “Spectral Analysis for FMCW Radar”
Fall 2005	Gregory Heim	• ECE 8903, “Experiments in Radar Signal Processing”
Fall 2006	Jeremy Marks	• ECE 8902, “Phased Array Antennas”



Fall 2006, Spring 2007, Summer 2007	Jenny Lynn Matthews	• ECE 8902, ECE8901, ECE8903, “Weather Radar Signal Processing”
Summer 2007	Roger Packham	• ECE8903, “Inverse Polar Format ISAR”

### III. SERVICE

#### A. Professional Activities

1. Senior Member, IEEE
2. Treasurer, Atlanta Chapter, IEEE Acoustics, Speech, & Signal Processing Society, 1982-1983 (elected)
3. Chairman, Atlanta Chapter, IEEE Acoustics, Speech, & Signal Processing Society, 1983-1984 (elected)
4. Secretary, Atlanta Chapter, IEEE Acoustics, Speech, & Signal Processing Society, 1984-1985 (elected)
5. Student Activities Chairman, Atlanta Section, IEEE, 1984-1985 (elected)
6. Secretary-Treasurer, Atlanta Chapter, IEEE Aerospace & Electronic Systems Society, 1985-1986 (elected)
7. Director, Group I Chapters, Atlanta Section, IEEE, 1985-1987 (elected)
8. Vice-Chairman, Atlanta Chapter, IEEE Aerospace & Electronic Systems Society, 1986-1987 (elected)
9. Vice-Chairman, Atlanta Section, IEEE, 1987-1988 (elected)
10. Chairman, Atlanta Section, IEEE, 1988-1989 (elected)
  
11. Co-Chair, Vector/Signal/Image Processing Library (VSIPL) Forum, 1999-2005
12. Member, Technical Advisory Board, DUSD (S&T) High Performance Embedded Computing Software Initiative, 2001-2005
  
13. Technical Program Committee, IEEE National Radar Conference, 1984
14. Technical Program Chairman, IEEE 1991 National Telesystems Conference, 1990-1991
15. General Chairman, First Annual RASSP Conference, 1994
16. General Chairman, Second Annual RASSP Conference, 1995
17. Technical Program Committee, High Performance Embedded Computing Workshop, 1999-present
18. General Chairman, IEEE 2001 Radar Conference (RADARCON 01), 1999-2001
19. Organizer and Co-Chair, First VSIPL User’s Group Meeting, 2002
20. Registration Chair, IEEE DSP/Signal Processing Education Workshop, 2002
21. Finance Chair, IEEE 2006 International Conference on Image Processing, 2002-2007

#### B. On-Campus Committees

1. Vice-President’s Promotion Committee for Research-Titled Employees, 1991
2. Member, Faculty Status and Grievance Committee, 1996 - 1999; Chair, 1998-1999
3. Member, Executive Board, 2000-2003
4. Member, General Faculty Assembly, 2000-2005
5. Member, GTRI Fellows Council, 1997 – 2001; Chair, 1998
6. Member, Faculty Review Committee for New program Development, Distance Learning and Professional Education, 2008

#### M.S. and Ph.D. Qualifying, Proposal, and Thesis Committees (not as principal advisor):

1. E. Bryan George, Ph.D thesis committee, ECE, 1991
2. Thomas Egolf, Ph.D. proposal and thesis committees, ECE, 1997
3. Benjamin Slocumb, Ph.D. thesis committee, ECE, 1998
4. J. DeBardelaben, Ph.D. proposal and thesis committees, ECE, 1997-1998
5. Richard Rau, Ph.D thesis committee, ECE, 1998
6. Y. Jung, qualifying exam committee, ECE, 1997

7. Ittichote Chuckpaiwong, Ph.D. proposal (2002) and thesis committee (2003), ME
8. William S. Marshall, Ph.D. proposal and thesis committees, ISyE, 1999
9. Gregory S. Showman, Qualifying exam (1998), Ph.D. proposal (1999) and thesis committees, ECE
10. Randall S. Janka, Ph.D proposal (1999) and thesis (2000) committees, ECE
11. Yaron Seliktar, Ph.D. thesis committee, ECE, 1998
12. C. Nilubol, Ph.D thesis committee, ECE, 2000
13. Greg Rohling, Ph.D proposal (2001), reading and thesis committees (2004), ECE
14. Ryan Hersey, Ph.D. proposal (2003), reading and thesis committees (2004), ECE
15. Lisa Ehrman, Ph.D. proposal (2004) and thesis (2005) committee, ECE
16. William F. Leven, Ph.D. proposal (2005) and thesis (2006) committee, ECE
17. Uzoma Onunkwo, Ph.D. proposal (2005) and thesis (2006) committee, ECE
18. Jie Yang, Ph.D. proposal and thesis (2007) committees, ME
19. Sze Tang, Ph.D. proposal (2007) and thesis (2008) committees, ECE
20. Matthew D. Clark, Ph.D. thesis committee (2007), ECE
21. Marcus Dutton, Ph.D. proposal committee (2009), ECE

### **C. Outside Professional Activities, Consulting, and Expert Witness Service**

1. Lear Astronics Corporation, 1990 (Consulting)
2. Martin-Marietta of Orlando, 1990 (Consulting)
3. Cross Systems, Inc., 1991-1992 (Consulting)
4. Comdisco Corporation, 1991-1992 (Consulting)
5. Bendix/King Division of Allied-Signal, 1992 (Consulting)
6. RDH, Inc., 1992 (Consulting)
7. Vitro Corporation, 1995 (Consulting)
8. Alliant Techsystems, 2003-2004 (Consulting)
9. Intel, 2007 (Consulting)
10. O'Melveny & Myers, LLP, 2007 (Expert Witness)
11. Advisory Board, QEDLabs, Inc., 2009-present

## **IV. OTHER CONTRIBUTIONS**

### **A. Special Activities**

1. Served on Georgia *Governor's Task Force on Warning and Communications*, Forecast Subcommittee, to develop recommendations for improving Georgia's systems for detection and warning of severe weather events, motivated by the Hall County tornado of March 20, 1998, and the Spring 1998 Flint River flooding.
2. Since 1995, conducting ongoing effort to increase DARPA/GIT interaction, including marketing trips, advising GIT researchers, organizing response teams in key areas, DARPA budget analysis, GIT research activity analysis, active and timely dissemination of solicitation information, and providing on-line information resources (with Bill Ballard, GTRI).
3. Since 2002, conducting a similar ongoing effort to assist ECE faculty in general marketing, especially to DoD sponsors
4. Co-Organizer, Joint DoD Workshop on a Common Operating Environment for Digital Signal Processors (with V. Madisetti), 1996
5. Co-Chair, Vector/Signal/Image Processing Library (VSIPL) Forum, 1999-2005
6. Chair, Morphware Forum (DARPA PCA Program), 2001-present
7. Participant, DARPA Information Science and Technology (ISAT) workshop on Adaptive Middleware for Cognitive Systems, Feb. 25-26, 2004.
8. Participant, DARPA Information Science and Technology (ISAT) workshop on Adaptive Middleware for Distributed Systems, March 30-31, 2004.
9. Participant, DARPA Summit on Embedded Systems, May 2004.

10. Advisor, Director of Defense Research and Engineering (DDR&E) Tech Opportunities Study, Jan.-Mar. 2005
11. Review Panel Member, Dept. of Energy review of Sandia National Laboratories Advanced Radar Systems program, March 2005.
12. SBIR/STTR proposal reviewer (2 proposals) for U.S. Dept. of Energy, March 2006.
13. Peer Review Panel Member, NASA Langley Research Center, Electromagnetic and Sensors Branch, June 2009.

## V. NATIONAL AND INTERNATIONAL PROFESSIONAL RECOGNITION

### A. Honors and Awards

1. Sigma Xi, Eta Kappa Nu Honoraries
2. Senior Member, IEEE
3. GTRI/RAIL Management Award, 1989
4. *Who's Who in the World, 2000-present; Who's Who in America, 1999-present; Who's Who in America, Science and Engineering, 1998 – present; Who's Who in America, South and Southwest, 1997-present*
5. GTRI Fellow, 1997-present
6. IEEE Third Millennium Medal for service to the Atlanta Section, 2000
7. Georgia Tech Outstanding Professional Education Award, 2008

### B. Invited Conference Session Chairmanships

1. Session Chairman, IEEE International Conference on Acoustics, Speech, and Signal Processing, 1986
2. Session Chairman, IEEE International Conference on Acoustics, Speech, and Signal Processing, 1996

### C. Professional Registration

Registered Professional Engineer, State of Georgia, 1984 – 1988

### D. Editorial and Reviewer Work for Technical Journals

1. Reviewer, IEEE *Transactions on Signal Processing*, 1984-2005
2. Reviewer for IEEE *Transactions on Aerospace & Electronic Systems*, 1988-2005
3. Reviewer for IEEE Individual Learning Package *Digital Signal Processing*, 2<sup>nd</sup> Edition, 1987
4. Associate Editor, IEEE *Transactions on Signal Processing*, 1989-1993
5. Guest Editor, Special Issue on Rapid Prototyping, IEEE *Design and Test of Computers*, Fall 1996 (with V. K. Madisetti)
6. Associate Editor, IEEE *Transactions on Image Processing*, 2000-2002

## VI. PROFESSIONAL DEVELOPMENT

“Georgia Tech Mid-Management Program”, Georgia Tech, 1998

Continuing Education Course Title	Provider	Date
“Computer Modeling of Electromagnetic Signatures”	Georgia Tech	1982
“Principles of Modern Radar”	Georgia Tech	1983
“Introduction to Artificial Intelligence”	Georgia Tech	1983
“Kalman Filtering”	Georgia Tech	1983
“Techniques of Radar Reflectivity Measurement”	Georgia Tech	1984
“Proposal Win Strategy”	R. N. Close Associates	1984
“Millimeter Wave Systems & Technology”	Georgia Tech	1984

“Missile Guidance”	Technology Service Corp.	1984
“Writing the IR&D Brochure”	Crane Morley	1987
“Synthetic Aperture Radar Technology”	University of Michigan	1988
“Radar Cross Section Reduction”	Georgia Tech	1990
“Basic Java Programming Workshop”	Georgia Tech	1998
“Advanced MATLAB Programming Techniques”	The MathWorks	2006