

## David W. Messinger, Ph.D.

Chester F. Carlson Center for Imaging Science  
Rochester Institute of Technology  
54 Lomb Memorial Dr.  
Rochester, NY 14623  
Phone: (585) 475 - 4538  
E-mail: messinger@cis.rit.edu

### EDUCATION:

Ph.D., Physics (September 1998), Rensselaer Polytechnic Institute, Troy, NY  
Thesis Title: "New Methods for Studying Interstellar Continuum and Spectral Polarization"  
Thesis Advisor: W.G. Roberge, Ph.D.  
B.S., Physics, Graduate with Distinction (May 1991), Clarkson University, Potsdam, NY

### PROFESSIONAL SUMMARY:

**Associate Research Professor (2010 - present),  
Assistant Research Professor (2007 - 2010),  
Director, Digital Imaging and Remote Sensing Laboratory,  
Chester F. Carlson Center for Imaging Science,  
Rochester Institute of Technology, Rochester, NY**

My research investigates the general problem of developing methods to extract quantitative information from spectral imagery. Specific efforts include the detection of man made phenomena in large area imagery and application of advanced mathematical techniques to spectral image processing. Other research interests include the use of physics-based signatures to augment methods of hyperspectral image exploitation and the use of remote sensing techniques for multi-disciplinary research such as Archeology. As Director of the DIRS Laboratory, I oversee and coordinate the research efforts of nine faculty in CIS, 16 full time research staff, and over 40 undergraduate and graduate students. The Laboratory operates with annual research revenue of approximately \$4M.

**Research Scientist (2002 - 2007),  
Digital Imaging and Remote Sensing Laboratory,  
Chester F. Carlson Center for Imaging Science,  
Rochester Institute of Technology, Rochester, NY**

I performed research into spectral image processing techniques supporting research programs within the Digital Imaging and Remote Sensing Laboratory. This work was partially funded through an Intelligence Community Postdoctoral Research Fellowship. My research focused on the detection and characterization of gaseous effluent plumes in thermal hyperspectral imagery, as well as the development of physics-based algorithms for target detection in reflective hyperspectral imagery.

**Aerospace Engineer (2000 - 2002),  
Northrop Grumman, Exton, PA**

I designed and implemented innovative algorithms to track clusters of ballistic objects during midcourse flight in the SBIRS-Low Program. I developed a medium-fidelity, pixel-level, infrared sensor and signal processing simulation to evaluate system requirements and algorithms as well as provided in-house infrared phenomenological expertise.

**Analyst (1998 - 2000),  
XonTech, Inc., Special Studies Division, Van Nuys, CA**

My work with the Internal Research and Development group required the development of algorithms to

determine sea-surface characteristics such as ocean wave spectra from data acquired with the NASA-JPL AVIRIS sensor. I implemented physical and statistical models of infrared and hyperspectral data as well as used signal and image processing techniques to further these efforts.

**CURRENT RESEARCH INTERESTS:**

- Investigation of physical and geophysical processes through analysis of remotely sensed data
- Multispectral & hyperspectral image exploitation
  - Spectral feature extraction
  - Large area search
  - Applications to gaseous plume detection and quantification
  - Target detection using physics-based signatures
  - Spectral image characterization
  - Application of advanced mathematical tools to spectral imagery
- LIDAR imaging

**ADMINISTRATIVE EXPERIENCE:****Director, Digital Imaging and Remote Sensing Laboratory (2007 - present):**

I am responsible for coordinating and overseeing the research programs for those affiliated to the laboratory, managing several funded research programs, conducting annual staff performance evaluations, and laboratory business development efforts. The laboratory includes nine faculty, ~20 full time research staff, and >40 students at the BS, MS, and Ph.D. levels. Other responsibilities include proposal writing to support the faculty, staff, and students, interfacing with research sponsors and RIT administrators, as well as strategic planning for the laboratory and management of discretionary funds.

**Interim Director, Digital Imaging and Remote Sensing Laboratory (2007 - 2008):**

I was responsible for coordinating and overseeing the research programs for those affiliated to the laboratory while the Director was on sabbatical. This included six faculty, ~10 full time research staff, and ~30 graduate students at the MS and Ph.D. levels.

**DIRS Algorithm and Phenomenology Group Leader (2004 - 2008):**

I was responsible for the management of two full-time staff scientists and their affiliated graduate and undergraduate students. This involved personnel and budgetary management as well as contributing to the planning and proposal process for the DIRS Laboratory.

**Member of the RIT College of Science Strategic Planning Core Committee, 2010-2011****Member of the RIT Steering Committee for the RIT - North Carolina A&T Partnership, 2011****Member of the Search Committee: Director of the Nanopower Research Laboratory, RIT, 2011****Member of the Advisory Board for the Biannual Publication, *Research at RIT* (2008 - present)****Member of the Technical Program Committee (2009 - present): SPIE Conference on Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery****Member of the Search Committee: Director of the Center for Imaging Science, RIT, 2003****Member of the Search Committee: Remote Sensing Faculty, Center for Imaging Science, RIT, 2003****Member of the Local Organizing Committee for the conference: Polarimetry of the Interstellar Medium, Troy, NY, June 1995****Member of the Graduate Student Committee: Rensselaer Polytechnic Institute Physics Dept. 1994 - 1996**

**FUNDING HISTORY:**

*Total Awarded as Principal Investigator: > \$2,700,000*

LPA Associates, "Hyperspectral Exploitation Tool Development", PI, 2004 - 2005, \$9,216

Kodak - RIT CIS Innovative Collaborative Research Opportunity, "Visualization of High-Dimensional Remote Sensing Data Products", Co-PI, 2005, \$5,000

Pacific Northwest National Laboratory, "Characterization of LWIR Imagery", PI, 2006, \$12,055

Army Research Laboratory, "Persistent Surveillance Research", PI, 2006 - 2007, \$46,452

VirtualScopics, through the Naval Research Laboratory, "Hyperspectral Algorithm Development", PI, 2007 - 2008, \$100,000

Pacific Northwest National Laboratory, "Bayesian Model Averaging for Species Identification in Gaseous Plumes", PI, 2007 - 2008, \$100,000

NGA University Research Initiative (NURI), "Dynamic Analysis of Spectral Imagery for Improved Exploitation", PI, 2007 - 2011, \$600,000

NASA, "Hyper- and Multi-spectral Satellite Imagery and the Ecology of State Formation and Complex Societies", Co-I, 2008 - 2010, \$80,485

Impact Technologies, Phase 1 SBIR, "Automated 3d Terrain Mission Profile Generation", PI, 2008, \$10,000

Black River Systems Corporation, "Multi-Sensor Exploitation for Space Situational Awareness", PI, 2008-2010, \$124,286

Sandia National Laboratory, "Clutter Scene Generation in DIRSIG", PI, 2008, \$24,585

NGA University Research Initiative (NURI), "Spatial / Spectral Large Area Search Tool Development", PI, 2009 - 2011, \$450,000

Department of Energy Nonproliferation Research and Development for Proliferation Detection, "Enhanced Radiometric Scene Simulation Through Incorporation of Process Models", PI, 2010 - 2013, \$894,000

ITT Geospatial Systems, "Hyperspectral Algorithm Development", PI, 2010, \$68,000

National Reconnaissance Office, "Information Theoretic Approach to Image Utility", PI, 2011-2012, \$199,958

**HONORS AND AFFILIATIONS:**

"Top Research Presentation at NGA Academic Research Program Symposium and Workshops", USGIF, September 2010, research to be presented as invited talk at GEOINT 2010

"Best Research Demonstration", NGA Academic Research Program Symposium and Workshops, September 2010

Academic Advisor to the US Department of Homeland Security Remote Sensing Advisory Board

Reviewer, Journal of Electronic Imaging

Reviewer, IEEE Transactions on Geoscience and Remote Sensing

Reviewer, IEEE Transactions on Aerospace and Electronic Systems

Reviewer, NASA Postdoctoral Program (NPP)

Intelligence Community Postdoctoral Research Fellow, 2003 - 2005

Member of the American Geophysical Union (AGU)

Member of IEEE, Geoscience and Remote Sensing Society (GRSS)

Member of the Society of Photo-Optical Instrumentation Engineers (SPIE)

Member of the US Geospatial-Intelligence Foundation (USGIF)

Department of Education Fellowship, Rensselaer Polytechnic Institute, Jan. 1997 - Aug. 1997

Graduate with Distinction, Clarkson University, May 1991

**REVIEW PANEL SERVICE:**

Member of an DOE Independent Review Panel, Infrared Signatures Program, Pacific Northwest National Laboratory, March, 2005

Member of an DOE Independent Review Panel, Spectral Signatures Program, Pacific Northwest National Laboratory, March, 2005

Member of an DOE Independent Review Panel, Alternative SNM Signatures, Pacific Northwest National Laboratory, March, 2008

Member of an DOE Independent Review Panel, Hyperspectral Observation of Solid Signatures, Los Alamos National Laboratory, December, 2010

**TEACHING EXPERIENCE:**

*Physics II*: Head instructor for class of 65 students. Duties included course development, lecturing, homework set assignment, solution, and grading, as well as exam writing and grading.

*Astrophysics II*: Teaching assistant for graduate/undergraduate course. Duties included guest lecturing, homework and exam grading, and providing office hours.

*Physics I & II Recitation*: Instructor for three recitations of up to 30 students each per semester. Duties included problem solving, homework and exam grading, and providing office hours.

**THESIS COMMITTEES:****Senior Thesis Project***Advisor:*

- [ 1 ] Rachael Gold, Imaging Science, Rochester Institute of Technology, 2005, "Performance Analysis of the Invariant Algorithm for Target Detection in Hyperspectral Imagery"
- [ 2 ] Sarah Paul, Imaging Science, Rochester Institute of Technology, 2007, "Investigation of Visiball Glasses Claims"
- [ 3 ] Joshua Zellweg, Imaging Science, Rochester Institute of Technology, 2010, "Point Density and Shift-Outlier Change Detection"

**Masters of Science***Advisor:*

- [ 1 ] Josef Bishoff, Imaging Science, Rochester Institute of Technology, 2008, "Target Detection Using Oblique Angle Hyperspectral Imagery"
- [ 2 ] Justin Kwong, Imaging Science, Rochester Institute of Technology, 2009, "Hyper- and Multispectral Satellite Imagery and the Ecology of State Formation and Complex Societies"
- [ 3 ] Alfredo Lugo, Imaging Science, Rochester Institute of Technology, 2010, "Analysis of Multitemporal, Low Spatial Resolution, Multispectral Imagery"

*Committee Member:*

- [ 1 ] Erin Peterson, Imaging Science, Rochester Institute of Technology, 2004, "Validation and Verification of Surface and Buried Landmine Signatures in DIRSIG"
- [ 2 ] Erin O'Donnell, Imaging Science, Rochester Institute of Technology, 2005, "Detection and Identification of Effluent Gases Using Invariant Hyperspectral Algorithms"

- [ 3] David Pogorzala, Imaging Science, Rochester Institute of Technology, 2005, "Gas Plume Species Identification in LWIR Hyperspectral Imagery by Regression Analyses"
- [ 4] David Grimm, Imaging Science, Rochester Institute of Technology, 2005, "Hybridization of Hyperspectral Imagery Target Detection Algorithm Chains"
- [ 5] Jason West, Imaging Science, Rochester Institute of Technology, 2005, "Matched Filter Stochastic Background Characterization for Hyperspectral Target Detection"
- [ 6] Adam Cisz, Imaging Science, Rochester Institute of Technology, 2006, "Performance Comparison of Hyperspectral Target Detection Algorithms"
- [ 7] Manuel Ferdinandus, Imaging Science, Rochester Institute of Technology, 2007, "Selection of Optimal Background Estimation Methods for Unstructured Detectors"
- [ 8] Michael Zelinski, Imaging Science, Rochester Institute of Technology, 2009, "Space Telescope Imaging Simulation Tool"
- [ 9] Anthony Rizzuto, Imaging Science, Rochester Institute of Technology, 2009, "A Low Light Level (LLL) Sensor Frame Work Incorporating Improved Capabilities in DIRSIG"
- [ 10] Tomothy Doster, Mathematics, Rochester Institute of Technology, 2009, "Improved Detection and Visualization of Anomalous Objects in Hyperspectral Imagery"
- [ 11] Danielle Simmons, Imaging Science, Rochester Institute of Technology, 2009, "Hyperspectral Detection of Chemical and Biological Agents Using Biosensors"
- [ 12] Amanda Ziemann, Mathematics, Rochester Institute of Technology, 2010, "Using n-Dimensional Volumes for Mathematical Applications in Spectral Image Analysis"
- [ 13] Marcela Muñoz-Reales, Mathematics, Rochester Institute of Technology, 2010, "Laplacian Eigenmaps Manifold Learning and Anomaly Detection Methods for Spectral Images"
- [ 14] Richard Labiak, Imaging Science, Rochester Institute of Technology, 2011, "A Method for Detection and Quantification of Building Damage Using Post-Disaster LIDAR Data"

**Ph.D.***Advisor:*

- [ 1] Shawn Higbee, Imaging Science, Rochester Institute of Technology, 2009, "Gas Plume Constituent Species Identification Using Bayesian Analysis with LWIR Hyperspectral Imagery"
- [ 2] Ariel Schlamm, Imaging Science, Rochester Institute of Technology, 2010, "Detection of Man-Made Material in Large Area Search Using Hyperspectral Imagery"
- [ 3] Aaron Weiner, Imaging Science, Rochester Institute of Technology, 2010, "A Systems Level Characterization of a Mobile Trace Fugitive Gas Detection Method Using Agile Fourier Transform Infrared Spectrometry"
- [ 4] Ryan Mercovich, Imaging Science, Rochester Institute of Technology, expected 2011, "Anomalous Change Detection in High Resolution, Multitemporal, Multispectral Imagery"
- [ 5] Shea Hagstrom, Imaging Science, Rochester Institute of Technology, expected 2012, "Voxelized Approaches to Detection of Concealed Objects in 3D LIDAR Imagery"
- [ 6] Kelly Canham, Imaging Science, Rochester Institute of Technology, expected 2012, "Feature Extraction from Hyperspectral Imagery in Support of Cultural Archeology in Oaxaca, Mexico"

*Committee Member:*

- [ 1] James Shell, Imaging Science, Rochester Institute of Technology, 2005, "Polarimetric Remote Sensing in the VNIR"
- [ 2] Michael Foster, Imaging Science, Rochester Institute of Technology, 2007, "Geometrically-Constrained Subspaces for Physics-Based Target Detection"

- [ 3] Marvin Boonmee, Imaging Science, Rochester Institute of Technology, 2007, "Land Surface Temperature and Emissivity Retrieval from Thermal Infrared Hyperspectral Imagery"
- [ 4] Hongqin Zhang, Imaging Science, Rochester Institute of Technology, 2007, "Color in Scientific Visualization: Perception and Image-based Data Display"
- [ 5] Yonghui Zhao, Imaging Science, Rochester Institute of Technology, 2008, "Image Segmentation and Pigment Mapping of Cultural Heritage Based on Spectral Imaging and Its Use In Restorative Inpainting"
- [ 6] Andrew Adams, Imaging Science, Rochester Institute of Technology, 2008, "Persistent Surveillance - Motion Detection and Tracking at Reduced Frame Rates Using Multispectral Information"
- [ 7] Jason Ward, Imaging Science, Rochester Institute of Technology, 2008, "Realistic Texture in Simulated Thermal Infrared Imagery"
- [ 8] Steve Lach, Imaging Science, Rochester Institute of Technology, 2008, "Multisource Data Processing for Semi-Automated Radiometrically Correct Scene Simulation"
- [ 9] Marcus Stefanou, Imaging Science, Rochester Institute of Technology, 2008, "Predicting Spectral Image Utility"
- [ 10] Brian Daniel, Imaging Science, Rochester Institute of Technology, 2008, "Sparse Aperture Modeling in a Spectral World with Broadband Phase Diversity"
- [ 11] Matthew Montanaro, Imaging Science, Rochester Institute of Technology, 2009, "Radiometric Modeling of Mechanical Draft Cooling Towers to Assist in the Extraction of their Absolute Temperature from Remote Thermal Imagery"
- [ 12] Andrew Michael, Imaging Science, Rochester Institute of Technology, 2009, "Imaging Schizophrenia: Data Fusion Approaches to Characterize and Classify"
- [ 13] Aaron Gerace, Imaging Science, Rochester Institute of Technology, 2010, "The Fusion of Thermal and Reflective Data Through the Use of a Hydrodynamic Model to Assist in the Determination of Water Quality and Materials Transport in Coastal Waters"
- [ 14] Clifton Anderson, Imaging Science, Rochester Institute of Technology, 2010, "Refinement of the Method for Using Pseudo-Invariant Sites for Long Term Calibration Trending of Landsat Reflective Bands"
- [ 15] Chabitha Devaraj, Imaging Science, Rochester Institute of Technology, 2010, "Analysis of a Polarized Remote Sensing System"

#### INVITED PRESENTATIONS:

- [ 1] Kodak Research Laboratories Colloquium, "Exploitation Algorithms for Hyperspectral Imagery", March 2004
- [ 2] International Symposium on Spectral Sensing Research 2006, "Detection of Gaseous Effluents from Airborne LWIR Hyperspectral Imagery Using Physics-Based Signature Predictions", May 2006
- [ 3] International Geoscience and Remote Sensing Symposium 2006, "Improving Background Multivariate Normality and Target Detection Performance Using Spatial and Spectral Segmentation", August 2006
- [ 4] School of Mathematical Sciences, RIT, Departmental Colloquium, "Characterization of High-Dimensional Spectral Image Data", December 2006
- [ 5] Telops Workshop on Hyperspectral Remote Sensing, "Topological Approaches to Exploitation of Hyperspectral Imagery: Beyond Statistics and Linear Geometry", October 2007
- [ 6] Information Institute 2008, Workshop on Image and Video Processing, Air Force Research Laboratory, Rome NY, "Advanced Mathematical Approaches to Spectral Image Processing", June 2008
- [ 7] Physics Department, SUNY Brockport, Departmental Colloquium, "Spectral Remote Sensing: What is the dimension of my image, how do I calculate it, and why do I care?", March 2009

- [ 8] NSG RDT&E Forum 2.0, Member of Panel on Academic Collaboration with the Intelligence Community and the NSG, April 2009
- [ 9] University of Buffalo, Department of Mechanical and Aerospace Engineering, Invited Colloquium Speaker, "Novel Approaches to Hyperspectral Image Analysis: Beyond Statistics and Linear Geometry", November 2009
- [ 10] GEOINT 2010, Invited academic speaker, New Orleans, "Spatial / Spectral Large Area Search Tool Development", November 2010
- [ 11] Cornell University, Society of Physics Students, Invited Speaker, "Using Airborne or Space-based Imagery to Search Large Areas, Without Knowing What You're Looking For", February, 2011
- [ 12] Optical Society of America, Rochester Chapter, Invited Speaker, "Advances in Hyperspectral Image Processing and an Overview of the RIT Support to the Haiti Relief Effort", February 2011
- [ 13] Imaging Spectrometry XVI, Keynote Speaker, "Production of imagery-derived maps to aid the Japanese earthquake / tsunami relief effort", August 2011
- [ 14] Applied Imagery and Pattern Recognition (AIPR) Workshop 2011, Invited Speaker, "Imaging for Decision Making: Lessons Learned in Remote Sensing for Disaster Relief Efforts", October 2011
- [ 15] GEOINT 2011, Invited Panelist, "Science & Technology Workshop: Multi-INT Fusion", October 2011

#### SELECTED PUBLICATIONS:

##### *Book Contributions:*

- [ 1] "Fundamentals of Polarimetric Remote Sensing", John R. Schott, SPIE, April 2009
- [ 2] "Spectral Sensing Research for Water Monitoring Applications and Frontier Science and Technology for Chemical, Biological, and Radiological Defense", eds. D. Woolard & J. Jensen, *Detection of Gaseous Effluents from Airborne LWIR Hyperspectral Imagery Using Physics-Based Signature Predictions*, **D.W. Messinger**, C. Salvaggio, N.M. Sinisgalli, World Scientific, March 2009

##### *Refereed Articles:*

- [ 1] "Spatially adaptive hyperspectral endmember selection and spectral unmixing", K. Canham, A. Schlamm, A. Ziemann, B. Basener, & **D.W. Messinger**, *accepted for publication in IEEE Transactions on Geoscience and Remote Sensing*, August 2011
- [ 2] "A Complexity Metric for Spectral Imagery Based on Spatially Local Convex Hull Volume Estimation", **D.W. Messinger**, A. Ziemann, B. Basener, & A. Schlamm, *submitted to Optical Engineering*, September 2011
- [ 3] "Change Detection in Multi- and Hyperspectral Image Tiles Based on Quantitative Measures of Point Density", A. Schlamm, **D.W. Messinger**, B. Basener, *accepted for publication in the Journal of Applied Remote Sensing*, September 2011
- [ 4] "Techniques for the graph representation of spectral imagery", Mercovich, R., Albano, J., and **Messinger, D.W.**, Proceedings of the 2011 IEEE WHISPERS workshop, Lisbon, Portugal, June 2011
- [ 5] "A graph theoretic approach to anomaly detection in hyperspectral imagery", **D.W. Messinger**, and J. Albano, Proceedings of the 2011 IEEE WHISPERS workshop, Lisbon, Portugal, June 2011
- [ 6] "Improved detection and clustering of hyperspectral image data by preprocessing with a Euclidean distance transform", A. Schlamm, and **D.W. Messinger**, Proceedings of the 2011 IEEE WHISPERS workshop, Lisbon, Portugal, June 2011
- [ 7] "A detection-identification process with geometric target detection and subpixel spectral visualization", B. Basener, A. Schlamm, **D.W. Messinger**, and E. Ientilucci, Proceedings of the 2011 IEEE WHISPERS workshop, Lisbon, Portugal, June 2011

- [ 8] "Spectro-polarimetric BRDF determination of in-scene materials and its use in target detection applications", B. Bartlett, M. Gartley, **D.W. Messinger**, C. Salvaggio, J. Schott, *Journal of Applied Remote Sensing*, Vol. 4, 043552, 1 November 2010
- [ 9] "A Euclidean Distance Transformation for Improved Anomaly Detection in Spectral Imagery", A. Schlamm & **D.W. Messinger**, accepted for publication in the Proceedings of the 2010 IEEE WNY Image Processing Workshop, Rochester, NY, November 2010
- [ 10] "Spectral Image Complexity Estimated Through Local Convex Hull Volume", **D.W. Messinger**, A. Ziemann, B. Basener, & A. Schlamm, Proceedings of the 2010 IEEE WHISPERS workshop, Reykjavik, Iceland, June 2010
- [ 11] "Geometric Estimation of the Inherent Dimensionality of Single and Multi-material Clusters in Hyperspectral Imagery", A. Schlamm, **D.W. Messinger**, & B. Basener, *Journal of Applied Remote Sensing*, Vol. 3, 033527, 22 April 2009
- [ 12] "Spin-Image Target Detection Algorithm Applied to Low Density 3D Point Clouds", M. Foster, J. Schott, & **D.W. Messinger**, *Journal of Applied Remote Sensing*, Vol. 2, 023539, 29 September 2008
- [ 13] "Detection of Gaseous Effluents from Airborne LWIR Hyperspectral Imagery Using Physics-Based Signature Predictions", **D.W. Messinger**, C. Salvaggio, N.M. Sinisgalli, *Int. Journal of High Speed Electronics and Systems*, vol 17 (4) December 2007
- [ 14] "A Comparative Evaluation of Background Characterization Techniques for Hyperspectral Unstructured Matched Filter Target Detection", J. West, **D.W. Messinger**, & J. Schott, *Journal of Applied Remote Sensing*, Vol 1, 013520, 13 July 2007
- [ 15] "Landscape Classification in Regional Archaeology Survey Employing Stepwise Unmixing of Hyperspectral Imagery from the Earth Observing 1 Satellite", William D. Middleton & **D.W. Messinger**, Proceedings of the 36th International Symposium on Archeometry, Quebec City, Canada, May 2006
- [ 16] "Three-Band Temperature Extraction from Airborne Imagery with Imprecise Atmospheric Knowledge", C. Salvaggio, M. Boonmee, N. Sinisgalli, **D.W. Messinger**, *J. Geophysical Research*, 111, D13107, doi: 10.1029/2005JD006770, 2006
- [ 17] "Interstellar Polarization in the Taurus Dark Clouds: Wavelength Dependent Position Angles and Cloud Structure Near TMC - 1", **D.W. Messinger**, D.C.B. Whittet, & W.G. Roberge. *Astrophysical Journal*, 1997, vol 487, p. 314
- [ 18] "Moderate Resolution Spectropolarimetry of the 3  $\mu\text{m}$  Ice Band Toward the BN Object", J.H. Hough, A. Chrysostomou, **D.W. Messinger**, D.K. Aitken, & P.F. Roche. *Astrophysical Journal*, 1996, vol 461, p. 902
- [ 19] "Grain Alignment by Ambipolar Diffusion in Molecular Clouds", W.G. Roberge, S. Hanany, & **D.W. Messinger**. *Astrophysical Journal*, 1995, vol 453, p. 238

#### *Conference Proceedings:*

- [ 1] "Enhanced DIRSIG scene simulation by incorporating process models", J. Sun, **D.W. Messinger**, and M. Gartley, *Imaging Spectrometry XVI*, Proceedings of SPIE vol. 8158, San Diego, CA, August 2011
- [ 2] "Production of imagery-derived maps to aid the Japanese earthquake / tsunami relief effort", **D.W. Messinger**, D.M. McKeown, N.G. Raqueño, S.A. Cavilia, C.R. DeAngelis, S. Maitra, and W. Sun, *Imaging Spectrometry XVI*, Proceedings of SPIE vol. 8158, San Diego, CA, August 2011
- [ 3] "Change detection using mean-shift and outlier distance metric", J. Zellweg, D. Gillis, A. Schlamm, and **D.W. Messinger**, *Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII*, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
- [ 4] "Graph theoretic metrics for spectral imagery with application to change detection", J.A. Albano, **D.W. Messinger**, A. Schlamm, and B. Basener, *Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII*, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011

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- [ 5] "Automatic clustering of multispectral imagery by maximization of the graph modularity", R.A. Mercovich, A.A. Harkin, and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
  - [ 6] "High spatial resolution hyperspectral spatially adaptive endmember selection and spectral unmixing", K. Canham, A.A. Schlamm, B. Basener, and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
  - [ 7] "Anomaly detection of man-made objects using spectro-polarimetric imagery", B. Bartlett, A.A. Schlamm, C. Salvaggio, and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
  - [ 8] "Trilateral filter on multispectral imagery for classification and segmentation", W. Sun and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
  - [ 9] "An empirical estimate of the multivariate normality of spectral image data", A. Schlamm and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVII, Proceedings of SPIE vol. 8048, Orlando, FL, April 2011
  - [ 10] "Line of sight analysis using voxelized discrete lidar", S. Hagstrom and **D.W. Messinger**, Laser Radar Technology and Applications XVI, Proceedings of SPIE vol. 8037, Orlando, FL, April 2011
  - [ 11] "High Resolution and LIDAR Imaging Support to the Haiti Earthquake Relief Effort", **D. W. Messinger**, J. van Aardt, D. McKeown, M. Casterline, J. Faulring, N. Raqueño, B. Basener, & M. Velez-Reyes, Imaging Spectrometry XV, Proceedings of SPIE vol. 7812, San Diego, CA, August 2010
  - [ 12] "An End-to-End Airborne FTS Simulation for Evaluating the Performance Trade Space in Fugitive Gas Identification", A. Weiner & **D. W. Messinger**, Imaging Spectrometry XV, Proceedings of SPIE vol. 7812, San Diego, CA, August 2010
  - [ 13] "A comparison study of dimension estimation algorithms", A. Schlamm, R. Resmini, **D. W. Messinger**, & B. Basener, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVI, Proceedings of SPIE vol. 7695, Orlando, FL, April 2010
  - [ 14] "A novel method for change detection in spectral imagery", A. Schlamm, **D. W. Messinger**, & B. Basener, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVI, Proceedings of SPIE vol. 7695, Orlando, FL, April 2010
  - [ 15] "Iterative convex hull volume estimation in hyperspectral imagery for change detection", A. Ziemann, **D. W. Messinger**, & B. Basener, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XVI, Proceedings of SPIE vol. 7695, Orlando, FL, April 2010
  - [ 16] "Fusing waveform LIDAR and hyperspectral data for species-level structural assessment in savanna ecosystems", D. Sarrazin, J. van Aardt, **D. W. Messinger**, & G. P. Asner, Laser Radar Technology and Applications XV, Proceedings of SPIE vol. 7684, Orlando, FL, April 2010
  - [ 17] "Feature extraction using voxel aggregation of focused discrete LIDAR data", S. Hagstrom, **D. W. Messinger**, & S. D. Brown, Laser Radar Technology and Applications XV, Proceedings of SPIE vol. 7684, Orlando, FL, April 2010
  - [ 18] "Hyperspectral Clustering and Unmixing for Studying the Ecology of State Formation and Complex Societies", J. Kwong, **D.W. Messinger**, & W. D. Middleton, Imaging Spectrometry XIV, Proceedings of SPIE vol. 7457, San Diego, CA, August 2009
  - [ 19] "A Bayesian Approach to Identification of Gaseous Effluents in Passive LWIR Imagery", S. Higbee, **D.W. Messinger**, Y. Tra, J. Voelkel, L. Chilton, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XV, Proceedings of SPIE vol. 7334, Orlando, FL, April 2009
  - [ 20] "Effect of Manmade Pixels in the Inherent Dimension of Natural Material Distributions", A. Schlamm,

- D.W. Messinger**, and B. Basener, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XV, Proceedings of SPIE vol. 7334, Orlando, FL, April 2009
- [ 21] "Anomaly Clustering in Hyperspectral Images", T. Doster, D. Ross, **D.W. Messinger**, and B. Basener, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XV, Proceedings of SPIE vol. 7334, Orlando, FL, April 2009
- [ 22] "Enhanced Detection and Visualization of Anomalies in Spectral Imagery", B. Basener, and **D.W. Messinger**, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XV, Proceedings of SPIE vol. 7334, Orlando, FL, April 2009
- [ 23] "Radiometric Modeling of Mechanical Draft Cooling Towers to Assist in the Extraction of their Absolute Temperature from Remote Thermal Imagery", M. Montanaro, C. Salvaggio, S. Brown, **D.W. Messinger**, A. Garrett, and J. Bollinger, Thermosense XXXI, Proceedings of SPIE vol. 7299, Orlando, FL, April 2009
- [ 24] "Oblique Hyperspectral Target Detection", J.P. Bishoff, **D.W. Messinger**, & E.J. Ientilucci, Imaging Spectrometry XIII, Proceedings of SPIE vol. 7086, San Diego, CA, August 2008
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