

APL Achievement Awards and Prizes

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The Applied Physics Laboratory has a long tradition—28 years—of granting awards and prizes for excellence by APL staff. Awards help to inspire others to do their best. They set standards that people strive to match and exceed. APL conducts five awards competitions to promote initiative and reward exceptional work: the APL Publication Awards, the R. W. Hart Prizes, the Invention of the Year, the Government Purpose Innovation Award, and, new this year, the Ignition Grants Prize for Innovation. In addition to these five annual competitions, the prestigious Lifetime Achievement Publication Award is conferred only occasionally, when an individual's accomplishments in publication and achievement span a productive and distinguished career at APL.

APL's first awards program, the Publication Awards competition, was established in 1985 both to encourage professional writing and to recognize outstanding publications by the APL professional staff. Professional publication in refereed journals is central to scientific communication and is the medium through which important results and innovations are promptly and accurately recorded and disseminated. To encourage and reward exceptional scholarship, the Editorial Board of the *Johns Hopkins APL Technical Digest* solicits from each APL department nominations for publications considered to be outstanding. Departments may submit up to two nominations in each of six categories. Judges base their selections on significance and clarity, with considerably greater weight given to the significance of the work in advancing science, engineering, or the mission of the Laboratory. In 2013, six departments submitted

44 publications from those published in 2012. Of these, 10 publications from three departments won awards.

The Lifetime Achievement Publication Award is APL's most prestigious publishing honor. Since the award's inception in 1986, only 15 have been conferred. This year, APL honored Russell Keith Raney with the Lifetime Achievement Publication Award. Dr. Raney is an internationally recognized expert in space-based radar design and ocean science, as well as a prolific author of over 100 frequently cited scientific articles. The Lifetime Achievement Publication Award is conferred only when a candidate meets the significant level of achievement defined by this award.

The value of a premier research and development organization is its ability to understand national mission needs, turn them into research and engineering challenges, and meet those challenges through the sci-

entific and technical expertise of its staff. The R. W. Hart Prizes, the Invention of the Year Award, the Government Purpose Innovation Award, and the Ignition Grant Prize for Innovation all support APL's resolve to foster and bring forth new technologies and concepts to meet the nation's critical challenges.

The R. W. Hart Prize for Excellence in Independent Research and Development was established in 1989 to recognize significant contributions to the advancement of general science and technology. Departments recommend candidates and the Management Forum judges the nominations on the quality and importance of the work to APL. Prizes are awarded in two categories: one for the best research project and the other for the best development project. In 2013, departments nominated 12 projects from those active in 2012. Of these, one prize was awarded in the research category, and one prize was awarded in the development category.

The concept of innovation is sometimes confused with the term invention. Although innovation and invention are closely related, invention specifically refers to making new discoveries and designs or coming up with new ways of doing things. Invention is the technical part of innovation, involving the development of an idea or discovery to the point where it works theoretically.

The Invention of the Year Awards program was established in 2000 to encourage new technology at APL and identify the top technology from the preceding year. An independent review panel of technical and business consultants, technology transfer professionals, and intellectual property attorneys judge the disclosures. Selection of the winning technology is based on evaluation of the nominated invention's creativity, novelty, improvement over existing technology, commercial potential, and probable benefit to society. In 2011, a Government Purpose Innovation Award was established to recognize an invention that specifically meets a critical need of a sponsor. For the 2012 competition, 355 APL researchers disclosed 202 inventions. Of these, one was selected for the Invention of the Year Award and one received the Government Purpose Innovation Award.

Innovation is the generation of fresh ideas, the ongoing development of products, services, and processes, and their commercial application. Creativity is the most important part of being innovative and is wasted if there is no process in place to take ideas and turn them into something that has market potential.

The Ignition Grant Prize for Innovation, the Laboratory's newest technical achievement award, was established in 2011 to provide APL staff with a way to explore innovative ideas outside of their traditional work assignments. Open to all APL staff, challenges are posted during several cycles held throughout the year and ideas are submitted for solutions. The winning ideas from each cycle are determined by popular vote, and the finalists receive funding to develop their ideas. The Management Forum narrows the field of awarded grants to a top few nominees, and staff vote for the top award on the basis of each idea's creativity and potential for impact. This year, one finalist received the Ignition Grant Prize for Innovation out of all those who submitted ideas in 2012.

APL's awards and prizes programs honor those who are setting the stage for tomorrow's science, technological advances, and the innovations that the world will need in the future. These individuals and teams, who give so much of themselves, help support APL's research, development, and teaching mission. This collaboration fosters an environment that is rewarding and challenging. What could be more inspiring and instructive for young scientists and engineers than for their organization to recognize and honor members of its professional staff who work by the principles of excellence, team work, and personal responsibility? It was a privilege, therefore, to honor the nominees in each competition and to reveal, for the first time, the winners of the 2012 awards and prizes at the Technical Achievement Awards reception on 1 May 2013. The names of the winners, along with the titles and brief descriptions of their publications, projects, inventions, and innovations, are displayed on the following pages.

PUBLICATION AWARDS FOR 2012

Author's First Paper in a Peer-Reviewed Journal or Proceedings

For "Structure and Properties of Collagen Vitrigel Membranes for Ocular Repair and Regeneration Applications," *Biomaterials* **33**(33), 8286–8295 (2012)

Collagen vitrigels are being developed for ocular repair. Tailoring synthesis parameters facilitated structure control (e.g., fibril diameter, density, and homogeneity), thus improving the optical and mechanical properties of the material. Reduction in vitrification time was also achieved, making the manufacturing process shorter and more practical.

Xiomara Calderón-Colón, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Univ. of North Carolina, Applied Science and Engineering; co-authored with Zhiyong Xia, Jennifer L. Breidenich, Daniel G. Mulreany, Qiongyu Guo, Oscar M. Uy, Jason E. Tiffany, David E. Freund, Russell L. McCally, Oliver D. Schein, Jennifer H. Elisseeff, and Morgana M. Trexler

Outstanding Paper in the *Johns Hopkins APL Technical Digest*

The Walter G. Berl Award

For "Fundamentals of Small Unmanned Aircraft Flight," *Johns Hopkins APL Technical Digest* **31**(2), 132–149 (2012)

Recent advances in sensors and processing have enabled unmanned aircraft systems (or UASs) to become smaller and more affordable. This article summarizes current UAS sensor and sensor configuration technology, describes sensor use in state estimation and flight control, and provides a valuable, concise mathematical derivation of UAS flight control algorithms.

Jeffrey D. Barton, Senior Professional Staff, Force Projection Department (FPD), M.S., JHU, Mathematics/Applied Math

For "A Fiber Laser Photonic Frequency Synthesizer: Concept, Performance, and Applications," *Johns Hopkins APL Technical Digest* **30**(4), 287–298 (2012)

This paper describes a unique type of microwave frequency oscillator based on photonic technologies, specifically a dual-wavelength Brillouin fiber laser that is capable of operating over a wide frequency range from megahertz to terahertz while maintaining low-phase noise properties over the entire range. Applications include advanced radio frequency sensors and communications.

Michael C. Gross, Senior Professional Staff, Air and Missile Defense Department (AMDD), Ph.D., Georgia Institute of Technology, Electrical Engineering; **Patrick T. Callahan** (formerly APL staff); **Michael L. Dennis**, Principal Professional Staff, AMDD, Ph.D., Univ. of New Mexico, Optics

For "All-Optical Computing Using the Zeno Effect," *Johns Hopkins APL Technical Digest* **30**(4), 346–360 (2012)

Novel approaches to photonic quantum and classical computing have been developed based on two-photon absorption and the Zeno effect. Although material and engineering demands currently place quantum logic demonstrations out of reach, the authors are on the verge of demonstrating a new class of devices that could revolutionize conventional optical computing.

Bryan Jacobs (formerly APL staff); **Chad N. Weiler**, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Univ. of Arizona, Optical Sciences/Atomic Physics; **Jeffrey P. Maranchi**, Senior Professional Staff, REDD, Ph.D., Carnegie Mellon Univ., Materials Engineering; **Chad R. Sprouse**, Senior Professional Staff, REDD, M.S., JHU, Computer Science; **Dennis G. Lucarelli**, Senior Professional Staff, REDD, Sc.D., Washington Univ., Systems Science and Math; Brian G. Rayburn (non-APL staff)

Outstanding Research Paper in an Externally Refereed Publication

For "Computing Myocardial Motion in 4-Dimensional Echocardiography," *Ultrasound in Medicine & Biology* **38**(7), 1284–1297 (2012)

A novel optical-flow technique operating on 3D+time data is introduced and thoroughly evaluated. The method provides for each time frame 3D optical flow vectors. It is highly accurate, generalizable to any 3D+time data, and provides significant gains over the state of the art. Its superiority is demonstrated by analysis of medical ultrasound data.

Ryan N. Mukherjee, Associate Professional Staff, Research and Exploratory Development Department (REDD), B.S., Univ. of Maryland at College Park, Computer Engineering; **Chad R. Sprouse**, Senior Professional Staff, REDD, M.S., JHU, Computer Science; Aurélio Pinheiro (non-APL staff); Theodore Abraham (non-APL staff); **Philippe M. Burlina**, Principal Professional Staff, REDD, Ph.D., Univ. of Maryland at College Park, Electrical Engineering

Outstanding Development Paper in an Externally Refereed Publication

For "Monitoring Dynamic Thermal Behavior of the Carbon Anode in a Lithium-Ion Cell Using a Four-Probe Technique," *Journal of Power Sources* **198**, 351–358 (2012)

A versatile battery internal temperature sensor, based on electrical measurement (impedance), requires only wire connections to the two terminals of the cell. The wire length does not influence the outcome of the measurements. It measures the internal temperature in real time (50 ms), an essential quality to prevent failure and fire.

Rengaswamy Srinivasan, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Indian Institute of Science, Chemistry

Outstanding Professional Book

For *Bayesian Estimation and Tracking: A Practical Guide*, John Wiley & Sons, Inc., Hoboken, New Jersey (2012)

This book presents a Bayesian development from first principles of practical approaches to estimation and tracking of dynamic systems in real-world applications, with case studies that apply the developed methods.

Anton J. Haug, Senior Professional Staff, Air and Missile Defense Department (AMDD), Ph.D., Catholic Univ. of America, Physics

For *Wavelets: A Concise Guide*, The Johns Hopkins University Press, Baltimore (2012)

Wavelets are an efficient technique to simultaneously describe time and frequency content with wide applications in signal and image processing and compression. This text introduces the mathematical underpinnings of wavelets and describes the common wavelet types. One- and two-dimensional applications are discussed.

Amir-Homayoon Najmi, Senior Professional Staff, Force Projection Department (FPD), Ph.D., Oxford Univ., Theoretical Physics

For *Microwave and Millimeter Remote Sensing for Security Applications*, Artech House, Norwood, MA (2012)

The book provides a thorough treatment of the principles of microwave and millimeter-wave remote sensing for security applications, as well as practical coverage of the design of radiometer, radar, and imaging systems.

Jeffrey A. Nanzer, Senior Professional Staff, Air and Missile Defense Department (AMDD), Ph.D., Univ. of Texas, Electrical and Computer Engineering

Outstanding Special Publication

For the book chapter: "Artificial Senses and Organs: Natural Mechanisms and Biomimetic Devices," Chap. 2, *Biomimetics: Nature-Based Innovation*, Y. Bar-Cohen (ed.), CRC Press, Boca Raton, pp. 35–93 (2011)

Humans have always looked to nature's inventions for inspiration. Recently, these efforts have become more intensive, with researchers seeking rules, concepts, and principles of biology to inspire new possibilities in materials, mechanisms, algorithms, and fabrication processes. This chapter reviews the state of the art in biomimetic organs and sensors.

Morgana M. Trexler, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Georgia Institute of Technology, Materials Science and Engineering; **Ryan M. Deacon**, Senior Professional Staff, REDD, Ph.D., Lehigh Univ., Materials Science and Engineering

LIFETIME ACHIEVEMENT PUBLICATION AWARD

Presented to Keith Raney

This award is intended to honor the recipient author for a lifetime of achievement through a substantial body of publications that are considered significant by peer recognition, prizes, citation frequency, or influence on technical developments at APL or elsewhere. As such, it is not awarded every year.

Dr. Raney is a world-recognized expert in space-based radar design and ocean science. During his time at APL, he published nearly 100 scientific articles that have been cited nearly 1400 times. He was the design architect for APL's Mini-RF hybrid-polarimetric radar on India's Chandrayaan-1 and NASA's Lunar Reconnaissance Orbiter.



R. W. HART PRIZES FOR 2012

Excellence in Research

For “Nanostructured Materials: Radiation Sensing Applications”

The project successfully characterized specific nanomaterials and demonstrated their application to detect specific nuclear materials for national defense purposes.

Joan A. Hoffmann, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Univ. of California, Berkeley, Physics; **David M. Deglau**, Associate Professional Staff, REDD, B.S., St. Vincent College, Biochemistry; **Stergios J. Papadakis**, Principal Professional Staff, REDD, Ph.D., Princeton Univ., Electrical Engineering; **Thomas S. Mehoke**, Associate Professional Staff, REDD, M.S., JHU, Bioinformatics; **Ryan M. Deacon**, Senior Professional Staff, REDD, Ph.D., Lehigh Univ., Materials Science and Engineering; **Brian M. Fisher**, Senior Professional Staff, Asymmetric Operations Department (AOD), Ph.D., Univ. of North Carolina at Chapel Hill, Physics

Excellence in Development

For “Organic Persistent Intelligence, Surveillance and Reconnaissance (OPISR)”

This multiyear project successfully field tested and demonstrated an autonomous, self-organizing surveillance network with unattended/unmanned airborne, ground, and at-sea sensors that can be transported and deployed by a small military unit.

David H. Scheidt, Principal Professional Staff, Space Department (SD), B.S., Case Western Reserve Univ., Computer Engineering; **Robert W. Chalmers**, Senior Professional Staff, Force Projection Department (FPD), M.S., JHU, Applied Physics; **Christopher C. Olson**, Associate Professional Staff, FPD, M.S., Univ. of Minnesota, Computer Science; **Jonathan C. Castelli**, Associate Professional Staff, FPD, M.S., Univ. of Maryland at College Park, Aerospace Engineering; **Dennis S. Patrone**, Senior Professional Staff, Asymmetric Operations Department (AOD), M.S., JHU, Computer Science; **Adam S. Watkins**, Senior Professional Staff, FPD, Ph.D., Univ. of Florida, Aerospace Engineering; **Russell J. Turner**, Senior Professional Staff, SD, Ph.D., Swiss Federal Institute of Technology, Computer Science; **William L. Van Besien**, Associate Professional Staff, SD, M.S., George Washington Univ., Computer Science; **William B. Fitzpatrick**, Senior Professional Staff, FPD, M.S., Embry Riddle Aeronautical Univ., Systems Engineering; **Robert C. Hawthorne**, Senior Professional Staff, FPD, M.S., JHU, Computer Science; **Robert J. Bamberger Jr.**, Principal Professional Staff, REDD, M.S., JHU, Applied Physics; **Justin Thomas**, Senior Professional Staff, SD, M.S., Univ. of Houston, Computer Science; **Andrew J. Newman**, Principal Professional Staff, FPD, Ph.D., Univ. of Maryland at College Park, Electrical Engineering; **Michael H. Biggins**, Associate Professional Staff, FPD, B.S., Univ. of Maryland at College Park, Computer Science; **Eliezer G. Kahn**, Senior Professional Staff, SD, Ph.D., Yale Univ., Electrical Engineering; **Michael Lucks**, Senior Professional Staff, SD, Ph.D., Southern Methodist Univ., Computer Science; **Stephen S. Carr**, Principal Professional Staff, Air and Missile Defense Department (AMDD), Ph.D., Univ. of Michigan, Space Science; Nathan J. Abraham (non-APL staff)

INVENTION OF THE YEAR AWARD FOR 2012

For “Apparatus and Method for Identifying Related Code Variants in Binaries”

CodeDNA is a novel technique that creates a compressed DNA-type fingerprint of a binary that represents the various types of instructions found in its code. It then compares this fingerprint to fingerprints of known malware, exposing any similarities between the binary’s code and code in known malware.

Jonathan D. Cohen, Senior Professional Staff, Asymmetric Operations Department (AOD), Ph.D., Univ. of Maryland at College Park, Electrical Engineering; **Ryan W. Gardner**, Senior Professional Staff, AOD, Ph.D., JHU, Computer Science; **Laura J. Glendenning**, Associate Professional Staff, AOD, M.S., Carnegie Mellon Univ., Software Engineering; **Sakunthala Harshavardhana**, Senior Professional Staff, AOD, M.A., Univ. of Madras, Economics/Statistics; **Robert T. Hider**, Senior Professional Staff, Research and Exploratory Development Department (REDD), M.S., JHU, Computer Science; **Margaret F. Lospinuso**, Senior Professional Staff, AOD, Ph.D., Tulane Univ., Music History; **C. Durward McDonell III**, Senior Professional Staff, AOD, Ph.D., Univ. of Minnesota, Mathematics/Applied Math; **David M. Patrone**, Principal Professional Staff, REDD, M.S., Texas A&M Univ., Computer Science; **Dennis S. Patrone**, Senior Professional Staff, REDD, M.S., JHU, Computer Science; **Nathan S. Reller**, Senior Professional Staff, AOD, M.S., Washington Univ., Computer Science; **Benjamin R. Salazar**, Associate Professional Staff, AOD, B.S., Florida State, Computer Engineering; **David P. Silberberg**, Principal Professional Staff, AOD, Ph.D., Univ. of Maryland at College Park, Computer Science

GOVERNMENT PURPOSE INNOVATION AWARD FOR 2012

For “Airport Radar Counter-Terrorism Protection System”

Radar jamming devices have become increasingly capable and are very affordable. These jammers sample and store a tracking radar’s signal. Airport radar systems may be overrun by these inexpensive jammers being used by terrorists. A system to detect and locate the source of the false repeats has been developed from this innovation.

William J. Geckle, Principal Professional Staff, Air and Missile Defense Department (AMDD), M.S., Michigan State Univ., Physics

IGNITION GRANT PRIZE FOR 2012

For “Protecting Soldiers from Hearing Damage”

This project sought to prevent catastrophic hearing damage from sudden blasts, such as those from improvised explosive devices. An inexpensive prototype device was devised that ordinarily provides unrestricted hearing but quickly isolates the eardrum from strong blast waves.

Daniel H. Simon, Senior Professional Staff, Asymmetric Operations Department (AOD), M.S., Massachusetts Institute of Technology, Mechanical Engineering; **Paul J. Biermann**, Principal Professional Staff, Research and Exploratory Development Department (REDD), B.S., Rensselaer Polytechnic Institute, Materials Engineering