

## K. P. (Kip) Haggerty, Principal Systems Engineer

### Contact Information

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### Summary of Qualifications

- PhD in Electrical Engineering
- Developed 3 new DSP courses for UCLA Extension
- Prior teaching and mentoring experience
- 34 years industry experience, 20 in private practice
- Professional Electrical and Control Systems Engineer
- Consultant for two start-up companies

## Employment History

Dates	Position
8/1994 to Present	<b>Principal Systems Engineer:</b> H&A Systems Engineering, El Segundo, CA – He provides control, communication, and sensor systems engineering consulting. He specified requirements, defined architecture, performed trade-off studies, analyzed performance, and produced system designs for advanced airborne radar, cruise missile defense, electronic warfare, calibration, power electronics, active RFID location, and sobriety monitoring devices.
6/2014 to Present	<b>Instructor:</b> UCLA Extension, Engineering and Technology Department, Los Angeles, CA – He is developing and teaching three new courses for the updated Digital Signal Processing Certificate.
1/2015 to Present	<b>Part-Time Lecturer:</b> California State University, Long Beach, CA – He is teaching Digital Logic Design and Electric and Electronic Circuits.
6/1988 to 8/1994	<b>Senior Staff Engineer:</b> Hughes Aircraft Company, El Segundo, CA – He developed, simulated, and analyzed avionic system concepts that included spread spectrum data communications, radar, and air traffic control communications. He led a cooperative engagement system concept study. He participated in a demonstration of the first high-resolution radar range profiles from a new waveform.
1990	<b>Instructor:</b> Advanced Technical Education Program, Hughes Aircraft Company, El Segundo, CA – He developed and taught a course in Kalman Filtering.
9/1984 to 6/1988	<b>Systems Engineer:</b> Hughes Aircraft Company, El Segundo, CA – He designed, simulated, analyzed and verified radar signal processing, tracking, and calibration algorithms.
7/1980 to 9/1984	<b>Member of the Technical Staff:</b> Hughes Aircraft Company, El Segundo, CA – He designed, simulated, analyzed and verified radar signal processing and tracking algorithms.

## Education

### Degrees

- PhD in Electrical Engineering, UCLA, 1988. Major: Control Systems, Minors: Communication Systems and Applied Mathematics
- ENGR in Electrical Engineering, UCLA, 1986. Major: Control Systems, Minors: Communication Systems and Applied Mathematics
- MSE in System Science, UCLA, 1983. Emphasis: Control and Communication Systems
- BSE in Electrical Engineering, University of Michigan, Ann Arbor, 1980 (Cum Laude). Emphasis: Control Systems and Computer Engineering.

### Doctoral Thesis

**Chair:** Richard E. Mortensen, Professor Emeritus of Electrical Engineering (deceased)

**Title:** *Aggregation and Validation of Random Square Wave Load Models for Electric Power Utility Load Control of Residential Cooling and Heating*

This research was used as part of Dr. Mortensen's application for an NSF research grant, which funded computing for my thesis work and several graduate student research assistantships after my graduation.

### Honors Received

- Tau Beta Pi National Engineering Honor Society
- Hughes Aircraft Company Graduate Fellowships

### Continuing Education

- *STAP I: Introduction to Theory and Applications*, IEEE Radar Conference, Joseph R. Guerci, 2002
- *Pulse Compression in Radar Systems*, IEEE Radar Conference, Marvin Cohen, 2002
- *Fundamentals and Applications of Object-Oriented Programming Using C++*, UCLA Extension 1996
- *Systems Engineering with Models and Objects*, David W. Oliver, 1994
- *New Parallel Architectures and Languages*, NTU, Arvind, 1992
- *Fuzzy Logic: Applications and Perspectives*, IEEE, M. Togai, L. Zadeh, P. Bonissone, 1991
- *Structured System Development*, Imtiaz Pirbhai, 1991
- *Massively Parallel Processing Architectures*, NTU, Winthrop W. Smith, 1990
- *Modern Navigation Systems*, Walter R. Fried, 1990

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## Teaching and Publications

### Courses and Tutorials

1. *EE 201 Digital Logic Design* (with Lab), CSULB, Spring 2015.
2. *EE 211 Electric and Electronic Circuits*, CSULB, Spring 2015.
3. *X 422.2 Digital Signal Processing Applications*, UCLA Extension, Spring 2015.
4. *X 422.15 Digital Signal Processing Algorithms*, UCLA Extension, Winter 2015.
5. *X 422.1 Fundamentals of Digital Signal Processing*, UCLA Extension, Fall 2014.
6. *Practical Considerations for Digital Control for Power Converters*, presented at *Wescon*, Anaheim, CA, Sep 21, 2004.
7. *Digital Control for Power Converters – An Introduction*, presented at *Wescon*, Anaheim, CA, Sep 26, 2002.
8. *Kalman Filtering Hands On with Matlab*, Ridgecrest, CA, June 17-21, 1996 – with D. Green and J. Pearson
9. *Kalman Filtering*, Hughes Aircraft ATEP, El Segundo, CA, June – Sep 1990.

### Publications

1. W. F. Butler, K. P. Haggerty, W. B. Kessler, Jr., R. K. Klinger, and J. M. Ziel, "Ultra High Range Resolution Waveform Development and Demonstration,"

presented at the *37th Annual Triservice Radar Symposium*, Peterson Air Force Base, Colorado Springs, CO, June 25-27, 1991 (Secret).

2. K. P. Haggerty, "The Navy/Hughes Advanced Airborne Anti-Air Warfare Engagement System (AAAES): An Overview," presented at the *Innovative Anti-Air Weapon Systems Conf.*, Johns Hopkins APL, Laurel, MD, June 26-28, 1990 (Secret).
3. K. P. Haggerty and R. E. Mortensen, "Simulation and Analysis of Air Conditioning Load for Individual Unit and Aggregate Load Model Development," participating paper *1989 IBM 3090 Supercomputing Competition*, Gainesville, FL, April 23-25, 1990.
4. R. E. Mortensen and K. P. Haggerty, "Dynamics of Heating and Cooling Loads: Models, Simulation, and Actual Utility Data," *IEEE Trans. Power Syst.*, vol. PWRS-5, pp. 243-249, Feb. 1990.
5. R. E. Mortensen and K. P. Haggerty, "A Stochastic Model for Heating and Cooling Loads," *IEEE Trans. Power Syst.*, vol. PWRS-3, pp. 1213-1219, Aug. 1988.

### IEEE Meeting Presentations

- Gave tutorials on HTML, accessing the Internet, and using the Internet for business at IEEE meetings.
- Led workshop sessions at IEEE networking and professional engineering licensing workshops.
- Spoke at IEEE and college meetings on consulting.

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## Professional Activities and Honors

### California Professional Engineering Licenses

- Electrical Engineer
- Control System Engineer

### IEEE Awards and Honors

- Millennium Medal (2000)
- Regional Activities Board Achievement Award (1999)
- Region 6 Special Achievement Award (1998)
- Elevated to Senior Member (1994)

### Hughes Awards

- 1992 Group Achievement Award, Advancement of Hughes in Tactical Airborne EW
- 1992 Achievement Award
- 1990 Superior Team Award, APG-71 FSD SW Dev
- 1989 Achievement Award and Bonus
- 1989 Superior Performance Award
- 1988 Approved Cost Savings: \$83,000 for Efficient Utilization of Department Computing Resources

## Professional Service

- IEEE RadarCon-02 Finance Chair and Webmaster (2001-2002)
- Electronic Conventions Inc. (ECI) Director (2000)
- Second Vice President, California Legislative Council for Professional Engineers (CLCPE) (1997-1998)
- IEEE Region 6 Southern Area Chair (1999)
- IEEE Los Angeles Council Chair (1998), Past Chair (1999), Webmaster (1998-1999), Legislative Coordinator (1995-1997), CLCPE Delegate (1995-1998)
- IEEE LAACN Webmaster (1996-1998, 2001-2013), Chair (1997-1998)
- IEEE Coastal Los Angeles Tellers Committee Chair (2000), Nominations Committee Chair (2000), Nominations Committee (2001)

- IEEE South Bay Harbor Section Educational Activities Chair (1996-1998), Tellers Committee Chair (1999)
- Electrical engineering, mathematics, and artificial intelligence reader for Learning Ally (1991-1998)
- University of California Academic Senate Computing Policy Committee and Academic Computing Council

## Community Service

- Trail Life USA Program Specialist (2013-2015)
- AHG volunteering: Treasurer, Unit Leader, Advancement Chair, Regional Camp Director (2008-2015)
- BSA volunteering: Cubmaster, Asst Cubmaster, Committee Chair, Asst Scoutmaster, Advancement Chair, Eagle Mentor, Merit Badge Counselor (2007-2013)

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## Summary of Professional Experience

### Communication Systems

- Reviewed Bluetooth encryption capabilities, proposed encryption technique, and other communication and storage issues for HIPAA compliance.
- Developed architecture of active RFID sensor to sniff ZigBee preambles to form location measurements.
- Specified communication requirements for cooperative multiplatform weapon guidance against ground targets.
- Analyzed requirements for multifrequency shared apertures for satellite communications.
- Specified requirements for advanced covert communication networks and determined data capacity requirements for cooperative engagement networks.

### New Product Development

- Defined scope and specified requirements for first two generations of sobriety monitoring devices and for an ignition interlock add-on.
- Defined and performed acceptance tests for first generation sobriety monitoring device.
- Performed requirements traces for FDA 510k approval on sobriety monitoring device, which was passed.
- Produced documentation for NHTSA CPL approval.
- Provided technical/design review of sobriety monitoring device and digital power converter prototype.
- Defined and performed acceptance tests for active RFID sensor.
- Performed radar proposal analysis, definition, and documentation.

### Technical Leadership

- Participated in the selections of a new developer (Talon Communications) and manufacturer (ACD) for the sobriety-monitoring device.

- Proposed efforts and approaches for active RFID sensor measurement improvement project.
- Active RFID Sensor Chief Architect
- Led proposal efforts on 5 small business innovation research (SBIR) proposals and 2 information technology proposals resulting in the award of a two-year master services agreement for the state of California.
- Led system/subsystem technical volume writing on 7 Hughes proposals with 4 winners.
- Led AAAES concept study, a 5-month 1-million dollar study involving about 15 engineers (see publication 2).
- Coordinated interdisciplinary analysis activities and led numerous concept studies in the areas of radar, electronic warfare, and cooperative engagement.
- Recommended changes in departmental computer utilization that saved \$83,000 in computing expenses.

### Location and Tracking Systems

- Proposed minimum square error location estimation using the active RFID sensor measurements.
- Responsible for active RFID location system sensor measurement budgets.
- Responsible for tracking performance estimates for advanced airborne radar.
- Developed method of real-time adaptation of radar dwell time to optimize radar track loading.
- Derived covariance transformations from track coordinates to a common track distribution reference frame.
- Analyzed effects of multipath on radar measurements.
- Developed measurement-processing corrections to account for the different sets of amplitude weights.

- Performed tracking performance trade-off study of antenna size for advanced airborne radar.
- Responsible for radar measurement error budgets.
- Debugged angle tracking issues that led to breakthrough performance during demonstrations of advanced airborne radar.
- Modeled atmospheric refraction on elevation angle and reconciled with test data to define an accurate real-time refraction correction algorithm for long-range airborne radar.
- Resolved GPS integration, timing, and performance issues.
- Analyzed monopulse antenna performance for radar and electronic support.
- Performed monopulse processing architecture trade-off study.

### **RF Sensors**

- Specified requirements for active RFID sensor.
- Responsible for link budget, hardware parameter list, antenna weights for digital beamforming, and demonstration active RFID location sensor specification.
- Defined clutter model for ISIS air-to-air modes.
- Defined and derived equations for performance parameters and models in the ISIS system specification.
- Polarimetric radar research and development including phenomenology and applicability.
- Wide band RF signal exploitation research and development including shortfalls and future approaches.
- Multistatic radar operation research and development.
- Derived and documented flight test analysis methodology for predicting track range performance.
- Performed performance trade-off studies for active array module configurations.
- Responsible for special mode performance estimates for advanced airborne radar.
- Developed receiver sensitivity budgets for radar and electronic support.
- Performed extensive analyses, simulations, and trade-off studies to derive requirements on hardware parameters to support advanced airborne radar modes.
- Performed hardware parameter requirements allocations from radar system requirements.
- Performed radar detection performance trade-off study of antenna concepts for several platforms.
- Analyzed clutter rejection requirements.
- Verified models with test data and solved problems discovered during test for fighter to surveillance size antennas.

### **Calibration**

- Defined calibration and correction methods for active RFID sensor.
- Developed prototype calibration functions for active RFID sensor in Mathematica and helped with transition to Matlab for rapid turn around factory calibration.
- Performed the first round of active RFID sensor calibration computations and produced the first set of correction factors
- Developed active RFID sensor calibration budgets.
- Developed design narratives for ISIS Calibration and other support modes.
- Derived waveform parameters for ISIS Calibration and other support modes.
- Specified ISIS Calibration simulation requirements.
- Participated in ISIS design concepts for interoperation of Calibration and in-air antenna phase-up.
- Analyzed and defined calibration tests for advanced airborne radars, including an antenna on a round inflatable structure (ISIS).
- Specified gain and phase imbalance budgets for radar calibration.
- Designed calibration for dual channel radar angle measurements.

### **Signal Processing**

- Defined requirements for adding passive ranging to an electronic support receiver.
- Helped produce the first range profile of an airborne target using the multifrequency phase code waveform (see publication 1).
- Analyzed spread spectrum waveforms.
- Analyzed radar, signal intercept, and communication receiver performance.
- Developed signal exploitation technologies and methodologies for radar and signal intercept receivers.
- Designed digital filters radar angle measurements.

### **Control Systems and Estimation**

- Standardized and simplified digital controllers used in multiple-unit solid-state power conversion system.
- Proved that the state of the power sharing power among the multiple-units of the power conversion system can enter the uncontrollable subspace when a unit goes off line and proved that algorithm reinitialization solves the problem.
- Assessed the applicability of fuzzy logic to scheduling of agile-beam radars.
- Designed and verified radar tracking control loops, including responses to jamming (intelligent control).
- Designed and verified Kalman filters used in radar tracking.

## **Modeling and Simulation**

- Responsible for providing track loading models and mode performance parameters to mission simulations.
- Developed track loading model. Developed in Mathematica and ported to Matlab.
- Developed comprehensive set of advanced airborne radar mode performance estimation tools in Mathematica and ported to Matlab for transition to Raytheon personnel.
- Developed atmospheric loss model for Mathematica, Matlab, and Excel.
- Developed method of linear fits to simulated data to produce accurate curve fits of required power vs. transmit and switching duty for trade-off studies from three points rather than parametric curves of 2500 points each. Developed in Mathematica and ported to Antenna tools in C.
- Used linear fit method to generate range performance vs. required power performance graphs (Mathematica).
- Developed Mathematica notebooks to analyze complex radar waveforms and derive the circular error probable performance metric from the two-dimensional Gaussian error distribution.
- Developed Matlab simulation model of multipath returns at each element of an interferometer.
- Developed Simulink, Matlab and C simulations of a pulse width modulation controlled DC-to-DC solid-state power converter.
- Wrote computer simulations of Kalman filters, track loops, and signal processing for radar track modes.
- Wrote numerically intensive Monte Carlo simulations of populations of cycling air conditioner electric loads on a vectorized supercomputer (mid 1980s).
- Developed load models conducive to applying intelligent control techniques to load management.

## **Software Engineering**

- Specified software requirements for first generation sobriety monitoring device.
- Defined common mode controller approach for ISIS support modes to reduce software footprint.
- Participated in Calibration software risk assessment.
- Knowledgeable reviewer for trusted downloads of reuse software from classified program.

- Responsible for ISIS software release plan.
- Responsible for ISIS software integration and test plan.
- Applied logic minimization to substantially simplify the mode transition logic software design.
- Responsible for specifying and writing software requirements specifications for numerous fighter and advanced airborne radar programs.
- Responsible for algorithm design and writing software design documents for numerous fighter and advanced airborne radar programs.
- Estimated software sizing for EW and radar software.
- Developed scripts in FileMaker Pro to remove duplicates from a law firm evidence database.
- Provided expert software consulting for a legal case.
- Supported the proposal team on original and revised SBIR proposal for virtual science lab software.
- Designed and implemented relational database systems for the LAACN online directory, electronic warfare system configurations, cooperative engagement network capacity requirements, and test accuracy tracking and analysis.

## **CASE Methods and Tools**

- Participant in Scrum of Scrums on ISIS software, including development of release and sprint goals.
- Participant in development of Agile product backlog.
- Responsible for incorporation of ISIS software integration and test planning into Agile with Scrum process and tools.
- Served as a shadow Agile product owner on the multiple product ISIS software effort.
- Performed requirements traceability analyses for system and software requirements for advanced airborne radars.
- Wrote Systems Engineering Management Plan for advanced airborne radar development program.
- Developed Hatley-Pirbhai Methodology (HPM) requirements and architecture models for a multiple-unit parallel solid-state power conversion system.
- Developed HPM requirements and architecture models for an avionics subsystem.
- Developed HPM requirements and architecture models for a cooperative engagement system.

## Professional References

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