**Thomas Henderson Kerr III**, 11 Paul Revere Rd, Lexington, MA 02421-6632; 781-862-5870
TeK Associates, 9 Meriam St., Suite 7-R , Lex., MA 02420-5336 (since '97); thomas_h_kerr@msn.com

**EDUCATION:**

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|---|---|---|
| Ph.D. in Electrical Engng., University of Iowa, Iowa City | Feb.'71 | 3.96/4.00 |
| MSEE/Control Systems; University of Iowa, Iowa City | Feb.'69 | 3.91/4.00 |
| BSEE (Magna cum Laude) /Electrical Engineering (electronics) Howard University, Washington, D.C. | Jun. '67 | 3.65/4.00 |

**EMPLOYMENT HISTORY:**

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|---|---|---|
| TeK Associates | 7/92-Present | Owner/CEO/Web Master/Prin. Engn. |
| Google Books contractor through Kelly Services | 4/9/07-4/8/09 | Scanner & QA Operator for 2-D images |
| Northeastern University Graduate School of Engineering (evenings only) | 1/90-6/95 (off 1 year) | Instructor: taught Optimal Control and Kalman filtering course |
| Lincoln Laboratory of MIT | 10/86-7/92 | Member of Technical Staff |
| Intermetrics, Inc.[became AverStar, now L3] | 11/79-8/86 | Systems Engineer/Senior Analyst |
| The Analytic Sciences Corporation (TASC) | 2/73-10/79 | Member of the Technical Staff |
| General Electric (Corporate Research and Development Center, Schenectady, NY) | 2/71-2/73 | Control Engineer in Industrial Simulation using computer models |
| University of Iowa | 2/68-2/69 | Research and Teaching Assistant |
| Howard University | 1/67-8/67 | Research Assistant |

As an R&D Systems engineer, he is a Senior Member of both the Institute of Electrical and Electronics Engineers and the American Institute of Aeronautics and Astronautics, and has been a member of the **I**nstitute **o**f **N**avigation (**ION**) since 1981. He has worked in the estimation area for over 35 years: first on DoD (Poseidon/Trident) submarine INS and on Air Force aircraft Navigation INS (failure detection and reconfiguration in Navigation system complexes for owncraft position and attitude determination); has some sonar/sonobuoy target tracking **I**ndependent **V**alidation and **V**erification (**IV&V**) experience; has done **G**lobal **P**ositioning **S**atellite (**GPS**) system receiver integration **D**evelopment **T**est and **E**valuation (**DT&E**) in submarines and served as independent monitor of Magnavox and Rockwell International GPS Phase 2 receiver competition for NADC/NOSC, and later investigated use of GPS in novel applications. He has contract work experience with NAVSAT and with Navy JTIDS RelNav. He has also worked in strategic Early Warning Radar target-tracking (SDI & NMD UEWR); and in some aspects of tactical and strategic **E**lectronic **W**arfare (**EW**) pattern recognition applications (for Honeywell E-O Missile Warning System). The common thread is that almost all of his previous experience was in Kalman filter signal processing or related estimation theory aspects of these applications. He documented all his work and published results (130+) in company technical reports and in corresponding papers in peer-reviewed open literature technical journals and conference proceedings. He currently uses (and possesses) MatLab, SimuLink (since '92), Fortran, and Visual Basic (3 to 6 & .NET), with 17 years experience developing Windows applications. Held Secret Clearance '73-'01 (need to reactivate) and Wintell Clearance '86-'01.

As an algorithm and signal processing specialist, he focuses on system aspects and signal processing related to optimal estimation and Kalman filtering and associated underlying mathematical models and, in particular, on requisite further processing of state estimates related to detection and tracking. Our TK-MIP commercial software includes image processing as yet another Kalman filter application and avails comparisons to other standard image processing algorithms included in s/w. Within last 10 years, joined SPIE, MAA, ASA, ACM, ISA &MSDN (level 2). He is a life member of ADIA. Chairman/vice-chairman of Boston IEEE Control System Society for 8 years. Served as ION NAV Conf. session co-chairman '99.

**Experience in Navigation, Kalman Filtering, & Maximum Entropy spectral estimation for DoD Applications:**

**At TeK Associates ('92-Present):** developed a Kalman filter-based covariance analysis program in MatLab™ for Navy AROSS program (2003) & used it to perform a quantitative analysis of the relative pointing accuracy provided by each of several alternative candidate INS platforms of varying quality (& cost) by using high quality GPS [P(Y)-code, differential, or kinematic] fixes at a high rate to enhance the INS with frequent updates to compensate for degradations incurred with time due to inherent gyro drift rate characteristic of each INS candidate. For four years (1997-2001), participated in the development of the next generation **U**pgraded **E**arly Warning **R**adar (**UEWR**) target tracking filters for **N**ational **M**issile **D**efense as a consultant, first, for **The MITRE Corporation** (via **Gemini Industries** BOA'97-'98), then

directly for **XonTech** ('98-'99), and, subsequently, directly for **Raytheon** ('99-'01). 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 (preliminary PowerPoint presentations, then Software Requirements Specifications for) both NMD Extended Kalman Filters and for the Batch filter and wrote the tracking Notebook and other final reports and memos. Our expertise encompasses statistics and we also possess Imaging & Statistics Toolboxes. 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 also gained experience with the **I**nteractive **M**ultiple **M**odel **(IMM)** Kalman filter approach. Published results in technical reports & papers. For one of our prior **MITRE** customers, obtained details of Canada's (with approval of Ottawa's Defense Dept.) unclassified INS-based motion-compensation of SAR. Such detail on U.S. SAR is less accessible. **URL: www.tekassociates.biz**

**As a member of Group 53 at Lincoln Laboratory**: concerned with passive and active infrared target tracking and pattern recognition (e.g., distinguishing Howitzers from tanks and armored personnel carriers) and image processing, looked into aspects of parallel processing research for Kalman filters as well as into **N**eural **N**etwork (**NN**) theory and applications and in particular the opportunity for using Kalman filters to expedite NN learning in place of standard backpropagation. Group 53 had a flight facility for gathering IR measurement data and laser range data on targets in different geographical areas, at different altitudes, from different aspect angles, using alternative optical and radar sensors (for later ATR algorithm tuning by others). He applied his Kalman filter/navigation theory background to perform investigations to recommend particular navaid use (type and fix frequency) out of candidate VOR/DME, GPS, or surveyed retro-reflector locations (as viewed from the onboard imaging equipment in real-time) to support tight accuracy goals in using the airborne LASERNAV II **I**nertial **N**avigation **S**ystem (**INS**) during data collection missions of the test aircraft over Electronic Terrain Board data patches so that swaths of the down-looking sensor have sufficient location accuracy to avoid blatant gaps in measurement coverage but, conversely, don't overlap too much (thus avoiding overly redundant data recording). Specified a procedure for pre-flight mission planning and data patch preparation and grooming via INS/GPS waypoint insertion and retro-reflector pre-placement (to expedite later scene alignment) to designate anticipated swath row boundaries of sensor footprint and introduced use of colored balloons (and other special end-of-row markers) to signal aircraft to initiate 3 minute $180^{o}$ turns for backsweep coverage of adjacent rows. Performed analysis and simulation support. **In Group 95**: performed analysis & simulation of EWR Extended Kalman filters for exoatmospheric **R**eentry **V**ehicle (**RV**) target tracking and angle-only optics-based (or range-denied jammed radar) target tracking. Implemented multichannel Maximum Entropy spectral estimation (of radar PP & OP) components of RV wake signatures for electronic emulation. Documented all work in company reports and in IEEE Journals/Conf. Proceedings.

**At Intermetrics Inc.:** Pioneered use of failure detection in conjunction with redundancy management of Navigation Complexes using several decentralized Kalman filter formulations for various navaids, as developed under Integrated Communications, Navigation, and Identification Avionics (ICNIA), as slated for the Advanced Tactical Fighter (ATF). Received 1988 M. Barry Carlton Award from IEEE Aerospace and Electronic Systems for Outstanding Paper in 1987 on aforementioned issue. Critiqued Kalman filter design and performance of early Magnavox version of Precise Integrated Navigation System (PINS), as was being developed for Minesweepers. Developed test plans, procedures, checklists, guidelines, and rationale for evaluating shipborne performance of 4 alternative commercial SatNav receivers for Naval Ocean Systems Center. Performed test and evaluation of GPS Phase II integration on attack submarine SSN701 *La Jolla* and on the susceptibility of its BRA-34 antenna to detection by enemy surveillance in its use of GPS. Also worked on Navy JTIDS RelNav Kalman filters. Documented all results in company reports to customer and in open literature**.** Experience writing several technical proposals over six years.

**At TASC**: Developed CR2 failure detection algorithms for INS in C-3 Poseidon & C-4 Trident SSBNs. Provided theoretical basis, developed the software simulation, and computed Pareto-optimal strategies for alternative external navaid usage (e.g., Loran-C, NavSat, bathymetric map-matching) to minimize SSBN exposure to enemy surveillance while maintaining adequate NAV accuracy to support its mission. Documented all results in company reports to customer and in open literature. **At G.E.:** simulations!