KENNETH W. TOBIN

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PROFESSIONAL SUMMARY

Dr. Kenneth W. Tobin is the Director of the Office of Institutional Planning at the Oak Ridge National Laboratory (ORNL). In this role, he is responsible for advancing the vision of the Laboratory Director to be the world's premier research institution through strategic planning and discretionary R&D investment in science and technology initiatives. From 2016-2018, Dr. Tobin was the Director of the Reactor and Nuclear Systems Division at ORNL supporting research for advanced reactor technology and the sustainability of our light water reactor fleet. From 2008-2016 he was the Director of the Electrical and Electronics Systems Research Division at ORNL with a focus on energy efficiency, resiliency, and security for the electric grid, transportation systems, and advanced manufacturing research. Prior to this, Dr. Tobin was the Group Leader of the Image Science and Machine Vision Group at ORNL where he focused on computational imaging and machine vision research for industry, security, and biomedicine. Concurrently with his ORNL position in 2009, Dr. Tobin became the co-founder and CTO of Hubble Telemedical, Inc., a start-up company commercializing a telemedical screening technology for diabetic retinopathy. Hubble was purchased by Welch Allyn, Inc., in 2015, and today provides retinal health care to thousands of patients nationwide with their RetinaVue™ care delivery model. He earned his BS in Physics and MS in Nuclear Engineering from Virginia Tech and his PhD in Nuclear Engineering from the University of Virginia where his dissertation contribution was in computational imaging methods for neutron radiography. He has authored and coauthored over 180 total publications and has 14 issued US Patents. He is an ORNL Corporate Research Fellow, a Fellow of IEEE and SPIE, and is a member of AAAS. He currently maintains a US DOE Q and SCI clearance.

EDUCATION

Ph.D.   Nuclear Engineering, University of Virginia, Charlottesville, Virginia, 1987.
   Dissertation: *Digital Filtering and Reconstruction of Coded Aperture Images.*
M.S.   Nuclear Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 1984.
   Thesis: *A Mathematical Model of Iodine Spiking in Pressurized Water Reactors.*
B.S.   Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 1983.

RESEARCH EXPERIENCE

Photonics, neutronics, X-ray, SEM, electronic imaging and microscopy coupled with signal processing and machine learning research to address problems of energy, security, and human health. Science and technology specialty in computational imaging, image metrology, and machine learning from multi-spectral, multi-source imagery for inverse imaging, robust human-level classifier development, image archival and retrieval applications, and image-based informatics. Primary interest was in the novel application of computer vision science, methods, and technologies to the

solution of real-world problems in industry, security, and biomedicine. Was designated an ORNL Corporate Research Fellow in 2003 for *outstanding contributions to the field of applied computer vision research and development*. Designation as a Corporate Fellow is made on a limited basis to recognize exceptionally gifted individuals at ORNL for their technical achievement in science or engineering. Of the over 4,600 staff at ORNL today, there are about 30 active Corporate Research Fellows. Fellow of the Institute of Electrical and Electronics Engineers (IEEE – since 2012), and Fellow of the International Society for Optics and Photonics (SPIE – since 2001). Current Google Scholar H-index = 30, i10-index = 76, Total Citations = 3,363 as of January 2020.

EMPLOYMENT HISTORY

2019-Present, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Director / Corporate Research Fellow, Office of Institutional Planning (OIP)

- **Director** – Director of the OIP (January 2019). Position reports to the Deputy Director for Science and Technology (DST) and advances the vision of the Laboratory Director to be the world's premier research institution by facilitating the development of laboratory S&T strategies, managing strategic investments, and implementing annual planning. Responsible for managing $55M of Laboratory Directed Research and Development funding and $24M of Laboratory Program Development funding. Works with the DOE Office of Science, DST, and Science Directorates to develop the Annual Report, Lab Plan, Lab Agenda, and directorate business plans. Works with the DST and Science Directorates to develop and manage strategic investments in the annual Directors R&D program, Strategic Hire program, Seed Money program, and Distinguished Staff Fellowship program. Oversees the ORNL Research Library, enabling research through collections management, training, and publication analytics.

- **Program Manager** – Advanced Research Projects Agency for Energy (ARPA-E). Coordinated and managed business opportunities for ORNL through the Funding Opportunity Announcement (FOA) process. Met with ARPA-E Program Directors, organized and led ORNL information meetings with Principle Investigators in support of the various calls, and provided signature authority to execute work with ARPA-E for ORNL. ORNL currently supports around $10M annually of ARPA-E funding in partnership with US industry on broad areas of high-risk energy research.

2016-2018, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Director / Corporate Research Fellow, Reactor and Nuclear Systems Division (RNSD)

- **Division Director** – Director of the RNSD Division (October 2016). Responsible for over 135 staff, a $57M annual budget authority, and a $5.6M organizational burden budget. Provided science and technology leadership and strategies for the U.S. Department of Energy (DOE) Nuclear Energy (NE) program, Nuclear Regulatory Commission (NRC) and U.S. Industry in support of advanced reactor science and technology (S&T), reactor physics and thermal hydraulics modeling and simulation, radiation transport, nuclear criticality and safety, and used fuel systems. RNSD provided the S&T required to extend the life of our existing light water reactor fleet, create advanced concepts for small modular and molten salt reactors for next generation power production, develop proliferation resistant nuclear fuel cycles, and modernize the nuclear regulatory infrastructure.

- **Assisted Associate Laboratory Director for Nuclear Science and Engineering in leading/managing the DOE/NE business portfolio (January 2018 – January 2019)** - Particular emphasis was on programmatic

activity and headquarters relationships through Nuclear Technology R&D (NE-4), Nuclear Technology Demonstration and Deployment (NE-5) and Spent Fuel & Waste Disposition (NE-8).

- **Versatile Test Reactor (VTR), ORNL Project Manager (January 2018-January 2019)** – Worked with Idaho National Lab (INL), Argonne National Lab (ANL), and DOE/NE in support of the VTR. The VTR is a fast spectrum, sodium cooled test reactor scheduled to be built at INL in 2026 to support U.S. industry in fuels and materials testing for the extreme environments of advanced reactors. ORNL roles support I&C and safety; fuel design, specification and supply chain; experiment system design for molten salt testing in the VTR environment; modeling and simulation for reactor shielding design, and DOE certification processes for reactor operation.
- **Transformational Challenge Reactor (TCR), (June 2018-January 2019)** – Provided input and support for the development of a concept to use advanced material design, additive manufacturing, high-fidelity modeling and simulation, artificial intelligence, and innovative I&C for an aggressive reactor technology deployment demonstration at ORNL. Organized DOE Office of Science-styled workshop to bring together technologists and engineers from industry, DOE labs, and universities to investigate state-of-the-art science and technology from multiple fields to inform the development of TCR concepts.

2013-2016, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Director / Corporate Research Fellow, Electrical and Electronics Systems Research (ESSR) Division

- **Division Director** – Founding Director of the EESR Division (October 2013). Led the organizational change to integrate the electronics research capabilities of the Energy and Environmental Science Directorate into a single division of 150 staff to address R&D in microelectronics, embedded electronics, power electronics, and power systems. EESR was positioned to better support the U.S. Department of Energy (DOE) in the design and test of wide-bandgap materials; development and evaluation of electric vehicle components; electric grid and cyber-physical systems; building sensors and controls; building/grid integration; nuclear energy instrumentation; and national nuclear security. These changes enhanced EESR's ability to achieve nationally important impact through applied, cross-cutting research in electronics, sensors, signal analysis, communications, and controls. The division was primarily funded through Work-for-Others (WFO) when established in 2008. Between 2008 and 2016, strategy and leadership achieved an R&D portfolio mix of 62% DOE, 33% WFO, and 5% LDRD, making EESR of high relevance to the missions of the U.S. DOE.

- **Building a Strong DOE Research Portfolio (2016, $61M Budget Authority, $14M Sold Services)** – The EESR Division provided the science and technology underpinnings in electronics, sensors, and controls for a number of important cross-cutting program areas for the directorate and the lab such as: low-cost sensors for characterizing and controlling energy use in commercial buildings (EERE/BTO); additive manufacturing sensing for control and analytics for advanced manufacturing (EERE/AMO); small form-factor 3D-printed inverters for electric vehicles (EERE/VTO); embedded sensing and control system for the Macromolecular Neutron Diffractometer with SNS (BES); application of neutrons and the VENUS imaging instrument to characterize materials in manufacturing and vehicle technology (EERE/AMO, BES); microwave guide inspection tool for ITER; computed tomography for gas well casements (EERE/GTO); key support for the development of sensors and controls for the Molten Salt Test Loop experiment (NE); and a significant increase in programmatic collaboration and S&T responsibility for the Domestic Uranium Enrichment program (NNSA), and the stable isotopes program (BES). Achieved increased DOE R&D budget authority and mission space from 10% in 2008 to over 60% in 2016.
- **Creating Internet-of-Things (IoT) Research Opportunities (2015, $3.2M LDRD, $300K Discretionary Investment)** – Established a successful approach to invest discretionary funding and achieve LDRD and Seed awards that are fueling a number of important programmatic opportunities in IoT research. EESR is leading the

efforts for ORNL on the Grid Modernization Lab Consortium in Sensing and Measurement activities (EERE/OE/EPSA); partners on a national team for the Smart Manufacturing National Network for Manufacturing Innovation (EERE/AMO); organizing a national proposal team to address spectrum sharing through the Model City opportunity (FCC/NTIA); and creating a connected vehicle and vehicle security initiative that resulted in a $600K lab investment at NTRC for a Vehicle Security Laboratory (EERE/VTO, DOT, DOD).

2009-2015, Hubble Telemedical, Inc., Memphis, Tennessee
Founder and Chief Technology Officer for Hubble Telemedical, Inc. Co-inventor of Hubble's patented telemedical diagnosis network technology to provide low-cost, high-throughput retinal screening for the detection and stratification of blinding eye disease. The technology was created to help save the sight of diabetic patients, particularly those with low incomes and a lack of access to regular vision screenings.

- **Hubble Telemedical's corporate objectives** were to demonstrate scalability and adoption of the company's disruptive technology into the medical care and managed care spaces and demonstrate that the revenue generated by its telemedical network could be scaled regionally, nationally, and internationally into a successful business model. The Hubble technology was licensed from UT-Battelle, LLC, in 2009. Dr. Tobin supported the commercial venture through an Outside Activity agreement with ORNL. Hubble achieved venture capital investment by **Memphis Biomed Ventures** in 2010 and was acquired by New York company, **Welch Allyn, Inc**., in January 2015. Welch Allyn is a leading medical diagnostic device company that delivers practical innovation at the point of care. Hubble Telemedical translated Dr. Tobin's semiconductor yield analysis technology to a venture capitalized C-Corp., to acquisition by Welch Allyn in seven years and is providing retinal health care to many thousands of patients nationwide, improving patient outcomes and reducing healthcare costs. Welch Allyn was acquired by **Hill-Rom, Inc**., in June 2015 to expand into the point-of-care diagnostics market.

2008-2013, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Director / Corporate research Fellow, Measurement Science and Systems Engineering Division

- **Division Director** – Provided science and technology leadership and management for a research division of 150 R&D, business, operations staff, and students. Founding Director of the Measurement Science and Systems Engineering (MSSE) Division (March 2008). MSSE performed applied research and development in nationally important areas of energy efficiency, resilience, and security. The mission of MSSE was to provide pathways for the translation of basic science to engineering applications through the creation of new science and technology in electronics, sensors, signals processing, and integrated systems. The division's staff were organized into eight technology-focused research groups with science and technology competencies and capabilities that encompassed the development of new electronic devices and high-performance embedded computing, new sensors and sensing materials, signal processing and machine learning methods, robust wireless communications, and the integration of these technologies into unique systems and instruments that address challenging measurement and controls problems.

- **Neutron Imaging Instrument at SNS for Energy Efficiency (2011-2016, $19M)** – Co-Developer and instrument advocate for the design, development, and commissioning of a world-class neutron imaging instrument designated the Versatile Neutron Imaging Instrument at SNS (VENUS). VENUS was intended to uniquely utilize the Spallation Neutron Source (SNS) to measure and characterize large-scale, multi-component, engineered materials and systems. VENUS would be the highest resolution neutron imaging instrument in the world, and it would provide industry with the opportunity to advance their development efforts in energy efficiency, transportation, material systems, and a wide variety of non-destructive engineering design and testing

applications. VENUS would uniquely support the missions and program areas of the U.S. DOE Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Electricity Delivery and Energy Reliability (OE).

- **Automated Screening for Diabetic Retinopathy by Content (2009-2011, $2.2M)** Co-developer with the University of Tennessee Health Science Center, Memphis, TN, of a competitive renewal for National Institute of Health (NIH) grant R-01 EY017065-02 with the National Eye Institute (NEI). Goal was to investigate the feasibility of using content-based image retrieval to detect and accurately describe and index human retinal disease, specifically diabetic retinopathy, collected remotely from low-cost, non-dilated retinal photographs. Using CBIR, we have successfully developed a telemedical method and technology that permits remote diagnosis of diabetic retinopathy (DR) in the primary health care setting, in real time, through remote access to a computer-based, diagnostic, image analysis method. The studies proposed in this competitive renewal were designed to address key methods in the performance of automated machine segmentation by our current algorithms. Our goal under this renewal grant was to improve system performance to a level that permitted implementation as a fully automated patient care paradigm with expert capabilities that yields the highest possible sensitivity and specificity of disease detection and stratification.

- **Novel Method to Achieve High-Resolution Neutron Microscopy (2008-2009, $175K)** – Co-developer of an ORNL Seed Money project to implement and test a unique method to achieve high-resolution neutron microscopy in the sub-5 μm resolution range using coded apertures. This is a novel configuration that encodes the source of neutrons passing through an object as opposed to an encoding of radiation emitted from an object. Project represents a partnership between MSSE, SNS, and NC State and was leveraged to establish a U.S. DOE Early Career Award for the project co-developer and PI. Successful demonstration of high-resolution neutron imaging supports our efforts to develop new instrumentation within the Neutron Sciences and Energy and Environmental Sciences Directorates that facilitates our ongoing Instrument Development Team (IDT) to establish a dedicated neutron imaging beam line at SNS.

2003-2008, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Group Leader / Corporate Research Fellow, Engineering Science & Technology Division

- **Group Leader** – Provided 17 years (1991-2008) of leadership, program development, programmatic guidance, and technical direction for a talented group of Ph.D.- and M.S.-level scientists in computer vision research and development. Helped define and maintain a consistent research mission and direction for R&D activities undertaken by the group. Hired personnel, developed and mentored staff, and developed research proposals and contracts that supported the group mission and activities in three program areas: Industrial Inspection and Metrology, Biomedical Imaging, and National Security. Group Mission: *To emulate the human visual sensory and cognitive process. To develop human-level visual and decision-making capabilities for computers and robots.*

- **Participation in the NIST Iris Challenge Evaluation: Algorithms for Improving Iris Recognition (2006, $178K)** – Co-developer and principle investigator of an Oak Ridge National Laboratory Seed Money project to perform iris segmentation and recognition research and development and to participate in the NIST Iris Challenge Evaluation (ICE). ICE was the first large-scale, open, independent technology evaluation effort for iris recognition. The primary goal of ICE was to promote the development and advancement of iris recognition technology and assess the state-of-the-art capability. Through this research we implemented and tested novel approaches for biometric iris recognition that addressed shortcomings in the current technology relating to degraded iris image quality due to off-axis viewing of the iris and the non-linear effects of pupil dilation on the iris pattern, with a goal of more efficacious evaluation of non-cooperative subjects.

- **Automated Screening for Diabetic Retinopathy by Image Content (2006-2008, $1.62M)** – Co-developer and co-principal investigator of this National Institute of Health (NIH) grant by the National Eye Institute (NEI) to

investigate the feasibility of a content-based image retrieval (CBIR) method to accurately describe and index human retinal images of diabetic retinopathy (DR) collected from low-cost, non-dilated retinal photographic examinations. The grant was titled "Automated Screening for Diabetic Retinopathy by Content" (1 R01 EY017065-01). The goal was to demonstrate the feature-based indexing and retrieval process of CBIR and verify our hypothesis, and novel concept, that retinal pathology can be identified and stratified from visually similar retinal images assembled from a large database comprising images of DR. This research adapted and extended an earlier CBIR method for industrial inspection and remote earth imaging by incorporating intrinsic and extrinsic human patient data to provide a diagnostic method. This grant was co-developed in partnership with the University of Tennessee Health Science Center's Hamilton Eye Institute, Memphis, Tennessee.

- **Diagnosis of Blinding Eye Disease (2004-2005, $178K)** – Developer and principle investigator of an Oak Ridge National Laboratory Seed Money project to develop a telemedicine capability for diagnosing retina-based blinding eye disease (e.g., resulting from diabetic retinopathy, macula edema, glaucoma, etc.) using a content-based image retrieval method in conjunction with a novel directed indexing concept. Established a collaborative R&D relationship with the University of Tennessee Health Science Center's Hamilton Eye Institute in Memphis, TN, to develop an extensive anonymized human patient database of diagnosed fundus, fluorescein angiography, and optical coherence tomography images.
- **Confocal Coded Aperture Gamma Camera (2003, $80K)** – Developer and principal investigator of this DOE NA-22 Exploratory R&D project to investigate the development of a novel coded aperture gamma imaging technology that overcomes limitations associated with historical attempts to image broadly distributed sources with coded apertures. Concept had the ability to perform high-resolution imaging of a distributed source while maintaining high collection efficiency. The initial application for this technology was to inhibit nuclear materials diversion and to support international safeguards related to activities of the International Atomic Energy Agency for LWR spent fuel verification. Participated by invitation of the IAEA as a U.S. expert on gamma imaging in a Coordinated Technical Meeting on Spent Fuel Verification Methods, held at the Vienna International Center, Vienna, Austria.
- **Image to Intelligence Archive (2003-2004, $770K)** – Co-developer and co-principal investigator of a Laboratory Directed R&D (LDRD) program to create a novel geographic information system (GIS) for managing, analyzing, and retrieving earth imagery gathered from satellite and aircraft. Technical contribution related to developing a Directed Indexing Library (DIL) method for succinct and adequate mapping of image region features for efficient database indexing and retrieval. The DIL method was also being applied to a fractal-based approach to segment images into functional regions (e.g., urban, forest, agricultural, etc.) prior to feature description and indexing. The archive architecture is broadly applicable to many fields where image data is collected and maintained such as biology, medical, industrial and GIS.

1999-2003, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Group Leader / Distinguished R&D Staff Member, Engineering Science & Technology Division

- **Digital Holographic Lithographic Mask Metrology (2002-2005, $710K)** – Developer and principal investigator of a cooperative research program with International SEMATECH (Litho Metrology Program), Austin, TX. This project included a feasibility study and prototype development effort to adapt the ORNL direct-to-digital holographic microscopy technology to the area of lithographic mask metrology. The ability to directly measure the modulation of the optical phase front imparted by a lithographic mask is inherent in the interferometric approach of the direct-to-digital holography technology. Application to binary, optical proximity correction, and phase shifting masks were studied in both reflective and transmissive geometries.
- **Digital Holographic Optical Microscopy for Wafer Inspection (2000, $1.5M, 2001-2003 NIST-ATP, $2.4M)** – Co-developer and principal investigator of this multi-year, cooperative research program to design, build, and transfer an interferometric optical microscope technology for the inspection of high-aspect ratio structures (e.g.,

contacts, vias, and trenches) on semiconductor wafers. Responsibilities included coordination and development of signal and image processing tasks related to hologram reconstruction, image alignment, defect detection, and noise mitigation.

- **3D Structural Metrology for Semiconductor Lithography (2000-2002, $500K)** - Developer and principal investigator of a cooperative research program with International SEMATECH (Litho Metrology Program), Austin, TX. This project was an extension of the Automated Image Retrieval technology to the estimation of three-dimensional sidewall structure from top-down, critical-dimension scanning electron microscopy. Method enabled semiconductor device manufacturers to reuse historical critical dimension metrology image information to estimate the shapes of critical structures during lithographic processes. This resulted in a reduced need to physically cross-section semiconductor product wafers, a time-consuming, destructive and expensive test.
- **Automated Image Retrieval (2000-2001, $1.1M, 2002-2003, $1.5M)** – Developer and principal investigator of a cooperative research program with Applied Materials, Inc., Santa Clara, CA. This work evolved from the Manufacturing-specific Content-based Image Retrieval and Semiconductor Yield Analysis projects started at ORNL. Included adapting and integrating the ORNL Automated Image Retrieval (AIR) technology for managing image data in the semiconductor manufacturing environment. Cooperative agreement included negotiations resulting in a commercial license between ORNL and Applied Materials, and ORNL and International SEMATECH for the patented AIR technology.

1996–1999, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Group Leader / Senior Research and Development Staff Member, Instrumentation & Controls Division

- **Semiconductor Yield Analysis (1994-2002, $2.7M)** - Developer and principal investigator of a cooperative research program with International SEMATECH (Metrology / Yield Management Tools Program), Austin, TX. This was a broad-based program to develop data analysis and data reduction technologies ranging from automatic defect classification and spatial signature analysis of patterned semiconductor wafers, to the application of content-based image retrieval technologies to semiconductor yield management. Worked closely with the semiconductor industry and suppliers of semiconductor inspection and yield management hardware and software. Developed novel (patented) electronic imaging paradigms for segmentation and pattern recognition to characterize semiconductor defects and manufacturing processes. Image modalities included optical (monochrome and color), scanning electron microscopy, digital holography, and confocal microscopy. Work culminated in 19 manufacturing and commercial licenses of the technology.
- **Video Forensics for Law Enforcement (1998-2002, $700K)** - Developer and principal investigator of a Department of Energy NA-22 project to assist law enforcement agencies in the analysis of surveillance video data primarily associated with crime scenes. Required the integration of object tracking, motion estimation, and multi-frame fusion algorithms to improve the fidelity and resolution of facial features and text items in low-quality video data. Collaborations were established with the United States Secret Service Video and Audio Forensics Unit, ATF Video Forensics Unit, and FBI Special Photographic Unit.
- **X-ray Inspection of Airport Baggage (1998-2003, $800K)** – Co-developer and principal investigator of this National Safe Skies Alliance / FAA project to develop novel concepts for operator-assist software for the x-ray inspection of carry-on luggage. Technology encapsulated human expert response in a fuzzy inferencing system that resulted in a demarcation of focus-of-attention regions. Applications of the technology included fusion with other commercial technologies for explosives and threat object detection to reduce false alarms.

1991-1995, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Group Leader / Research and Development Staff Member, Instrumentation & Controls Division

- **Automatic Optical and SEM Defect Classification (1992-1995, $600K, 1997-2000, $850K)** – Co-developer of several working relationships with the U.S. semiconductor inspection and yield management industry. Programs required the design of algorithms and software systems to address defect image analysis, feature representation, and classification of both color optical and SEM imagery collected in the pre-and post-fab environment. Inspection resolution regimes are post fab optical (>5 μm), in-line optical (<0.25 μm), and off-line SEM review (<0.1 μm). Collaborative partners included Electroglas, KLA-Tencor Instruments, Applied Materials, Knights Technology, Texas Instruments, and Intel.
- **Manufacturing-specific, Content-based Image Retrieval (1998-1999, $120K) -** Developer and principal investigator of an Oak Ridge National Laboratory Seed Money project to develop a Manufacturing-specific, Content-based Image Retrieval technology for image retrieval in the industrial environment. This technology was designed to take advantage of the unique characteristics of electronic images generated during in-line and off-line inspection processes. The method incorporated an efficient $O(\log_2(N))$ approximate nearest-neighbor indexing/search structure and operator feedback to accommodate a wide variety of query scenarios. This work resulted in the creation of two patented technologies and various commercial licenses in the semiconductor industry.
- **Printed Fabric Inspection and Imaging Colorimetry (1993-95, $450K, 1998-1999, $790K)** - Co-developer of the American Textile Partnership™ Computer Assisted Fabric Evaluation Program to provide applied R&D for on-line quality monitoring and automation of textile production and finishing processes. Principal investigator for the development of an on-line, high-speed tri-color data collection system for monitoring rotary screen print processes for screen registration, screen flaws, and other color printing errors. Principal investigator for development of a unique color printed-pattern and imaging tristimulus colorimeter system for inspecting patterned color textile products. Colorimetric approach used adaptation of the projection onto convex sets (POCS) method to estimate reflectance spectra based on tristimulus color camera measurements.
- **Technical Ceramics Inspection (1992-1997, $1.1M)** - Co-developer of a Cooperative Research and Development (CRADA) program with Coors Technical Ceramics, Grand Junction, CO, and Chattanooga, TN, to automate the inspection of thick-film ceramic substrates and pre-fired patterned ceramic package components. Developed novel methods for optical defect detection and dimensional metrology of thick film ceramic components. Resulted in the development and deployment of two inspection systems, one for thick-film ceramic substrates in Grand Junction, CO, and a second for inspecting patterned substrates in Chattanooga, TN.

1987-1991 Oak Ridge National Laboratory, Oak Ridge, Tennessee
Research and Development Staff Member, Applied Technology Division

- **Research Staff Member** - Developed remote measurement algorithms, methods, sensors and systems relying on infra-red, optical, and ultraviolet lasers, free space optics and fiber optics, and associated electronic devices. Applications included laser induced fluorescent spectroscopic studies, high, low, and transient temperature applications of thermographic phosphor materials, remote stress/strain diagnostics, and design and characterization of fiber optic and optical based probes.
- **High-speed Inspection of U.S. Printed Currency and Postage Stamps** – Developer of image processing methods for high accuracy, three-dimensional image registration (i.e., spatial x and y position plus grey-scale histogram specification) in support of off-line currency review and in-line postage stamp inspection for the U.S. Bureau of Engraving and Printing and the U.S. Postal Service. Quality control prototype systems were created to support these agencies development of commercial Requests for Proposals (RFPs).
- **Turbine Engine Thermometry** - Key designer of signal processing methods to implement non-contact, spectroscopic thermography for in-situ turbine blade temperature analysis. Participated in the design of air-cooled, fiber optic probes to work in harsh turbine/combustor environments. Oversaw three field tests of

fiber/laser delivery systems at Pratt & Whitney in Hartford, Connecticut, and Orlando, Florida, and at the Turbine Engine Test Facility at Virginia Tech, Blacksburg, Virginia.

- **Vehicle Weigh-in-motion** - Principal developer of signal processing algorithms and methodology for implementing a compact, silicon rubber-based fiber optic vehicle weigh-in-motion system for highway vehicle characterization. Responsibilities included the design of algorithms to estimate vehicle weight per wheel, system calibration, and participation in field-testing.

1983-1987 University of Virginia, Charlottesville, Virginia
Graduate Research Assistant, Department of Nuclear Engineering

Developed novel computational imaging methods in support of the neutron radiography facility at the University of Virginia Nuclear Reactor facility, with advisor Prof. Jack Brenizer. Performed some of the world's earliest direct-to-digital neutron imaging experiments utilizing a modified Thomson CSF X-ray imaging tube and Reticon video camera coupled to a digital image processing module and DEC PDP-11/23 computer system. Focus was on quantitative transmission imaging of low-Z materials to computed tomographic reconstruction and novel image encoding techniques. Dissertation topic focused on the development of digital techniques for the reconstruction of images captured with coded apertures. Coded apertures – such as Fresnel zone plates, random pinhole arrays, and uniformly redundant arrays – were developed to image non-diffracting or refracting radiation at high resolution while maintaining high signal-to-noise. Novelty was achieved in first digital reconstruction of digitally captured encoded images (i.e., no film) for scattered radiation.

1982-1983 Virginia Tech, Blacksburg, Virginia
Graduate Research Assistant, Department of Nuclear Engineering

Developed a mathematical model of iodine spiking in pressurized water reactors in support of a project with the Surry Nuclear Power Station operated by Dominion Energy in Surry County, Virginia. Va Tech Advisors: Profs. Ronald J. Onega and J.R. Thomas. Created a mathematical model of iodine production (I-131, 132, and 133) and thermally-driven migration in uranium oxide fuel. Model output was coupled to a fluid dynamics model to emulate leaching of available iodine isotopes at the UO_2 surface through cracks in the Zircalloy cladding into the primary coolant of a PWR during reactor shutdown (transient) conditions.

1982 (June – August) Stanford Linear Accelerator Center, Palo Alto, California
Summer Internship

Supported Dr. Luke Mo, Virginia Tech Department of Physics, on an NSF grant to construct several 3m x 3m drift chambers and interstitial scintillation panels for use in a high-energy particle physics experiment to detect the elementary Axion particle. The Axion is a hypothesized particle whose existence could help resolve the strong charge conjunction and parity problem (CP) in quantum physics. The Axion particle is a potential constituent of dark matter whose existence has not yet been experimentally verified.

PROFESSIONAL SOCIETIES / COMMITTEES / EDITOR / BOARDS

Invited Boards / Panels

Roane County Chamber of Commerce, Kingston, Tennessee – Member of the Board of Directors, July 2016 – present.

Industrial Advisory Board (IAB), Department of Electrical Engineering and Computer Science, University of Tennessee, Knoxville – Member of the Board, Academic Year 2012-present.

National Safe Skies Alliance, Alcoa, TN – Member, Board of Directors, 2011-2018.

FIRST Robotics Competition, Knoxville, TN - Member, Regional Board of Directors, Competition judge, 2011-2013. Team Founder and Mentor, Roane County High School, 2012-2017.

U.S. Department of Homeland Security - S&T Secure Boarders Initiative, Invited Member Review Panel, Tucson, AZ, August 15-18, 2011.

CIP R&D Plan – Lead writer: "Entry and Access Portals" theme for the <u>Critical Infrastructure Protection R&D Plan</u>, for the Office of Science & Technology Policy, the White House, 2004.

Excelerate Technology, Inc., Boston, MA – Member of the Technical Advisory Board, 2001-2004.

SIA-ITRS - Semiconductor Industry Association, International Technology Roadmap for Semiconductors,
      Member: U.S. Domestic Yield Enhancement Technology Working Group, 2002-2003.
      Member: U.S. Defect Reduction Technology Working Group, 1999-2001.
SIA-NTRS - Semiconductor Industry Association, National Technology Roadmap for Semiconductors,
      Member: Defect Reduction Technology Working Group, 1997-1998.

FBI SWGIT – Member, Federal Bureau of Investigation's Scientific Working Group on Imaging Technologies, Quantico, Virginia, 1998-2000.

ORNL – <u>Service to the Oak Ridge National Laboratory, 1998-present.</u>

Technology Innovation Program (TIP) Proposal Selection Committee, 2015-2019.
Inventor Week 2017, **Entrepreneur Roundtable Panel Discussion**, December 8, 2017.
Member of the ORNL **Distinguished Fellowship Selection Committee**, 2017-present.
Member, **Inventor of the Year and Tech Transfer Selection Committee**, UT-Battelle Awards Night 2017.
Member, **Distinguished Fellowship Review Committee**, 2017-present (36-month obligation)
Member of the **ORNL Named Fellowship Selection Committee**, 2017-2018.
Chairman, **UT-Battelle United Way Campaign**, 2017.
Co-Chair, **UT-Battelle United Way Campaign**, 2016.
Member, **Innovation and Commercialization Committee**, UT-Battelle Awards Night 2016.
Chairman of the **Wigner Fellow Selection Committee**, 2015-2016.
Member of the **Wigner Fellow Selection Committee**, 2004-2014.
Chairman, **Technical Support Award Committee**, UT-Battelle Awards Night 2011.
Chairman, **Engineering Award Committee**, UT-Battelle Awards Night 2010.
FY 2011 LDRD Initiative Review **Committee Member**, Global Security, 2010.
FY 2010 LDRD Initiative Review **Committee Member**, Advanced Energy Systems, 2009
Chairman, **Engineering Committee**, UT-Battelle Awards Night 2009.
Lead Writer: **Engineering Science and Technology Division Strategic Plan Revision** for 2005-2007.
Invited Member of the **National Security Directorate Strategic Advisory Group**, 2007-2008.
Vice-Chairman of the Oak Ridge National Laboratory **Corporate Fellow Committee**, 2006-2007.

Engineering Sciences Directorate Representative, **Invention Disclosure Review Committee** (IDRC), 2004-2006.
Member of the Oak Ridge National Laboratory **Seed Money Proposal Review Committee** (PRC), 2001-2002.
Member of the Oak Ridge National Laboratory **Inventor's Forum Executive Committee**, 1998-2000.

SPIE (Elected to rank of Fellow, March 2001) - The International Society for Optics and Photonics, 1989 - present.

Associate Editor for Vision Systems: 2005-2018, SPIE Journal of Electronic Imaging, Editor-in-Chief, Prof. Gaurav Sharma, University of Rochester.
Conference Co-Chair: 2006, SPIE Conference on Data Analysis and Modeling for Patterning Control III, part of the SPIE International Symposium on Microlithography, San Jose, CA
Conference Co-Chair: 2005, SPIE Conference on Data Analysis and Modeling for Process Control II, part of the SPIE International Symposium on Microlithography, San Jose, CA
Conference Chairman / Creator: 2004, SPIE Conference on Data Analysis and Modeling for Process Control I, part of the SPIE International Symposium on Microlithography, Santa Clara, CA
Conference Chairman / Creator: 2003, SPIE Conference on Process and Materials Characterization and Diagnostics in IC Manufacturing II, part of the 1st Annual International Symposium on Advanced Microelectronic Manufacturing, Santa Clara, CA
Conference Chairman / Creator: 2002, SPIE Conference on Process Characterization and Diagnostics in IC Manufacturing I, part of the 27th Annual International Symposium on Microlithography, Santa Clara, CA
Committee Member: 2003, SPIE Conference on Microsystems Engineering: Metrology and Inspection III, part of SPIE's International Symposium on Optics and Lasers in Metrology International Congress Center Munich, Munich, Germany, 23-26 June 2003.
Committee Member: 2003, SPIE Conference on Wavelet Applications in Industrial Processing, International Symposium on Intelligent Systems and Advanced Manufacturing, part of Photonics East, Rhode Island Convention Center, Providence, Rhode Island, 27-31 October 2003.
Program Chairman: 2001, Program on Micro-engineering / Manufacturing, SPIE International Symposium on Lasers and Applications in Science & Technology, San Jose, CA
Conference Chairman: 2001, Conference on Metrology-based Control for Micro-manufacturing, SPIE International Symposium on Lasers and Applications in Science & Technology, San Jose, CA.
Conference Chairman: 1999-2000 Conference on Machine Vision Applications in Industrial Inspection, SPIE International Symposium on Electronic Imaging, San Jose Convention Center, San Jose, CA
Committee Member: 1996-1998, 2001-2002 Conference on Machine Vision Applications in Industrial Inspection, SPIE International Symposium on Electronic Imaging, San Jose Convention Center, San Jose, CA

IEEE (Elected to rank of Fellow, January 2012) – The Institute of Electrical and Electronics Engineers, 1999 - present.

General Chair, 4th Annual Future of Instrumentation and Internet Workshop, IEEE Instrumentation and Measurement Society, National Rural Electric Cooperative Association, Arlington, VA, May 4-6, 2015.
General Chair, 3rd Annual Future of Instrumentation International Workshop, IEEE Instrumentation and Measurement Society, Gatlinburg, Tennessee, October 8-11, 2012.
General Chair, 2nd Annual Future of Instrumentation International Workshop, IEEE Instrumentation and Measurement Society, Oak Ridge, Tennessee, November 7-8, 2011.
Session Chairman, 33rd Annual International IEEE EMBS Conference, Retinal Image Analysis II, Boston, MA, August 30 - September 3, 2011.
General Chair, Future of Instrumentation International Workshop, IEEE Instrumentation and Measurement Society, Oak Ridge, Tennessee, November 8-9, 2010.

Co-Sponsor, 3rd Annual ORNL Biomedical Science and Engineering Conference: Image Informatics and Analytics in Biomedicine, in Cooperation with IEEE EMBS, March 2011.
Co-Sponsor, 2nd Annual ORNL Biomedical Science and Engineering Conference: Biomedical Research and Analysis in Neuroscience (BRAiN), in Cooperation with IEEE EMBS, May 2010.
Co-Sponsor, 1st Annual ORNL Biomedical Science and Engineering Conference: Exploring the Intersections of Interdisciplinary Biomedical Research, in Cooperation with IEEE EMBS, March 2009.
Reviewer, IEEE Transactions on Image Processing, Transactions on Signal Processing, Transactions on Medical Imaging
Vice-Chairman and Founding Officer of the East Tennessee Chapter of the Engineering in Medicine and Biology Society (EMBS), 2006-2008
Program Committee Member for the IEEE Workshop on Applications of Computer Vision, WACV 2008, Colorado, January 2008
Co-Chair, International Scientific Committee, 8th International Conference on Quality Control by Artificial Vision, Le Creusot, France, May 2007
Program Committee Member – IEEE, EURASIP 8th Annual Symposium on Advanced Concepts for Intelligent Vision Systems (ACIVS), University of Antwerp, Antwerp, Belgium, 2006-2007.
Reviewer, IEEE Nuclear Science Symposium and Medical Imaging Conference, Wyndham El Conquistador Resort, Puerto Rico, October 23-29, 2005,
Co-Chair, International Scientific Committee, 2005, Quality Control by Artificial Vision, Nagoya Congress Center, Nagoya, Japan
Conference Organizer and General Chair: 2003, 6th International Conference on Quality Control by Artificial Vision, Gatlinburg, Tennessee, USA (in cooperation with SPIE and SME)
Co-Chair, International Scientific Committee: 2001, Quality Control by Artificial Vision, Le Creusot, France
Committee Member: 1998-2000, IEEE Workshop on Computer Vision Beyond the Visible Spectrum: Methods and Applications

AAAS – American Association for the Advancement of Science, 2015-present

ANS – American Nuclear Society, 2016-present

Invited Conferences / Committees

General Chair: Organizer, NEUWAVE-4, 4th Workshop on Neutron Wavelength Dependent Imaging, Gatlinburg, TN, October 2-5, 2011.

International Program Committee Member – 2nd International Topical Meeting on Optical Sensing and Artificial Vision, 12-15 May, 2008, St. Petersburg, Russia.

Ph.D. Committee Member – ORNL Mentor and Doctoral Committee for Vincent Paquit, University of Burgundy, Le Creusot, France, December 2008.

International Program Committee Member / Conference Chair – International Symposium on Visual Computing, Lake Tahoe, Nevada, 2005-07.

International Program Committee Member / Conference Chair- International Topical Meeting on Optical Sensing and Artificial Vision, St. Petersburg, Russia, October 19-21, 2004

Ph.D. Committee Member – ORNL Mentor and Doctoral Committee for Pierrick Bourgeat, University of Burgundy, Le Creusot, France, July 2004.

PATENT LICENSE SUMMARY

Career intellectual property activities incorporating patents and copyrights listed below include 14 issued patents, and 8 patent licenses between 1993-2010 with companies such as SEMATECH, Inc. ($15K), Applied Materials, Inc. ($117K), nLine Systems Corp. ($130K), Rudolph Technologies, Inc. ($781K), International Road Dynamics, Inc. ($8K), and Welch Allyn, Inc. ($123K), **achieving royalty and patent reimbursements totaling $1.3M**.

ISSUED PATENTS

- **Tobin**, K.W., Karnowski, T.P., Chaum, E., "Method and System for the Diagnosis of Disease Using Retinal Image Content and an Archive of Diagnosed Human Patient Data," UT-Battelle, LLC, Invention Disclosure No. 1596.1, U.S. Patent No. 8,503,749, August 6, 2013.
- **Tobin**, K.W., Bingham, P.R., Hawari, A., "Apparatus and Method to Achieve High-Resolution Microscopy with Non-Diffracting or Refracting Radiation," UT-Battelle, LLC, Invention Disclosure No. 1300002076, U.S. Patent No. 8,304,737, November 6, 2012.
- **Tobin**, K.W., Karnowski, T.P., Chaum, E., "A Method for the Diagnosis of Blinding Eye Disease using Image Content and an Archive of Diagnosed Human Patient Data," UT-Battelle, LLC, Invention Disclosure No. 1596, DOE No. S-105,198, U.S. Patent No. 8,243,999, August 14, 2012.
- Karnowski, T.P., **Tobin**, K.W., Govindasamy, P., "Method for Confidence Metric in Optic Disk Location in Retinal Images," UT-Battelle, LLC, Invention Disclosure No. 2031, U.S. Patent No. 8,218,838, July 10, 2012.
- **Tobin**, K.W., Karnowski, T.P., "Method for the Reduction of Image Content Redundancy in Large Image Databases", UT-Battelle, LLC, Invention Disclosure No. 1485, US DOE S-105,086, U.S. Patent No. 7,672,976, March 2, 2010.
- Hanson, G.R., Bingham, P.R., **Tobin**, K.W., "Spatial-Heterodyne Interferometry for Reflection and Transmission (SHIRT) Measurements," UT-Battelle, LLC, Invention Disclosure No. 1225, DOE S-101,813, U.S. Patent No. 6,999,178 B2, February 14, 2006.
- Bingham, P.R., Hanson, G.R., **Tobin**, K.W., "Spatial-heterodyne interferometry for transmission (SHIFT) measurements", UT-Battelle, LLC, Invention Disclosure No. 1224, DOE S-101,812, U.S. Patent No. 7,119,905, October 10, 2006.
- **Tobin**, K.W., Karnowski, T.P., Ferrell, R.K., "Method for Indexing and Retrieving Manufacturing-Specific Digital Imagery Based on Image Content", ERID No. 0668 / Q&B 6321-131, U.S. Patent No. 6,751,343, June 15, 2004.
- **Tobin**, K.W., Karnowski, T.P., Ferrell, R.K., "Method for Localizing and Isolating an Errant Process Step", U.S. Patent No. 6,535,776, March 18, 2003.
- Paulus, M.J., Sari-Sarraf, H., **Tobin**, K.W., Gleason, S.S., Thomas, C.E., "Ultra-High Resolution Computed Tomography Imaging", U.S. Patent No. 6,421,409, July 16, 2002.
- **Tobin**, K.W., Thomas, C.E., "X-ray Confocal Coded Aperture Imaging System", U.S. Patent No. 6,195,412, February 27, 2001.
- **Tobin**, K.W., Jr., Gleason, S.S., Karnowski, T.P., and Sari-Sarraf H., "Automated Defect Signature Analysis for Semiconductor Manufacturing Process Improvement", U.S. Patent No. 5,982,920, January 7, 1997.
- Dooley, J.B., Muhs, J.D., **Tobin**, K.W., "Fiber Optic Vibration Sensor", U.S. Patent No. 5,381,492, January 10, 1995,
- Muhs, J.D., Jordan, J.K., **Tobin**, K.W., LaForge, J.V., "Apparatus for Weighing and Identifying Characteristics of a Moving Vehicle", U.S. Patent No. 5,260,520, November 9, 1993.

PENDING PATENTS

- **Tobin**, K.W., Datskos, P., Phelps, T., Bingham, P.R., "CTIR Spectrometer for Large Area Assessment of Gas Emissions," Disclosure No. 1215, Provisional Application Serial No. 62/330,882 filed May 3, 2016. Patent Application 3136.1 filed May 3, 2017.

INVENTION DISCLOSURES

- Price, J.R., Paquit, V., **Tobin**, K.W., "Improved Device for Assisted Venipuncture," UT-Battelle, LLC, Invention Disclosure No. 1300002067, March 31, 2008.
- **Tobin**, K.W., Karnowski, T.P., "A Method for Directed Indexing of Image Databases for Content-based Retrieval Applications", UT-Battelle, LLC, Invention Disclosure No. 1151, September 2002.
- Ferrell, R.K., **Tobin**, K.W., Karnowski, T.P., "Focus-of-Attention with Database Retrieval Comparison for Operator Threat Assessment X-Ray Screening," UT-Battelle, LLC, Invention Disclosure No. 1413, May 2004.
- **Tobin**, K.W., Neal, J.S., "A Confocal Coded Aperture Detector and Camera," UT-Battelle, LLC, Invention Disclosure No. 1386, March 2004.
- Karnowski, T.P., Bingham, P.R., **Tobin**, K.W., and Simpson, J.T., "Through-the-Pellicle Heterodyne Mask Inspection", UT-Battelle, LLC, Invention Disclosure No. 1311, August 13, 2003.
- Karnowski, T.P., **Tobin**, K.W., "Content-based Pattern Retrieval", UT-Battelle, LLC, Invention Disclosure No. 1227C, DOE S-101,813, January 2003.
- Gleason, S.S., **Tobin**, K.W., "A Method for Geo-spatial Image Segmentation using Fractal Encoding and Exemplars", UT-Battelle, LLC, Invention Disclosure No. 1150, September 2002.

COPYRIGHTS

- UT-BATTELLE Copyright Docket Number 40000092, "Retina Image Screening and Analysis Software, Version 2.0," T.P. Karnowski, L. Giancardo, D. Aykac, K.W. **Tobin**
- UT-BATTELLE Copyright Docket Number 40000031, "Automated Image Retrieval (AIR) Version 1.0," Creators: T. P. Karnowski, R. K. Ferrell, K. W. **Tobin**
- UT-BATTELLE Copyright Docket Number 40000032, "Automated Image Retrieval (AIR) Version 2.0," Creators: T. P. Karnowski, R. K. Ferrell, K. W. **Tobin**
- UT-BATTELLE Copyright Docket Number 40000053, "Intelligent Data Management (IDM) for a Content Based Image Retrieval," Creators: T. P. Karnowski, K. W. **Tobin**
- UT-BATTELLE Copyright Docket Number 40000054, "Defect Mask Encoder (DME) for a Content-Based Image Retrieval System," Creators: J. R. Price, K. W. **Tobin**

NATIONAL / INTERNATIONAL AWARDS AND RECOGNITION

- Battelle Distinguished Inventor, Battelle Memorial Institute, 2015.
- Elected to the grade of Fellow of IEEE, The Institute of Electrical and Electronics Engineers, January 2012.
- American Telemedical Association (ATA) Innovation Award for development of the TRIAD Ocular Telehealth Network, April 2011.
- Southeast Region Federal Laboratory Consortium Award for "TRIAD (Telemedical Retinal Image Analysis and Diagnosis)," recognition for Excellence in Technology Transfer, October 2010.
- R&D Magazine's R&D 100 Award for applied research in the development of the Telemedical Retinal Image Analysis and Diagnosis (TRIAD) System and Technology, November 2010.

- Southeast Region Federal Laboratory Consortium Award for " Automated Image Retrieval: Semiconductor-Specific Image Retrieval Method and System", recognition for Excellence in Technology Transfer, August 2007.
- SPIE Symposium on Medical Imaging, Conference on Visualization, Image-Guided Procedures, and Display, "Best Poster" of session and "Cum Laude" poster, February 2006.
- National Federal Laboratory Consortium Award for " MicroCAT Small Animal Imaging System ", recognition for Excellence in Technology Transfer, May 2005.
- Southeast Region Federal Laboratory Consortium Award for "MicroCAT Small Animal Imaging System", recognition for Technology Transfer Project of the Year, September 2004.
- Elected to the grade of Senior Member of IEEE, The Institute of Electrical and Electronics Engineers, August 2004.
- National Federal Laboratory Consortium Award for "Automated Image Retrieval System for Semiconductor Yield Improvement", recognition for Excellence in Technology Transfer, May 2003.
- Southeast Region Federal Laboratory Consortium Award for "Automated Image Retrieval Technology", recognition for Excellence in Technology Transfer, January 2003.
- R&D Magazine's R&D 100 Award for applied research in the development of the Defect Source Identifier – Automated Image Retrieval (DSI-AIR) System for Semiconductor Image Data Management, 2002.
- National Federal Laboratory Consortium Award for Excellence in Technology Transfer, "Direct-to-Digital Holography for High-Speed, High Resolution Defect Inspection", March 2002.
- Southeast Region Federal Laboratory Consortium Award for "Direct-to-Digital Holography for High-Speed, High Resolution Defect Inspection", recognition for the new category of Excellence in Technology Transfer Award of the Year, November 2002.
- Elected to the grade of Fellow of SPIE, The International Society for Optics and Photonics, March 2001.
- Tennessee Academy of Science, Industrial Scientist of the Year, for Leadership and Scientific Contributions to Semiconductor Metrology, November 2000.
- American Museum of Science and Energy Award for Marketed Technology for the "Spatial Signature Analysis Software System", May 1998.
- National Federal Laboratory Consortium Award for Excellence in Technology Transfer, "Spatial Signature Analysis System for Semiconductor Yield Improvement", March 1998.
- Southeast Region Federal Laboratory Consortium Award for Excellence in Technology Transfer, "Spatial Signature Analysis System for Semiconductor Yield Improvement", March 1998.

OAK RIDGE NATIONAL LABORATORY AWARDS

- UT-Battelle, LLC, Awards Night Recognition for Excellence in Technology Transfer for Successful Technology Transfer of a Creative and Innovative Application of ORNL Technology to Solve Important High-Impact Problems in Public Health Care, September 2010.
- ORNL Laboratory Directed Research and Development Poster Day "Best Poster" for "Improving Iris Recognition," October 2006.
- UT-Battelle, LLC, Awards Night Director's Award for Outstanding Team Accomplishment in Science and Technology, for Successful Development of a Content-based Image Retrieval System for Semiconductor Yield Improvement October 2002.
- UT-Battelle, LLC, Awards Night Recognition for Outstanding Engineering Development Team Accomplishment, for Successful Development of a Content-based Image Retrieval System for Semiconductor Yield Improvement October 2002.
- UT-Battelle, LLC, Awards Night Recognition for Distinguished Engineer (Individual) for Developing an Internationally Recognized Program in Computer Vision and Semiconductor Metrology, November 2001.

- UT-Battelle, LLC, <u>Awards Night Recognition</u> for Engineering Development by a Team for Development of a Direct-to-digital Holographic System for Metrology and Inspection, November 2001.
- Oak Ridge National Laboratory <u>Significant Event Award</u> for "Development of ORNL Automated Image Retrieval Technology", September 2001.
- Oak Ridge National Laboratory <u>Significant Event Award</u> for "Establishing a unique and precedent-setting, three way working relationship in the semiconductor industry between ORNL, International SEMATECH, and Applied Materials, Inc.", June 2000.
- Lockheed Martin Energy Systems, Inc. <u>Awards Night Recognition</u> for Development Accomplishment for Imaging Colorimetry Technology/System, March 1999.
- Lockheed Martin Energy Systems, Inc. <u>Awards Night Recognition</u> for Technology Achievement in support of the semiconductor industry, March 1998.
- Oak Ridge National Laboratory <u>Significant Event Award</u> for delivery of Spatial Signature Analysis technology to SEMATECH, March 1997.

BOOKS / CHAPTERS / EDITOR

Tobin, K.W., Clayton, D., Vacaliuc, B., (Kim Fowler, Ed.) "Case Studies at the Oak Ridge National Laboratory for the Development of Real-Time Instrumentation Systems," <u>Developing and Managing Embedded Systems and Products</u>, Elsevier, Inc., New York, New York, September 26, 2014.

Karnowski, T.P., Li, Y., Giancardo, L., Aykac, D., **Tobin**, K.W., Chaum, E., (Togesan, K., Goldschmidt, L., Cuadros, J., Eds.), "Automated Image Analysis and the Application of Diagnostic Algorithms in an Ocular Telehealth Network," <u>Digital Teleretinal Screening Under Teleophthalmology in Practice</u>, Springer-Verlag, New York, New York, April 28, 2012.

Karnowski, T.P., Li, Y., Giancardo, G., Aykac, D., Garg, S., Abramoff, M.D., Tennant, M.T., **Tobin**, K.W., and Chaum, E., (Dua, S., Acharya, R., Ng, E. Eds.), "Automating the Diagnosis, Stratification, and Management of Diabetic Retinopathy Using Content-Based Image Retrieval in an Ocular Telehealth Network," <u>Computational Analysis of the Human Eye with Applications</u>, World Scientific Publications, March 2011.

Giancardo, L., Meriaudeau, F., Karnowski, T.P., Chaum, E., **Tobin**, K.W., (Campolo, D., Editor), "Quality Assessment of Retinal Fundus Images using Elliptical Local Vessel Density," <u>New Developments in Biomedical Engineering</u>, INTECH Online, January 2010, pp. 201–224.

Tobin, K.W., Bingham, P.R., Gregor, J. (Anderson, Ian S., et al., Eds.), "Mathematics of Neutron Imaging," <u>Neutron Imaging and Applications</u>, Springer-Verlag, New York, New York, January 2009.

Tobin, K.W., Chaum, E., Gregor, J., Price, J.R., Wall, J., Karnowski, T.P., (G. Schaefer, Editor) "Image Informatics for Clinical and Preclinical Biomedical Analysis," <u>Computational Intelligence in Medical Imaging: Techniques and Applications</u>, CRC Press, Nov. 26, 2008.

Singh, B., **Tobin**, K.W., Guest Editor for special Section of the <u>Journal of Microlithography, Microfabrication, and Microsystems</u>, SPIE, Vol. 5, No.2, April 2006.

Emami, I., Ausschnitt, C. P., and **Tobin**, K.W., Chair/Editor, <u>Data Analysis and Modeling for Process Control II</u>, Proceedings of the SPIE, Vol. 5755, March 2005.

Tobin, K.W., Lead Writer, "Entry and Access Portals," <u>National Plan for Research and Development in Support of Critical Infrastructure Protection</u>, The Executive Office of the President, Office of Science and Technology Policy, 2004.

Tobin, K.W., Mereaudeau, F., Costa, Luciano de Fontoura, Guest Editor for special Section of the <u>Journal of Electronic Imaging</u> on "Quality Control by Artificial Vision", SPIE, Vol. 13, No. 3, July 2004.

Tobin, K.W., Emami, I, Chair/Editors, <u>Data Analysis and Modeling for Process Control I</u>, Proceedings of the SPIE, Vol. 5378, May 2004.

Tobin, K.W., Meriaudeau, F., Chair/Editors, <u>Quality Control by Artificial Vision</u>, Proceedings of the SPIE Vol. 5132, May 2003.

Tobin, K.W., Emami, I., Chair/Editors, <u>Process and Materials Characterization and Diagnostics in IC Manufacturing II</u>, Proceedings of the SPIE Vol. 5041, May 2003.

Tobin, K.W., Starikov, A., Chair/Editors, <u>Design, Process Integration, and Characterization for Microelectronics</u>, Proceedings of the SPIE Vol. 4692, March 2002.

Tobin, K.W., Lakhani, F., Chair/Editors, <u>Metrology-based Control for Micro-manufacturing</u>, Proceedings of the SPIE, Vol. 4275, July 2001.

Tobin, K.W., Chair/Editor, <u>Machine Vision Applications in Industrial Inspection VIII</u>, Proceedings of the SPIE, Vol. 3966A and B, July 2000.

Tobin, K.W., Miller J.W., Guest Editor for special Section of the <u>Journal of Electronic Imaging</u> on "Machine Vision for Industrial Inspection", SPIE, Vol. 10, No. 1, January 2001.

Tobin, K.W., Neiberg, L., "Metrology Data Management and Information Systems", (Alain C. Diebold, Editor) <u>Handbook of Silicon Semiconductor Metrology</u>, Alain Diebold, Editor, Marcel Dekker, Inc., New York, New York, 2001.

Tobin, K.W., Editorial Advisory Board for Engineering/Machine Vision (Joseph P. Hornak, Editor), <u>The Encyclopedia of Imaging Science and Technology</u>, Vol. 1-2, John Wiley & Sons, Inc., New York, 2002.

Sankaran, V., Weber, C.M., **Tobin**, K.W. Jr. and Lakhani, F., "Inspection in Semiconductor Manufacturing", <u>Webster's Encyclopedia of Electrical and Electronic Engineering</u>, Vol. 10, pp. 242-262, Wiley & Sons, NY, NY, 1999.

Tobin, K.W., Chang, N., Chair/Editors, <u>Machine Vision Applications in Industrial Inspection VII</u>, Proceedings of the SPIE, Vol. 3652, July 1999.

NATIONAL / INTERNATIONAL INVITED PRESENTATIONS

Tobin, K.W., "Instrumentation and Controls for Advanced Reactor Deployment," Department of Nuclear Engineering Seminar Series, Ohio State University, Columbus, Ohio, December 6, 2017.

Tobin, K.W., "Advanced Nuclear Reactor Research and Development at the Oak Ridge National Laboratory," Oak Ridge Lions Club, Oak Ridge, Tennessee, October 23, 2017.

Tobin, K.W., "IoT and the Electric Grid," Dept. of Commerce NTIA Workshop Fostering the Advancement of the Internet of Things, USPTO Office, Alexandria, Virginia, September 1, 2016.

Tobin, K.W., "Electronics, Sensors, and Controls for the Internet of Things," HAVI Global Solutions, Packaging Technology and Integrated Solutions: Future of Packaging Annual Meeting, National Transportation Research Center, Knoxville, Tennessee, May 24, 2016.

Tobin, K.W., "The Energy Revolution in an Interconnected World," Keynote Speaker, Oklahoma Research Day, Northeastern State University, March 11, 2016.

Tobin, K.W., "Electronics, Sensors, and Controls for the Energy Challenge," Global Institute of Sustainability, Arizona State University, January 27, 2016.

Tobin, K.W., "Science and Technology Research for the Energy Challenge," ORNL Challenge Opportunity, Duke University, October 7, 2015.

Tobin, K.W., "Advanced Material Characterization with Neutron Imaging," Neutron Characterization of Additively Manufactured Components Workshop, Oak Ridge National Laboratory, Feb 25-26, 2015.

Tobin, K.W., "Electronics, Sensing, and Communications Research for Energy Efficiency, Resiliency, and Security," Idaho National Laboratory, Idaho Falls, Idaho, September 25, 2014.

Tobin, K.W., "ORNL Sensing and Communications Research for City System Design," Oak Ridge National Laboratory Extended Leadership Team Meeting, July 28, 2014.

Tobin, K.W., "Electronics, Sensing, and Communications Research for City System Design," Keynote Speaker - NETL Crosscutting Research Review Meeting, Pittsburg, Pennsylvania, May 19-23, 2014.

Tobin, K.W., "The Impact of Sensing and the Internet-of-Things on the City as a System," Urban Dynamics Institute Seminar Series, Oak Ridge National Laboratory, May 5, 2014, May 20, 2014.

Tobin, K.W., "Biomedical Technology Development and Maturation at ORNL," Venture Match Seminar: Medical Device and Imaging, The Proton Therapy Center, Knoxville, Tennessee, February 25, 2014.

Tobin, K.W., "Electrical and Electronics Systems Research: High Resolution Neutron Microscopy," Center for Intelligent Systems and Machine Learning, Department of Electrical Engineering and Computer Science, *University of Tennessee*, January 31, 2014.

Tobin, K.W., "Sensor Technology, Instrumentation, and Analysis for Energy Research," *UC Davis / McClellan Nuclear Research Center*, Sacramento, California, June 25, 2013.

Tobin, K.W., Bilheux, H., Herwig, K., Keener, S., Davis, L., Geoghegan, C., Gallmeier, F., Popova, I., "VENUS: Versatile Neutron Imaging Instrument at the Spallation Neutron Source," 5th Neutron Wavelength Dependent Imaging Workshop, Lund, Sweden, April 21-24, 2013.

Tobin, K.W., "Sensors and Sensor Networks for a Sustainable Environment," Sustainable Eagle Ford Shale Community Infrastructure Challenges and Solutions Workshop, *Texas A&M*, Kingsville, Texas, April 10, 2013.

Tobin, K.W., "Telemedical Retinal Image Analysis and Diagnosis (TRIAD) and the R&D 100 Award," Oak Ridge Institute for Continuous Learning (ORICL), *Roane State Community College*, Oak Ridge, TN, February 23, 2011.

Tobin, K.W. "Multi-Disciplinary Research and Development in the Field of Applied Computer Vision at the Oak Ridge National Laboratory," ECE Graduate Seminar Series, Electrical and Computer Engineering, *Purdue University*, October 21, 2009.

Tobin, K.W., Chaum, E., Karnowski, T.P., Li, Y., Giancardo, L., Aykac, D., "A Telemedicine Approach to the Reduction of Blindness from Diabetic Retinopathy," The Technical Society of Knoxville, Crown Plaza, Knoxville, TN, June 28, 2009.

Tobin, K.W., Chaum, E., Giancardo, L., Karnowski, T.P., Li, Y, "A Telemedicine Network for the Automated Diagnosis of Diabetic Retinopathy," SAOT Retina Image Processing Workshop 2009, *Friedrich-Alexander University*, Erlangen, Germany, March 9-10, 2009.

Tobin, K.W, Chaum, E., Giancardo, L., Karnowski, T.P., "Using Image Content to Diagnose and Stratify Diabetic Retinopathy," Asilomar Conference of Signal, Systems, and Computers; General Session on Biomedical Signal and Image Processing, Pacific Grove, California, Oct. 26-29, 2008.

Tobin, K.W., "Applied Research and Development at the Oak Ridge National Laboratory," Center for Advanced Computer Studies Distinguished Lecture Series, *University of Louisiana*, Lafayette, Louisiana, September 26, 2008.

Tobin, K.W., "A History of Applied Research and Development through the Measurement Science and Systems Engineering Division at the Oak Ridge National Laboratory," Friends of ORNL, Oak Ridge, Tennessee, September 17, 2008.

Tobin, K.W., "Computer Vision Research and Development at the Oak Ridge National Laboratory," Department of Mechanical and Nuclear Engineering, *Pennsylvania State University*, State College, Pennsylvania, March 20, 2008

Tobin, K.W., Abdelrahman, M., Chaum, E., Govindasamy, V.P., Karnowski, T.P., "A Probabilistic Framework for Content-Based Diagnosis of Retinal Disease," Electrical and Computer Engineering Colloquium, *Tennessee Technological University*, Cookeville, Tennessee, November 6, 2007.

Tobin, K.W., Bingham, P.R., Price, J.R., "Optical Spatial Heterodyned Interferometry and Inspection of Micro-Electro-Mechanical Systems," 8th International Conf. on Quality Control by Artificial Vision, *Proceedings of SPIE*, Vol.6356, Le Creusot, France, May 23-25, 2007.

Tobin, K.W., "Biomedical Imaging and Computer Vision at the Oak Ridge National Laboratory," Preclinical Research & Development, *Siemens Medical Solutions USA, Inc*., Knoxville, Tennessee, January 29, 2007.

Tobin, K.W., "Biomedical Imaging and Informatics and the Oak Ridge National Laboratory," *Vanderbilt University Institute of Imaging Science*, Nashville, Tennessee, January 17, 2007.

Tobin, K.W., Chaum, E., Karnowski, T.P., Govindasamy, V.P., "An Image-Based Method for Rapid Screening of Diabetic Retinopathy," Engineering Colloquium Lecture, Electrical Engineering Department, *Norfolk University*, Norfolk, Virginia, October 27, 2005.

Tobin, K.W., Chaum, E., Karnowski, T.P., Govindasamy, V.P., "An Image-Based Method for Rapid Screening of Diabetic Retinopathy," *The Technical Society of Knoxville*, Crowne Plaza Hotel, Knoxville, Tennessee, October 24, 2005.

Tobin, K.W., "Small Animal Image Analysis and Data Management for CT and SPECT," Symposium on Nanotechnology Applications in Medicine, *Hamilton Eye Institute*, Memphis, TN, September 28, 2005.

Tobin, K.W., Bingham, P.R., "Optical Spatial Heterodyned Interferometry for Applications in Semiconductor Inspection and Metrology," International Conference on Lasers, Applications, and Technologies, *Proceedings of SPIE*, Vol. 6162, St. Petersburg, Russia, May 11-15, 2005.

Tobin, K.W., "Applied Computer Vision R&D at the Oak Ridge National Laboratory," Fall Colloquia, Computer Science and Engineering Department, and Northern Nevada IEEE, *University of Nevada*, Reno, Nevada, Oct. 18, 2004.

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