Shawn Kraut

Northwest Research Associates   contact: 831-655-4261 (office)
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SKILLS/ EXPERTISE

- Statistical signal and array processing
- Sonar, radar, and wireless communication applications
- Tracking, Bayesian filtering, and data association
- Propagation physics and physics-based signal processing
- Effective presentation of technical work

CURRENT POSITION

2014-present   Research Scientist, Northwest Research Associates

- Detection of traveling ionospheric waves
- Cramer Rao bounds for sequential-Bayesian state estimation
- Radar array localization, data conditioning, data analysis, and performance analysis with polarization-diverse sensor data
- Radio propagation modeling for over-the-horizon (OTH) radar: 3D ray homing in perturbed ionosphere, in Matlab and Fortran
- Development of simulation tool with flexible interfaces in Python; implementation of signal strength and array gain calculations

EDUCATION

Ph.D. 1999   Physics, University of Colorado at Boulder
Dissertation Topic: Adaptive Cosine Estimator (ACE) detection statistic, used in adaptive radar and hyper-spectral imaging (advisor: Louis L. Scharf)

M.S. 1996   Physics, University of Colorado at Boulder

B.S. 1993   Engineering Physics, University of Arizona

PRIOR POSITIONS

2005-2014   MIT Lincoln Laboratory, Advanced Sensor Techniques Group
Technical Staff

Adaptive array beamforming

- Led data collection and analysis team for DARPA CLASS program on cooperative distributed **MIMO wireless communications.**
- Government consultant on DARPA PREW program on distributed cooperative jamming.
- Assessed feasibility of surface-ship suppression in distributed **passive**

sonar array data, ONR Future Naval Capabilities program.
- Contributor to algorithm and operator display for detection of narrowband signals, US Navy Advanced Processing Build (APB) program and ONR.

Tracking, filtering, and data association	- Developed bearings-only multiple-target tracking and data association software for passive sonar array data, US Navy APB and ONR. - Developed tool to analyze effect of **MIMO radar** on tracking association performance, Lincoln Laboratory line program. - Developed approach to node localization and registration from time delay measurements, DARPA PREW program - Advised on source association and geo-tracking across multiple distributed arrays, ONR PSAT program.
Physics-based signal processing	- Developed normal-mode based acoustic depth discrimination algorithm. - Developed passive-sonar simulation package for beamforming work.
Detection performance analysis	- Evaluated performance of depth discrimination algorithm, using advanced statistical analysis technique. - Evaluated performance loss of adaptive beamforming algorithms in shallow-water propagation conditions.

2002-2005   Assistant Professor, Queen's University
Department of Mathematics and Statistics, and
Department of Electrical and Computer Engineering

- Supervised three graduate students in M.S. and Ph.D. work.
- Developed algorithm for shallow-water passive source localization in range-rate in presence of near-endfire interference.
- Proved significant optimality result for ACE detection statistic used in adaptive radar: Uniformly-Most Powerful Invariant property.
- Supervised project on computational **optical interferometry** and imaging
- Taught graduate course in "Statistical Signal Processing," and undergraduate courses in "Methods of Applied Mathematics," "Mathematical Methods for Engineering and Physics," and "Probability and Statistics for Electrical and Computer Engineers."

1999-2002   Post-doctoral Research Associate, Duke University
Department of Electrical and Computer Engineering (supervisor: Jeffrey L. Krolik)

- **Physics-based statistical signal and array processing**
- Developed recursive-Bayesian algorithm for localizing acoustic sources in depth, using particle-filter sequential importance sampling methods.
- Developed approach to parameter reduction to improve tropospheric refractivity

profile from microwave radar sea-clutter returns.
- Contributed to parameter estimation for recursive-Bayesian technique for estimating airplane altitude with **over-the-horizon radar.**

1996-1999   Graduate Research Assistant, University of Colorado at Boulder
Department of Electrical and Computer Engineering (supervisor: Louis L. Scharf)
- **Statistical signal processing and detection theory**
- Theoretically derived the Adaptive Coherence Estimator (ACE), used in adaptive radar applications to improve robustness to training-data mismatch.
- Simplified performance-prediction analysis of a class of adaptive detectors, deriving a reduced random-variable decomposition in only five variables.

- Interdisciplinary DSP/optics project (Lloyd Griffiths/Kelvin Wagner)
- Discovered modification needed to implement in optical hardware an LMS-based algorithm (BEAMTAP) for broadband adaptive array processing.

1993-1996   Graduate Research Assistant, University of Colorado at Boulder
Department of Physics
- Non-linear optics: derived solution to equations for evolution of signal content.
- Experimentally demonstrated unscrambling acoustic signals, in ring resonators.

1992   NSF summer intern, Arizona State University, Department of Physics
- Developed new modality for scanning transmission electron microscopy.

TEACHING EXPERIENCE

2002-2005   Queen's University, Department of Mathematics and Statistics
- STAT 863, Statistical Signal Processing
- MATH 338, Methods of Applied Mathematics
- MATH 334, Mathematical Methods for Engineering and Physics
- STAT 356, Probability and Statistics for Electrical and Computer Engineers

1998   University of Colorado at Boulder,
Department of Electrical and Computer Engineering
- ECEN 5612, Noise and Random Processes

PROFESSIONAL RECOGNITION

2011-present
- Elected to IEEE Signal Processing Sensor Array and Multichannel (SAM) technical committee

2009
- Named "Excellent Reviewer" by IEEE Journal of Oceanic Engineering, April 2009 issue

2000, 2002
- Invited speaker in two special sessions on invariance theory in signal processing, Asilomar Conference on Signals, Systems, and Computers

2002   •   Young Author Best Paper award from IEEE Signal Processing Society, for January 2001 paper "Adaptive Subspace Detectors"
This paper had 322 citations on Google Scholar as of December 2013

PROFESSIONAL ACTIVITIES

2013   Session chair, "WA6a: Multi-Sensor Signal Processing," for 2013 Asilomar Conference on Signals, Systems, and Computers, Nov. 3-6, 2013

2011-present   Technical Program Committee reviewer for conferences CAMSAP 2013, ICASSP 2013, SSP 2012, ICASSP 2012, ICASSP 2011

1997-present   Technical reviewer for journals IEEE Trans. on Signal Processing, IEEE Signal Processing Letters, Signal Processing, IEE Electronics Letters, IEEE Trans. on Information Theory, IEEE Trans. on Aerospace and Electronic Systems, IEEE Journal of Oceanic Engineering, Applied Optics, and Applied Physics

2009   Received "Reviewer Appreciation" letter from IEEE Transactions on Signal Processing for 9 reviews written in 2008

2006-2007   Member of organizing committee, Session Chair, and Technical Program Committee reviewer, Adaptive Sensor Array Processing (ASAP) workshop, MIT Lincoln Laboratory, June 2-6, 2007

2004   Session chair and Technical Program Committee reviewer, 22nd Biennial Symposium on Communications, Queen's University, May 31-June 3, 2004

2003   Panelist, National Science Foundation (NSF) Review Panel in Signal Processing Systems, March 3-4, 2003

CONTRACTS, GRANTS, AND FUNDING

2008-2011   Principal investigator, program on mitigation of surface-ship interference, US Office of Naval Research (ONR)

2003-2005   Principal investigator, "Dynamic multipath suppression of endfire interference with towed passive sonar arrays," US Office of Naval Research (ONR)

2003-2005   Principal investigator, "Improved adaptive detection and inverse imaging by beamforming and related methods," NSERC Canada Research Grant

SELECTED BRIEFINGS AND PRESENTATIONS

- Fourteen major briefings since 2006, including major program reviews and conferences
- Complete list in addendum below

S. Kraut, A. R. Margetts, and D. W. Bliss, **"Reducing the fractional rank of interference with space-time-frequency adaptive beamforming,"** in *47ᵗʰ Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, November 6, 2013

S. Kraut and D. W. Bliss, **"Analyzing the impact of MIMO radar on tracking association error,"** in *IEEE 7th Sensor Array and Multichannel Signal Processing Workshop (SAM),*

Stevens Institute of Technology, Hoboken, NJ, June 18, 2012

"Surface-ship interference suppression," ONR Undersea Signal Processing Annual Program Review, Applied Physics Laboratory, University of Washington, 2008, 2009, 2010, and 2011

S. Kraut, J.P. Kitchens, S. Bhadra, and W. Payne, **"Two-stage tracker for improved association with bearing-only measurements,"** at Fifteenth Annual *Adaptive Sensor and Array Processing (ASAP) Workshop*, MIT Lincoln Laboratory, Lexington, MA, June 6, 2007

SELECTED PUBLICATIONS

- Fourteen peer-reviewed journal publications
- Thirty-seven peer-reviewed conference publications or presentations
- Complete list in addendum below

S. Kraut, L. L. Scharf, and R.W. Butler, **"The adaptive coherence estimator: a uniformly-most-powerful-invariant adaptive detection statistic,"** *IEEE Transactions on Signal Processing,* vol. 53, pp. 427-438, February 2005
81 citations on Google Scholar (December 2013)

R.H. Anderson, S. Kraut, and J.L. Krolik, **"Robust altitude estimation for over-the-horizon radar using a state-space multipath fading model,"** *IEEE Transactions on Aerospace and Electronic Systems,* vol. 39, no.1, pp. 192-201, Jan. 2003
14 citations on Google Scholar (December 2013)

S. Kraut, L. L. Scharf, and L. T. McWhorter, **"Adaptive subspace detectors,"** *IEEE Transactions on Signal Processing*, vol. 29, no. 1, pp. 1-16, Jan. 2001
322 citations on Google Scholar (December 2013)

S. Kraut and L. L. Scharf, **"The CFAR adaptive subspace detector is a scale-invariant GLRT,"** *IEEE Transactions on Signal Processing*, vol. 47, no. 9, pp. 2538-2541, Sept. 1999
208 citations on Google Scholar (December 2013)

Shawn Kraut
Addendum: presentations and publications

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RECENT PRESENTATIONS AND BRIEFINGS (PRESENTOR)

S. Kraut, A. R. Margetts, and D. W. Bliss, **"Reducing the fractional rank of interference with space-time-frequency adaptive beamforming,"** in *47th Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, November 6, 2013

S. Kraut and D. W. Bliss, **"Analyzing the impact of MIMO radar on tracking association error,"** in *IEEE 7th Sensor Array and Multichannel Signal Processing Workshop (SAM)*, Stevens Institute of Technology, Hoboken, NJ, June 18, 2012

S. Kraut and V. Kmelnitsky, **"Surface-ship interference suppression: Year 4 review,"** ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 4, 2011

S. Kraut, R. Lacoss, V. Kmelnitsky, P. Ryu, A. McKellips, and W.H. Payne, **"Surface-ship interference suppression: Year 3 review,"** ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 5, 2010

S. Kraut, Christ D. Richmond, V. Kmelnitsky, and W. H. Payne, "**Performance prediction analysis of depth discrimination algorithm**," *IEEE Undersea Signal Processing workshop (UASP)*, Alton Jones Campus, University of Rhode Island, October 16, 2009

S. Kraut, V. Kmelnitsky, A. McKellips, and W.H.Payne, "**Surface ship interference suppression: Year 2 review**," ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 6, 2009

S. Kraut, C. Richmond, V. Kmelnitsky, and W. Payne, **"Acoustic source depth-discrimination performance-prediction analysis,"** department colloquium, Department of Electrical and Computer Engineering, University of Massachusetts Dartmouth, April 24, 2009

S. Kraut, J. P. Kitchens, P. Fiore, A. McKellips, and W. H. Payne, **"Surface-ship interference suppression: Year 1 review"** ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 7, 2008

K. D. Arsenault, J. P. Kitchens, S. Kraut, and W. H. Payne, presentation on algorithm for **operator-assisted detection** with bearing-time record display, ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 23, 2007

C. Richmond, S. Kraut, V. Kmelnitsky, and W. Payne, "**Acoustic source depth-discrimination performance prediction analysis**," ONR Undersea Signal Processing Program Review, Applied Physics Laboratory, University of Washington, August 23, 2007

C. Richmond, S. Kraut, V. Kmelnitsky, and W. Payne, **"Acoustic source depth-discrimination performance-prediction analysis,"** at Fifteenth Annual *Adaptive Sensor and Array Processing (ASAP) Workshop*, MIT Lincoln Laboratory, Lexington, MA, June 6, 2007

S. Kraut, J.P. Kitchens, S. Bhadra, and W. Payne, **"Two-stage tracker for improved association with bearing-only measurements,"** at Fifteenth Annual *Adaptive Sensor and Array Processing (ASAP) Workshop*, MIT Lincoln Laboratory, Lexington, MA, June 6, 2007

S. Kraut, J.P. Kitchens, and J.A. Watson, **"Quantifying ABF gains and development of system metrics: impact on tracking,"** at meeting of *Advanced Processing Build (APB) Thin Line Working Group (TLWG)*, Lockheed Martin, Orincon Division, Arlington, VA, August 8, 2006

JOURNAL PAPERS

S. Vasudevan, R.H. Anderson, S. Kraut, P. Gerstoft, L. T. Rogers, J. L. Krolik, **"Recursive Bayesian electromagnetic refractivity estimation from radar sea clutter,"** in *Radio Science*, vol. 42, no. 2, April 2007, paper RS2014

O. Besson, L. L. Scharf, and S. Kraut, **"Adaptive detection of a known signal known only to lie on a line in a known subspace, when primary and secondary data are partially homogeneous,"** in *IEEE Transactions on Signal Processing*, vol. 54, no. 12, Dec. 2006, pp. 4698-4705

O. Besson, S. Kraut, and L. L. Scharf, **"Detection of an unknown rank-one component in white noise,"** *IEEE Transactions on Signal Processing*, vol. 54, no. 7, pp. 2835-2839, July 2006

K. LePage, D.J. Thomson, S. Kraut, and D.J. Brady, **"Multitaper scan-free spectrum estimation using a rotational shear interferometer,"** *Applied Optics*, vol. 45, no. 13, pp. 2940-2954, May 2006

S. Kraut, L. L. Scharf, and R.W. Butler, **"The adaptive coherence estimator: a uniformly-most-powerful-invariant adaptive detection statistic,"** *IEEE Transactions on Signal Processing,* vol. 53, pp. 427-438, February 2005

S. Kraut, R.H. Anderson, and J.L. Krolik, **"A generalized Karhunen-Loeve basis for efficient estimation of atmospheric refractivity using radar clutter,"** *IEEE Transactions on Signal Processing*, vol. 52, pp. 48-60, Jan 2004

S. Basty, M. A. Neifeld, D. Brady, and S. Kraut, **"Nonlinear estimation for interferometric imaging,"** *Optics Communications,* vol. 228, pp. 249-261, Dec. 15, 2003

R.H. Anderson, S. Kraut, and J.L. Krolik, **"Robust altitude estimation for over-the-horizon radar using a state-space multipath fading model,"** *IEEE Transactions on Aerospace and Electronic Systems,* vol. 39, no.1, pp. 192-201, Jan. 2003

S. Kraut, L. L. Scharf, and L. T. McWhorter, **"Adaptive subspace detectors,"** *IEEE Transactions on Signal Processing*, vol. 29, no. 1, pp. 1-16, Jan. 2001

L. L. Scharf and S. Kraut, **"Geometries, invariances, and SNR interpretations of matched and adaptive subspace detectors,"** *Traitement du Signal,* vol. 15, no. 6, pp. 527-534, June 1999

S. Kraut and L. L. Scharf, **"The CFAR adaptive subspace detector is a scale-invariant GLRT,"** *IEEE Transactions on Signal Processing*, vol. 47, no. 9, pp. 2538-2541, Sept. 1999

S. Kraut, N. Nuttall, and D.Z. Anderson, **"Photorefractive two-beam coupling equations with multiple spatial-temporal features: an SVD Approach,"** *Applied Physics B, Photorefractive Materials: Properties and Applications*, vol. 68, no. 5, pp. 937-945, May 1999

G. Kriehn, A. Kiruluta, P.E.X. Silveira, S. Weaver, S. Kraut, K. Wagner, R. T. Weverka, L. Griffiths, **"Optical BEAMTAP beam-forming and jammer-nulling system for broadband phased-array antennas,"** *Applied Optics*, vol. 39., no. 2, pp. 212-230, Jan. 2000

S. Kraut and J. M. Cowley, **"A simplified mode of differential phase contrast Lorentz microscopy,"** *Microscopy Research and Technique*, vol. 25, no. 4, pp. 341-345, July 1993

CONFERENCE PAPERS AND PRESENTATIONS

L.J. Nickisch, S.V. Fridman, M. Hausman, S. Kraut, and G. Zunich, "**Assimilative modeling of ionospheric dynamics for now-casting of HF propagation channels in the presence of TIDs**," in *Proc. 14th Ionospheric Effects Symposium*, May 12-14, 2015 (Alexandria, VA)

S.V. Fridman, L.J. Nickisch, M. Hausman, S. Kraut, and G. Zunich, "**Model for ionospheric dynamics employing delay, Doppler, and direction of arrival measurements from multiple HF channels**," in *Proc. 14th Ionospheric Effects Symposium*, May 12-14, 2015 (Alexandria, VA)

S. Kraut, A. R. Margetts, and D. W. Bliss, **"Reducing the fractional rank of interference with space-time-frequency adaptive beamforming,"** in *Proc. 47th Asilomar Conference on Signals, Systems, and Computers*, November 3-6, 2013 (Pacific Grove, CA)

A. R. Margetts, R. Bartlett, E. G. Torkildson, S. Kraut, **"Optimal training and data power allocation for distributed transmit beamforming,"** in *Proc. 47th Asilomar Conference on Signals, Systems, and Computers*, November 3-6, 2013 (Pacific Grove, CA)

P. Bidigare, D. R. Brown, S. Kraut, U. Madhow, **"MIMO Channel Prediction Results on Outdoor Collected Data,"** in *Proc. 47th Asilomar Conference on Signals, Systems, and Computers*, November 3-6, 2013 (Pacific Grove, CA)

S. Kraut and D. W. Bliss, **"Analyzing the impact of MIMO radar on tracking association error,"** in *Proc. of IEEE 7th Sensor Array and Multichannel Signal Processing Workshop (SAM)*, June 17-20, 2012, pp. 161-164 (Hoboken, NJ)

D.W. Bliss, S. Kraut, and A. Agaskar, **"Transmit and receive space-time-frequency adaptive processing for cooperative distributed MIMO communicaitons,"** in *Proceedings of International Conference on Acoustics, Speech, and Signal Processing (ICASSP),* March 25-30, 2012 (Kyoto, Japan)

D.W. Bliss, K.W. Forsythe, S.K. Davis, G.S. Fawcett, D.J. Rabideau, L.L. Horowitz, and S. Kraut, **"GMTI MIMO radar,"** in *Proceedings of 2009 Waveform Diversity and Design Conference*, February 8-13 2009, pp. 118-122 (Orlando, FL)

O. Besson, L. L. Scharf, and S. Kraut, **"Adaptive matched direction detector,"** in *Proceedings of Fourth IEEE Workshop on Sensor Array and Multi-channel Signal Processing, SAM 2006*, July 12-14 2006, pp. 137-141 (Waltham, MA)

K. Lepage, S. Kraut, **"Multitaper methods for spectrum estimation with a rotational shear interferometer,"** in *Proceedings of Computational Optical Sensing and Imaging (COSI)*, Optical Society of America, June 6, 2005, paper CTuC3 (Charlotte, NC)

H. He and S. Kraut, **"Colored loading for robust adaptive beamforming with low sample support,"** in *Proceedings of the Eighth International Symposium on Signal Processing and Its Applications*, August 28-31, 2005, pp. 395-398 (Sydney, Australia)

H. He and S. Kraut, "**Partially adaptive beamforming with Slepian-based quiescent response,"** in *Proceedings of the Thirteenth IEEE Workshop on Statistical Signal Processing (SSP)*, July 17-20 2005, pp. 301-305 (Bordeaux, France)

V. Bobko and S. Kraut, **"Passive localization in range-rate with tilted line arrays,"** in *Proceedings of International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2005,* v.4, pp. 1037-1040, March 18-23, 2005 (Philadelphia, PA)

Jeffrey L. Krolik, Paul Book, and Shawn Kraut, **"Adaptive sonar detection performance when the signal wavefront and noise covariance are uncertain,"** in *Proc. 2004 IEEE Sensor Array and Multichannel Signal Processing Workshop, SAM 2004,* July 2004 (Barcelona Spain)

S. Kraut and L.L. Scharf, **"UMP invariance of the multi-rank adaptive coherence estimator,"** in *Proc. 37th Asilomar Conference on Signals, Systems, and Computers*, pp. 1863-1867, Nov. 9-12, 2003 (Pacific Grove, CA)

S. Kraut and J. Krolik, **"Passive source localization in the presence of near-endfire interference,"** in *Proc. 37th Asilomar Conference on Signals, Systems, and Computers*, pp. 760-764, Nov. 9-12, 2003 (Pacific Grove, CA)

S. Kraut and L.L. Scharf, **"UMP invariance in adaptive detection: kernels that preserve**

monotone likelihood ratio," in *Proc. 2003 IEEE Workshop on Statistical Signal Processing*, pp. 629-632, Sept 28—Oct. 1 2003 (St. Louis, MO)

S. Kraut and J. L. Krolik, **"Supression of moving interference with SIS-based projections, in shallow water environments,"** in *Proc. 2002 IEEE Sensor Array and Multichannel Signal Processing Workshop, SAM 2002,* pp. 96-99, August 2002 (Arlington, VA)

S. Kraut, J. Gallicchio, and D. Brady, **"High-resolution direction finding and scan-free spectrum estimation with rotational-shear interferometric sensor arrays,"** in *Proc. SPIE's 47th Annual Meeting SPIE 2002,* July 2002 (Seattle, WA)

S. Kraut and J. Krolik, **"Passive localization in range-rate of shallow-water moving targets, by sequential importance sampling,"** in *Proc. 27th International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2002,* v.3, pp. 2877-2880, May 2002 (Orlando, FL)

Louis L. Scharf, L. Todd McWhorter, and S. Kraut, **"Capon redux: new formulas, geometries, and computational efficiencies,"** in *Proc. 10th Workshop on Adaptive Sensor Array Processing, ASAP-01,* March 2002 (MIT Lincoln Laboratory, Lexington, MA)

J. Gallicchio, E. Cull, S. Kraut, and D.J. Brady, **"Spatio-spectral triangulation using a rotational shear interferometer,"** in *Proc. 2001 OSA Conference on Integrated and Computational Imaging System, ICIS 2001,* pp. 74-6, October 2001 (Albuquerque, NM)

R.H. Anderson, S. Kraut, and J.L. Krolik, **"Robust altitude estimation for over-the-horizon radar using a state-space model for multipath fading,"** in *Proc. 26th International Conference on Acoustics, Speech, and Signal Processing, ICASSP 2001,* v.5, pp. 2901-4, May 2001 (Salt Lake City, UT)

S. Kraut and J. Krolik, **"Moving target depth estimation for passive sonar, using sequential resampling techniques,"** in *Proc. 9th Workshop on Adaptive Sensor Array Processing, ASAP-01,* pp. 91-6, March 2001 (MIT Lincoln Laboratory, Lexington, MA)

S. Kraut and J. L. Krolik, **"Application of Maximal Invariance to the ACE Detection Problem,"** in *Proc. 34th Asilomar Conference on Signals, Systems, and Computers*, v.1, 417-420, Oct. 2000 (Pacific Grove, CA) (***invited talk***)

S. Kraut and J. Krolik, **"Optimal subspace selection for non-linear parameter estimation applied to refractivity from clutter,"** in *Proc. 10th IEEE Workshop on Statistical Signal and Array Processing,* pp. 113-7, Aug. 2000 (Pocono Manor, PA)

S. Kraut, K. Harmanci, and J. Krolik, **"Space-time adaptive processing for over-the horizon spread-Doppler clutter mitigation,"** in *Proc. 2000 IEEE Sensor Array and Multichannel Signal Processing Workshop, SAM 2000,* pp. 245-9, March 2000 (Boston, MA)

L. L. Scharf, S. Kraut, and M.L. McCloud, **"A review of matched and adaptive subspace detectors,"** in *Proc. IEEE 2000 Adaptive Systems for Signal Processing,* pp. 82-6, Oct. 2000

(Lake Louise, Alberta)

S. Kraut and L. L. Scharf, **"Adaptive estimators of output SNR for random channels,"** in *Proc. 33rd Asilomar Conference on Signals, Systems, and Computers,* vol.2, pp. 1145-1148, Oct. 1999 (Pacific Grove, CA)

S. Kraut and L. L. Scharf, **"Performance comparison of the ACE, AMF, and Kelly GLRT,"** in *Proc. of the 7th Workshop on Adaptive Sensor Array Processing, ASAP-99*, March 1999 (MIT Lincoln Laboratory, Lexington, MA)

S. Kraut and L. L. Scharf, **"Performance convergence of the adaptive matched filter,"** in *Proc. 32nd Asilomar Conference on Signals, Systems, and Computers*, vol. 2, pp. 1181-1185, Nov. 1998 (Pacific Grove, CA)

S. Kraut and L. L. Scharf, **"Performance evaluation of adaptive subspace detectors, based on stochastic representations,"** in *Proc. of the 9th Biennial European Signal Processing Conference, EUSIPCO-98,* Sept. 1998 (Rhodes, Greece)

S. Kraut and L. L. Scharf, **"The CFAR adaptive subspace detector is a scale-invariant GLRT,"** in *Proc. 9th IEEE Signal Processing Workshop on Statistical and Array Processing*, pp. 57-60, Sept. 1998 (Portland, OR)

S. Kraut, L. L. Scharf, and L. T. McWhorter, **"Stochastic representations for higher rank adaptive subspace detectors,"** in *Proc. 8th IEEE Digital Signal Processing Workshop, IEEE DSP-98*, August 1998 (Bryce Canyon, UT)

S. Kraut, L. Scharf, and L. T. McWhorter, **"A canonical representation for adaptive matched subspace detectors,"** in *Proc. 31st Asilomar Conference on Signals, Systems, and Computers*, vol. 2, pp. 1331-1335. Nov. 1997 (Pacific Grove, CA)

A.Kiruluta, G. Kriehn, P.E.X. Silveira, S. Weaver, S. Kraut, K. Wagner, D. Anderson, **"Adaptive beamforming with TDI CCD based true-time-delay processing,"** in *Proc. SPIE,* vol. 3804, pp. 62-71, July 1999 (Denver, CO)

K. H. Wagner, S. Weaver, S. Kraut, L. Griffiths, R. T. Weverka**, "Broadband efficient adaptive method for true-time-delay array processing,"** in *Proc. 1998 IEEE Aerospace Conference Proceedings*, vol. 5, pp. 289-298, March 1998 (Aspen, CO)

K. Wagner, S. Kraut, L. Griffiths, S. Weaver, R. T. Weverka, and A. W. Sarto**, "Broadband and efficient adaptive method for true-time-delay array processing,"** in *Proc. of Optics in Computing, OC97*, pp. 108-110, March 1997 (Lake Tahoe, NV)

K. Wagner, S. Kraut, L. Griffiths, S. Weaver, R.T. Weverka, and A.W. Sarto, **"Efficient true-time-delay adaptive-array processing,"** in *Proc. SPIE*, vol. 2845, pp. 287-300, Aug. 1996 (Denver, CO)