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Work done by Thomas H. Kerr III (TeK Associates) on UEWR National Missile Defense

For the four years ('97-'01), participated in the development of the next generation of Upgraded Early Warning Radar (UEWR) target tracking filters for National Missile Defense as a consultant, first, for The MITRE Corporation (via Gemini Industries '97-'98) [1]-[4], then directly for XonTech ('98-'99) [5], and, subsequently, directly for Raytheon ('99-'00) [6]-[9]. He has personally developed Cramer-Rao lower bound evaluation analysis and corresponding MatLab software for gauging nonlinear filter performance and has contributed on other tracking issues such as specifying and documenting (first, as preliminary PowerPoint presentations, then as Software Requirements Specifications) the Extended Kalman Filter and Batch filters to be used and in writing the tracking Notebook and other final reports and memos. As part of associated modeling considerations, he also investigated use of the Lambert algorithm versus Levenberg-Marquardt least squares fitting and variations thereof in determining when to include the second zonal harmonic of gravity to account for the oblateness of the earth and when it can be ignored for UEWR. He is gaining more experience with the Interactive Multiple Model (IMM) estimation approach as well.

As a contractor (via Gemini) at The MITRE Corporation in consulting on National Missile Defense target tracking filters, he has provided Cramer-Rao lower bound evaluation analysis and software for gauging nonlinear filter performance [1]-[4] and has contributed on other issues as well relating to evaluating algorithms provided by other participating National Missile Defense (NMD) contractors.

1. Kerr, T. H., *NMD White Paper on Designated Action Item*, MITRE, Bedford, MA, January 1998.
2. Kerr, T. H., "Cramer-Rao Lower Bound Implementation and Analysis for NMD Radar Target Tracking," TeK Associates Technical Report No. 97-101 (for MITRE), Lexington, MA, 26-30 Oct. 1997.
3. Kerr, T. H., "Cramer-Rao Lower Bound Implementation and Analysis: CRLB Target Tracking Evaluation Methodology for NMD Radars," MITRE Technical Report, Contract No. F19628-94-C-0001, Project No. 03984000-N0, Bedford, MA, February 1998.
4. Kerr, T. H., "Developing Cramer-Rao Lower Bounds to Gauge the Effectiveness of UEWR Target Tracking Filters," Proceedings of AIAA/BMDO Technology Readiness Conference and Exhibit, Colorado Springs, CO, 3-7 August 1998.
5. Kerr, T. H., UEWR *Design Notebook-Section 2.3: Track Analysis*, TeK Associates, Lexington, MA, (for XonTech, Hartwell Rd, Lexington, MA), XonTech Report No. D744-10300, 29 March, 1999.
6. Kerr, T. H., and Satz, H. S., "Evaluation of Batch Filter Behavior in comparison to EKF," TeK Associates, Lexington, MA, (for Raytheon, Sudbury, MA), 22 November 1999 (PowerPoint Presentation).
7. Kerr, T. H., "TeK Associates' view in comparing use of a recursive Extended Kalman Filter (EKF) versus use of Batch Least Squares (BLS) algorithm for UEWR," TeK Associates, Lexington, MA, (for Raytheon, Sudbury, MA), 12 September 2000.
8. Kerr, T. H., "Considerations in whether to use Marquardt Nonlinear Least Squares vs. Lambert Algorithm for NMD Cue Track Initiation (TI) calculations," TeK Associates, Lexington, MA, (for Raytheon, Sudbury, MA), 27 September 2000.
9. Satz, H. S., Kerr, T. H., "Comparison of Batch and Kalman Filtering for Radar Tracking," *Proceedings of 10th Annual AIAA/BMDO Conference*, Williamsburg, VA, 25 July 2001, Unclassified.

June 1999 To October 2000 **Wrote specialty "tracking" segments of Software Requirements Spec. for Updated Early Warning Radar (UEWR)**

With a direct TeK Associates sub-contract from: Raytheon, Sudbury, MA
RADAR SYSYEM CONSULTANT specializing in Tracking Issues

- Participated in the **development** (and **debug**), and **refinement** of parameters in the **implementation** and **test** of various candidate Extended Kalman Filters (EKF's) for UEWR, as implemented in **Fortran** on several different UNIX platforms and targeted for eventual C/C++ implementation. Prototypes were first in **MatLab™ 5.3** and **Fortran** on PC for our experiments.
- Wrote an **M/S Word** memo "On use of Lambert algorithm versus use of Levenberg-Marquardt algorithm for EKF Track Initiation (**TI**)".
- Participated in the writing (**M/S Word™**) of the **Software Requirements Specification** (SRS) for Raytheon's Batch Least Squares (BLS) Algorithm, RVCC EKF, RUV EKF, Interactive Multiple Model (**IMM**) Filter, and **TI**.

December 1998 To May 1999 **Performed System Analysis Studies of UEWR**
As a subcontractor to: XonTech, Inc. (Lexington, MA), the original LSI
RADAR SYSYEM CONSULTANT specializing in Tracking Issues

- Exercised the same **CRLB** evaluator for gauging tracking accuracy, that had been previously implemented below for MITRE, and applied it to XonTech's more realistic **TD/SAT™** simulations and compared results to EKF results**.**
- Prepared and delivered **M/S PowerPoint™** presentation of the above results.
- Became familiar with parameter settings of XonTech's **TD/SAT** and associated corresponding UEWR radar performance.
- Single-handedly wrote the 150 page UEWR Analysis Design Notebook on Tracking, summarizing the tracking behavior established to date for UEWR.

May 1997 to August 1998 **Performed System Analysis Studies of UEWR**
As a contract engineer to: MITRE (Bedford, MA)
RADAR SYSYEM CONSULTANT specializing in Tracking Issues

- Designed and developed a Cramer-Rao Lower Bound (**CRLB**) evaluator (an area of my prior published 1974 and 1989-'90 expertise) for gauging tracking accuracy and personally implemented this evaluation tool in **MatLab™ 4.2**.
- Documented the **CRLB** implementation and User instructions.
- Exercised this **CRLB** tool to **evaluate** expected performance of best possible tracking algorithms over a variety (40) of specified trajectories, as viewed by different Early Warning Radar locations and their respective characteristics.
- Wrote a TeK Associates' final report (in **LaTeX**) and then as a MITRE final report (in **M/S Word**) summarizing the results of these **CRBL** evaluations.
- Wrote a White Paper (in **M/S Word**) for MITRE considering both CRLB and other aspects that affect tracking accuracy for UEWR.
- Wrote (in **LaTeX™**) and delivered a published peer-reviewed paper on all the above aspects at *AIAA Ballistic Missile Defense Organization (BMDO) Conference and Workshop* at Colorado Springs in August 1998.

October, 1992 To Present **Designed, Developed, Implemented, Tested, and Documented TK-MIP™**
Client: Myself, doing business as (dba) TeK Associates
CEO/Chief Programmer/acting Advertising & Marketing Manager:

- Design of commercial TK-MIP™ software for the PC as a way to quickly and cost-effectively implement various Kalman filter design options as a prototype so that user avoids the need to do any programming whatsoever.
- Developed several closed-form test cases to Verify and Validate **TK-MIP™** and that can be similarly used for any other software of this type.
- Implemented **TK-MIP** Graphical User Interface (**GUI**) in **Visual Basic (VB) 3.0**, with other critical portions implemented in **VB 5.0** and **6.0** (so that they are truly compiled identically to what **M/S VC/C++** does).
- Performed **unit and integration testing** of **TK-MIP™**. Performed thorough **regression tests** after every major change.
- Prepared two levels of selectable **on-line user guide** for **TK-MIP™** to prompt and support both the novice and experienced user.
- Did publicity and marketing: published successful applications in peer-reviewed professional IEEE, SPIE, and Institute of Navigation journals (in GPS use for airborne image collection for mapping; for image enhancement and multi-sensor data fusion; for simplifying iterated EKF implementation). Had a total of 9 technical publications in 2001.

Feb. '71 to Aug. '92 Control Engineer, GE R&DC for 2 years; Member of Technical Staff: at TASC 6 years, at Intermetrics, Inc. 6 yrs., at Lincoln Lab. 6 yrs., taught Optimal Control in the evenings for four years ('90-'95) in graduate ECE Dept. of NU. From '73 to '92, was exclusively in navigation (INS/Loran/GPS) and radar work for DoD for a variety of different platforms including SSBNs, CVs, SSNs, F-23 ATF (all in an R&D design and/or simulation and test capacity).

EDUCATION: From '71-Present: has taken numerous (~80) Continuing Education Courses and Short Courses since his highest degree below.

University of Iowa, Iowa City:

- Ph.D. in E. E./Stochastic Control and Estimation Theory in February 1971.
- MSEE/Control Systems in February 1969.

Howard University, Washington, DC:

- BSEE (Magna cum Laude) /Electrical Engineering (solid state electronics) in June 1967.

Relevant prior experience and/or publications:

For Group 95 at Lincoln Laboratory:

- Performed investigation of various multi-channel generalizations of *maximum entropy* technique for spectral estimation and applied two alternative implementations to the estimation of Primary Polarization (PP) and Orthogonal Polarization (OP) components of RV wake signatures from (Kwajalein Islands) *Tradex* wideband radar data. Also explored use of Matrix Spectral factorization computer program in conjunction with use of realization theory results on the same problem. *Tradex* radar uses coherent phase processing so data and algorithm formulations had to accommodate both real and imaginary complex processing. Validated software with synthetic data simulated as problems of known solution, then applied validated implementation to actual *Tradex* radar data (as recorded on magnetic tape). Same techniques were used in reverse to emulate signatures of real targets for purposes of enemy deception as an electronic decoy.
- Participated as a speaker in the videotaped in-house *Distributed Sensor Systems Workshop* and participated in the associated round-table panel discussion which followed.

- Looked into aspects of satellite survivability for SDI including the interaction and/or impact of evolutionary navigation, pointing, and triangulation technology associated with angles-only tracking (as with coordinated electro-optic sensors or with range-denied jammed radars).
- Performed study to assess the utility of using two range-denied (jammed) radar to track an incoming RV via triangulation. Varied sensor location from target, orientation of sensors, and baseline length as well as radar pulse repetition frequency PRF and Kalman filter initial conditions to assess the effect. I developed a new computer program for this application. Prior errors in the methodology were pointed out.
- Developed an Extended Kalman filter for RV target tracking using either radar or passive optics measurements (exclusively or in combination). Took steps to make software that was developed compatible with eventual inclusion within a multi-target tracking framework for updating/maintaining target track files and properly extinguishing or pruning nonexistent false target reports. Planned use of on-line time-varying variance within adaptive tracking gates for clutter suppression. This was all for a detailed simulation. Generated detailed intermediate software design memos (already listed above) and unit tests and performed integration testing as well. Looked into other state-of-the-art approaches to tracking maneuvering targets, of solving the resource "assignment problem" inherent in multi-target tracking and for implementing the solutions, and of handling the related problem of multi-sensor fusion.

For Intermetrics, Inc. **[renamed AverStar and moved to Burlington, MA from Cambridge and more recently made part of Titon]**, the following navigation, Kalman filtering, or signal-processing related investigations/tasks were performed:

- Pioneered failure detection/redundancy management/decentralized filter formulations as developed under Integrated Communications, Navigation, and Identification for Avionics (ICNIA) for the Advanced Tactical Fighter (ATF).
- Critiqued Kalman filter design and performance of early Magnavox version of Precise Integrated Navigation System (PINS), as is being developed for Minesweepers.
- Surveyed and summarized how Phase II Global Positioning System (GPS) works and options/variations in cross-checking both contractor's compliance (and in tagging violations) during the Phase II demonstration and competition for follow-on Phase III.
- Worked on integration of Joint Tactical Information and Distribution System (JTIDS) Relative Navigation (RelNav) into aircraft/aircraft carriers and JTIDS/GPS integration issues.
- Performed test and evaluation of data monitoring GPS Phase II integration on Strategic Submersible Nuclear attack submarine SSN701 *La Jolla* and the susceptibility to detection by enemy surveillance in its use of GPS.
- Found stable decentralized Kalman filter formulations for JTIDS RelNav.

For The Analytic Sciences Corporation (TASC) [in Reading, MA, which became part of Litton but is now part of Northrop Grumman], the following navigation, Kalman filtering, and fault detection/signal-processing related investigations/tasks were performed:

- Posed the problem of optimal navigation fix utilization for submarines in such a way that navigation accuracy is adequate while exposure to enemy surveillance is minimized. Considerations also included associated sweep-rate exposure to enemy surveillance and thwarting enemy ASW search procedures.
- Developed a failure detection technique for monitoring performance of the Electrostatically Supported Gyro Monitor (ESGM) on Trident submarines. Used confidence regions, as

previously developed by me and refined them for this application. Was actively involved in the development, analysis, simulation, and programming using both covariance analysis and Monte-Carlo simulation. Involvement included real data validation of the proposed algorithm after handing it over to Sperry Systems Management (then SSM, now UNISYS in Great Neck, NY) to implement.

For General Electric Corporate Research & Development Center (in Schenectady, NY), was involved in various aspects of the following two major projects:

- Making improvements to Automated Dynamic Analyzer (ADA) and performing simulations in ADA.
- Developing and implementing an algorithm for real-time mini-computer processing (GE-PAC.30) of data in the ultrasonic location of flaws in the rotors of large turbines.

Relevant publications:

10. Kerr, T. H., "ADA70 Steady-State Initial-Value Convergence Techniques," General Electric Report, Technical Information Series No. 72 CRD095, 1972.
11. Kerr, T. H., "A Simplified Approach to Obtaining the Steady-State Initial Conditions for Linear System Simulations," *Proceedings of the Fifth Annual Pittsburgh Conference on Modeling and Simulation*, 1974.
12. Fagan, J., Kerr, T. H., and Uttam, B., "Poseidon Improvement Studies," TASC Technical Report TR-315-1, Reading, MA, June 1973 (Confidential) for Navy, SP-24 of Strategic Systems Project office (Crystal City, VA).
13. Kerr, T. H., "Poseidon Improvement Studies: Real-Time Failure Detection in the SINS/ESGM," TASC Report TR-418-20, Reading, MA, June 1974 (Confidential) for Navy, SP-24.
14. Kerr, T. H., ``A Two Ellipsoid Overlap Test for Real-Time Failure Detection and Isolation by Confidence Regions," *Proceedings of IEEE Conference on Decision and Control*, Phoenix, AZ, December 1974.
15. Kerr, T. H., "A New Multivariate Cramer-Rao Inequality for Parameter Estimation (Application: Input Probing Function Specification)," *Proceedings of IEEE Conference on Decision and Control*, Phoenix, AZ, pp. 97-103, December 1974.
16. Kerr, T. H., "Failure Detection in the SINS/ESGM System," TASC Report TR-528-3-1, Reading, MA, July 1975 (Confidential) for Navy, SP-24.
17. Kerr, T. H., "Improving ESGM Failure Detection in the SINS/ESGM System (U)," TASC Report TR-678-3-1, Reading, MA, October 1976 (Confidential) for Navy, SP-24.
18. Kerr, T. H., "Failure Detection Aids for Human Operator Decisions in a Precision Inertial Navigation System Complex," *Proceedings of Symposium on Applications of Decision Theory to Problems of Diagnosis and Repair*, Keith Womer (editor), Wright-Patterson AFB, OH: AFIT TR 76-15, AFIT/EN, Oct. 1976, sponsored by the local Dayton Chapter of the American Statistical Association, Fairborn, Ohio, June 1976.
19. Kerr, T. H., "Real-Time Failure Detection: A Static Nonlinear Optimization Problem that Yields a Two Ellipsoid Overlap Test," *Journal of Optimization Theory and Applications*, Vol. 22, No. 4, August 1977.
20. Kerr, T. H., "Preliminary Quantitative Evaluation of Accuracy/ Observables Trade-off in Selecting Loran/NAVSAT Fix Strategies," TASC Technical Information Memorandum TIM-889-3-1, Reading, MA, December 1977 (Confidential) for Navy, SP-24.
21. Kerr, T. H., "An Invalid Norm Appearing in Control and Estimation," *IEEE Transactions on Automatic Control*, Vol. AC-23, No. 1, February 1978.
22. Kerr, T. H., "Three Important Matrix Inequalities Currently Impacting Control and Estimation Applications," *IEEE Transactions on Automatic Control*, Vol. AC-23, No. 6, December 1978.
23. Kerr, T. H., "Improving C-3 SSBN Navaid Utilization," TASC Technical Information Memorandum TIM-1390-3-1, Reading, MA, August 1979 (Secret) for Navy, SP-24.
24. Kerr, T. H., "Statistical Analysis of a Two Ellipsoid Overlap Test for Real-Time Failure Detection," *IEEE Transactions on Automatic Control*, Vol. AC-25, No. 4, August 1980.
25. Kerr, T. H., "Stability Conditions for the RelNav Community as a Decentralized Estimator-Final Report," Intermetrics, Inc. Report No. IR-480, Cambridge, MA, 10 August 1980, for NADC (Warminster, PA).

26. Kerr, T. H., and Chin, L., "A Stable Decentralized Filtering Implementation for JTIDS RelNav," *Proceedings of IEEE Position, Location, and Navigation Symposium (PLANS)*, Atlantic City, NJ, 8-11 December 1980.
27. Kerr, T.H., and Chin, L., "The Theory and Techniques of Discrete-Time Decentralized Filters," in *Advances in the Techniques and Technology in the Application of Nonlinear Filters and Kalman Filters*, edited by C.T. Leondes, NATO Advisory Group for Aerospace Research and Development, AGARDograph No. 256, Noordhoff International Publishing, Lieden, 1981.
28. Kerr, T. H., "Modeling and Evaluating an Empirical INS Difference Monitoring Procedure Used to Sequence SSBN Navaid Fixes," Proceedings of the Annual Meeting of the Institute of Navigation, U.S. Naval Academy, Annapolis, Md., 9-11 June 1981. (Selected for reprinting *in Navigation: Journal of the Institute of Navigation*, Vol. 28, No. 4, pp. 263-285, Winter 1981-82).
29. Kerr, T. H., "False Alarm and Correct Detection Probabilities Over a Time Interval for Restricted Classes of Failure Detection Algorithms," *IEEE Transactions on Information Theory*, Vol. IT-28, No. 4, pp. 619-631, July 1982.
30. Kerr, T. H., "Impact of Navigation Accuracy in Optimized Straight-Line Surveillance/Detection of Undersea Buried Pipe Valves," *Proceedings of National Marine Meeting of the Institute of Navigation (ION)*, Cambridge, MA, 27-29 October 1982.
31. Kerr, T. H., "Phase III GPS Integration; Volume 1: GPS U.E. Characteristics," Intermetrics Report IR-MA-177, Cambridge, MA, January 1983, for Navair.
32. Kerr, T.H., "GPS/SSN Antenna Detectability," Intermetrics Report No. IR-MA-199, Cambridge, MA, 15 March 1983, for NADC.
33. Kerr, T. H., "Examining the Controversy Over the Acceptability of SPRT and GLR Techniques and Other Loose Ends in Failure Detection," *Proceedings of the American Control Conference*, San Francisco, CA, 22-24 June 1983.
34. Kerr, T. H., "Update to and Refinement of Aspects of Pattern Recognition Principles Used in the Missile Warning System (AN/AAR-47)," Intermetrics Report No. IR-MA-362, 15 September 1983, for Honeywell Electro-Optical.
35. Carlson, N. A., Kerr, T. H., Sacks, J. E., "Integrated Navigation Concept Study," Intermetrics Report No. IR-MA-321, 15 June 1984, for ITT (Nutley, NJ).
36. Kerr, T. H., "Navy GPS/SSN Phase II User Equipment DT&E Magnavox Modification Center (Mod Center) Test Report," 1 June 1985, for NADC Code 4022.
37. Kerr, T. H., "Navy GPS/SSN Phase II User Equipment DT&E Rockwell-Collins Modification Center (Mod Center) Test Report," 1 June 1985, for NADC Code 4022.
38. Kerr, T. H., "Navy GPS/SSN Phase II User Equipment DT&E Rockwell-Collins Developmental Test and Evaluation (Operational Readiness) [DT&E (OR)] Test Report," 10 June 1985, for NADC Code 4022.
39. Kerr, T. H., "Magnavox Military Utility Test Report," 10 June 1985, for NADC Code 4022.
40. Kerr, T. H., "Decentralized Filtering and Redundancy Management Failure Detection for Multi-Sensor Integrated Navigation Systems," *Proceedings of the National Technical Meeting of the Institute of Navigation (ION)*, San Diego, CA, 15-17 January 1985.
41. Kerr, T. H., "The Proper Computation of the Matrix Pseudo-Inverse and Its Impact in MVRO Filtering," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-21, No. 5, September 1985.
42. Kerr, T. H., "Decentralized Filtering and Redundancy Management for Multisensor Navigation," *IEEE Trans. on Aerospace and Electronic Systems*, Vol. AES-23, No. 1, pp. 83-119, Jan. 1987 (minor corrections appear on p. 412 of May and on p. 599 of July 1987 issues of same journal).
43. Kerr, T. H., "Testing Matrices for Definiteness and Application Examples that Spawn the Need," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 10, No. 5, pp. 503-506, Sept.-Oct., 1987 (reply to and rebuttal by author in Vol. 12, No. 5, p. 767, Sept.-Oct. 1989 issue).
44. Kerr, T. H., "Computational Techniques for the Matrix Pseudoinverse in Minimum Variance Reduced-Order Filtering and Control," in *Control and Dynamic Systems-Advances in Theory and Applications*, Vol. XXVIII: Advances in Algorithms and computational Techniques for Dynamic Control Systems, Part 1 of 3, C. T. Leondes (Ed.), Academic Press, N.Y., 1988.
45. Kerr, T. H., "Status of CR-Like Lower bounds for Nonlinear Filtering," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-25, No. 5, pp. 590-601, September 1989 (Author's reply in Vol. AES-26, No. 5, pp. 896-898, September 1990).
46. Kerr, T. H., "On Misstatements of the Test for Positive Semidefinite Matrices," *AIAA Journal of Guidance, Control, and Dynamics*, Vol. 13, No. 3, pp. 571-572, May-June 1990.

47. Kerr, T. H., "Multichannel Shaping Filter Formulations for Vector Random Process Modeling Using Matrix Spectral Factorization," MIT Lincoln Laboratory Report No. PA-500, Lexington, MA, 27 March 1989 (BSD [previously BMO] limited distribution).
48. Kerr, T. H., "An Analytic Example of a Schweppe Likelihood Ratio Detector," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-25, No. 4, pp. 545-558, July 1989.
49. Kerr, T. H., "Multichannel AR Modeling for the Active Decoy (U)," MIT Lincoln Laboratory Report No. PA-499, Lexington, MA, March 1987 Secret.
50. Kerr, T. H., and Kaufman, J., "Satellite Survivability: 3-D Geometric Update to the Prior 2-D Analysis of Bearings-Only Target Triangulation- Further Gauging the Deleterious Impact of Satellite Navigation/Attitude Uncertainties on Required Operational Performance," Group Memo No. 95.3560, Lincoln Laboratory, Lexington, MA, 30 March 1988.
51. Kerr, T. H., "Comments on 'Estimation Using a Multirate Filter'," *IEEE Transactions on Automatic Control*, Vol. AC-34, No. 3, p. 384, March 1989.
52. Kerr, T. H., "Comments on 'A Chi-Square Test for Fault Detection in Kalman Filters'," *IEEE Transactions on Automatic Control*, Vol. AC-35, No. 11, pp. 1277-1278, November 1990.
53. Kerr, T. H., "A Critique of Several Failure Detection Approaches for Navigation Systems," *IEEE Transactions on Automatic Control*, Vol. AC-34, No. 7, pp. 791-792, July 1989.
54. Kerr, T. H., "On Duality Between Failure Detection and Radar/Optical Maneuver Detection," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-25, No. 4, pp. 581-583, July 1989.
55. Kerr, T. H., "Fallacies in Computational Testing of Matrix Positive Definiteness/Semidefiniteness," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-26, No. 2, pp. 415-421, March 1990.
56. Kerr, T. H., "Angle-Only Tracking," slide presentation *for Reentry Systems Program Review* at Lincoln Laboratory, Lexington, MA, 10 January 1989.
57. Kerr, T. H., "New Developments in Kalman Filter Theory," invited slide presentation to faculty and graduate students at The University of Iowa, Iowa City, Iowa on 20 April 1989.
58. Kerr, T. H., "Decentralized Filtering and Redundancy Management for Multisensor Navigation," half day slide presentation as one of several primary lecturers, along with Peter Maybeck (AFIT), in an East Coast version of a Kalman Filter Technology intensive Short Course to have been given the week of 13 November 1989 at the University of Maryland, College Park, MD (and to be repeated in subsequent years), as organized by C. T. Leondes (UCLA).
59. Kerr, T. H., "Rationale for Monte-Carlo Simulator Design to Support Multichannel Spectral Estimation and/or Kalman Filter Performance Testing and Software Validation/Verification Using Closed-Form Test Cases," MIT Lincoln Laboratory Report No. PA-512, Lexington, MA, 22 December 1989 (BSD [previously BMO] limited distribution).
60. Kerr, T. H., "A Constructive Use of Idempotent Matrices to Validate Linear Systems Analysis Software," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-26, No. 6, pp. 935-952, November 1990 (minor correction appears in Nov. 1991 issue).
61. Kerr, T. H., "Streamlining Measurement Iteration for EKF Target Tracking," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-27, No. 2, March 1991 (minor correction appears in Nov. 1991 issue).
62. Kerr, T. H., "Evaluation of Airborne Inertial Navigational Accuracy using PC-Based Kalman Filter Technology: Airborne LASERNAV II with usage options in external NAVAID type and frequency of fixes," Lincoln Laboratory SLIDE PRESENTATION pre-transparencies, 31 October 1991.
63. Kerr, T. H., "Comments on 'Federated Square Root Filter for Decentralized Parallel Processes'," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-27, No. 6, November 1991.
64. Kerr, T. H., "Numerical Approximations and Other Structural Issues in Practical Implementations of Kalman Filtering," a chapter in Approximate Kalman Filtering, edited by Guanrong Chen, 1993.
65. Kerr, T. H., "Emulating Random Process Target Statistics (using MSF)," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-30, No. 2, pp. 556-577, April 1994.
66. Kerr, T. H., "Use of GPS/INS in the Design of Airborne Multisensor Data Collection Missions (for Tuning NN-based ATR algorithms)," the Institute of Navigation *Proceedings of GPS-94*, Salt Lake City, UT, pp. 1173-1188, 20-23 Sept. 1994.
67. Kerr, T. H., "Further Comments on 'Optimal Sensor Selection Strategy for Discrete-Time Estimators'," *IEEE Trans. on Aerospace and Electronic Systems*, Vol. 31, No. 3, pp. 1159-1166, June 1995.

68. Kerr, T. H., "Assessing and Improving the Status of Existing Angle-Only Tracking (AOT) Results," *Proceedings of the International Conference on Signal Processing Applications & Technology (ICSPAT)*, Boston, MA, pp. 1574-1587, 24-26 Oct. 1995.
69. Kerr, T. H., "A Critique of Neural Networks as Currently Exist for Control and Estimation," *Proceedings of the International Conference on Signal Processing Applications & Technology (ICSPAT)*, Boston, MA, pp. 1434-1443, 24-26 Oct. 1995.
70. Kerr, T. H., "Extending Decentralized Kalman Filtering (KF) to 2-D for Real-Time Multisensor Image Fusion and/or Restoration," Signal Processing, Sensor Fusion, and Target Recognition V, *Proceedings of SPIE Conference*, Vol. 2755, Orlando, FL, pp. 548-564, 8-10 April 1996.
71. Kerr, T. H., "Extending Decentralized Kalman Filtering (KF) to 2D for Real-Time Multisensor Image Fusion and/or Restoration: Optimality of Some Decentralized KF Architectures," *Proceedings of the International Conference on Signal Processing Applications & Technology (ICSPAT96),* Boston, MA, 7-10 Oct. 1996.
72. Kerr, T. H., "A Critical Perspective on Some Aspects of GPS Development and Use," *Proceedings of 16th Digital Avionics System Conference,* Vol. II, pp. 9.4-9 to 9.4-20, Irvine, CA, 26-30 Oct. 1997
73. Kerr, T. H., and Satz, H., S., "Applications of Some Explicit Formulas for the Matrix Exponential in Linear Systems Software Validation," *Proceedings of 16th Digital Avionics System Conference*, Vol. I, pp. 1.4-9 to 1.4-20, Irvine, CA, 26-30 Oct. 1997 (submitted to IEEE AC in Jan. 1998).
74. Kerr, T. H., "Critique of Some Neural Network Architectures and Claims for Control and Estimation," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. AES-34, No. 2, pp. 406-419, April 1998. (extends beyond prior version above).
75. Kerr, T. H., "Comments on 'An Algorithm for Real-Time Failure Detection in Kalman Filters'," *IEEE Trans. on Automatic Control*, Vol. 43, No. 5, pp. 682-683, May 1998.
76. Kerr, T. H., "Sensor Scheduling in Kalman Filters: varying navaid fixes for trading-off submarine NAV accuracy vs. ASW exposure," *Proceedings of The Workshop on Estimation, Tracking, and Fusion:* A Tribute to Yaakov Bar-Shalom (on the occasion of his 60th Birthday) following the *Fourth ONR/GTRI Workshop on Target Tracking and Sensor Fusion*, Naval Postgraduate School, Monterey, CA, 17 May 2001.
77. Kerr, T. H., "Verification of Linear System Software Sub-Modules using Analytic Closed-Form Results," *Proceedings of The Workshop on Estimation, Tracking, and Fusion:* A Tribute to Yaakov Bar-Shalom (on the occasion of his 60th Birthday) following the *Fourth ONR/GTRI Workshop on Target Tracking and Sensor Fusion*, Naval Postgraduate School, Monterey, CA, 17 May 2001.
78. Kerr, T. H., "Further Critical Perspectives on Certain Aspects of GPS Development and Use," *Proceedings of 57th Annual Meeting of the Institute of Navigation*, pp. 592-608, Albuquerque, NM, 9-13 June 2001.
79. Kerr, T. H., "Sensor Scheduling in Kalman Filters: Evaluating a Procedure for Varying Submarine Navaids," *Proceedings of 57th Annual Meeting of the Institute of Navigation*, pp. 310-324, Albuquerque, NM, 9-13 June 2001.
80. Kerr, T. H., "Vulnerability of Recent GPS Adaptive Antenna Processing (and all STAP/SLC) to Statistically Non-Stationary Jammer Threats," *Proceedings of SPIE,* Session 4473: Tracking Small Targets, pp. 62-73, San Diego, CA, 29 July-3 Aug. 2001.
81. Kerr, T. H., "Exact Methodology for Testing Linear System Software Using Idempotent Matrices and Other Closed-Form Analytic Results," *Proceedings of SPIE,* Session 4473: Tracking Small Targets, pp. 142-168, San Diego, CA, 29 July-3 Aug. 2001.
82. Kerr, T. H., "New Lamps for Old: a shell game for generalized likelihood use in radar? Or this isn't your father's GLR!," *Proceedings of SPIE,* Session 4473: Tracking Small Targets, pp. 476-483, San Diego, CA, 29 July-3 Aug. 2001.
83. Kerr, T. H., "A Critical Survey of Some New and Older approaches to EWR Target Tracking: a summary and endorsement of Kalman-filter-related techniques," submitted to *Automatica* as a candidate survey paper in 2005 (still in review).
84. Kerr, T. H., "Apparent Drawbacks that Exist in the Underlying Structure of Covariance Intersection." submitted to *Automatica* in 2006.