


APL Achievement Awards and Prizes

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Challenges to our national security are increasing. Terrorism, climate and demographic changes, resource protection and cybersecurity, and the impact of extreme economic events challenge our current and future national security environment. To combat these challenges, accelerating scientific discovery and technological innovation is a high priority. The Johns Hopkins University Applied Physics Laboratory (APL) has a proud history of applying state-of-the-art science and technology to the national security requirements of the time as well as to the challenges of tomorrow.

For the past seven decades, APL's investment in its science and technology enterprise has been central to ensuring its position as a leader among premier engineering organizations. To promote initiative and reward exceptional work, APL conducts annual awards programs to recognize individuals whose work from the previous year advances science, technology, and education through tangible achievement in technical publications, independent research and development (IR&D) projects, and out-of-the-box innovative thinking that leads to the invention of new technologies. The Invention of the Year Award, the Government Purpose Innovation Award, the Ignition Grant Prize for Innovation, the R. W. Hart Prizes, the Publication Awards, and new this year, the Outstanding Mission Accomplishment Awards, all support APL's resolve to foster and bring forth new technologies and concepts to meet the nation's critical challenges.

The term *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 at which it works theoretically. The Invention of the Year Awards program encourages new technology and innovation at APL and identifies the top technology from the preceding year. Invention disclosures are judged by an independent review panel of technical and business consultants, technology transfer professionals, and intellectual property attorneys. Judges base their selections of the winning technologies on creativity, novelty, improvement to 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 2013 competition, APL researchers disclosed 230 inventions. Of these, one was selected for the Invention of the Year Award and one received the Government Purpose Innovation Award.

Master Inventor Awards are rare and honor staff who can meet the criterion of at least 10 U.S. patents for their

APL work. This year one recipient received the prestigious award for 10 U.S. patents issued during his employment at APL. He is only the 25th person in the history of the Laboratory to qualify for this award.

Creativity 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 was established to help APL staff explore innovative ideas outside of APL's traditional programs. Open to all 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 then APL staff vote for the top award on the basis of each idea's creativity and potential for impact. Of all those who submitted ideas in 2013, one finalist received the Ignition Grant Prize for Innovation.

The R. W. Hart Prize for Excellence in Independent Research and Development recognizes significant contributions to the advancement of science and technology. Sectors and 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. From those projects active in 2013, one prize was awarded in the research category and two prizes were awarded in the development category.

This year APL established the Outstanding Mission Accomplishment Awards to recognize major achievement in mission-oriented programs and projects. Awards are given in each of two categories, Outstanding Mission Accomplishment for a Current Challenge and Outstanding Mission Accomplishment for an Emerging Challenge. For both types of awards, a review team

of top managers and executives from APL's sectors and mission areas solicits nominations for technical accomplishments achieved during the previous year. Entries are judged on technical excellence and potential impact. Two winners were selected for the Outstanding Mission Accomplishment for a Current Challenge: one for defense operations and one for intelligence operations. One program won honors for contributions to an emerging challenge.

Professional publication in refereed journals is central to scientific communication and is the medium by 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* established the Publication Awards competition both to encourage professional writing and to recognize outstanding publications by the APL professional staff. Departments and sectors 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 2014, six technical departments and sectors submitted 36 publications from those published in 2013. Of these, six publications, including one book, won honors.

The hard work, excellence, and innovation represented in these technical awards are the qualities that have shaped APL's character since the early days of World War II. Promoting and rewarding scientific discovery and technological innovation is a high priority for the Laboratory. The work of these outstanding individuals not only represents APL's best but also enhances APL's capacity to meet evolving challenges to our long-term national security. The recipients' names, along with the titles of their inventions, projects, and publications are displayed on the following pages.

INVENTION OF THE YEAR AWARD FOR 2013

For “System and Method to Rapidly Design Viral Vaccines to Prevent Vaccine Failure”



From left to right, Jeffrey Lin and Andrew Feldman.

Existing vaccines are designed to protect against viruses that are already infecting humans and animals. Viruses quickly adapt to resist vaccines and immune systems, and new vaccines currently take years to develop. This award-winning technology speeds up this process and can predict new viruses before they exist.

Andrew B. Feldman, Principal Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Harvard Univ., Physics; **Jeffrey S. Lin**, APL Principal Professional Staff, REDD, M.S., Johns Hopkins Univ., Computer Science

GOVERNMENT PURPOSE INNOVATION AWARD FOR 2013

For “Aircraft and Sensor Product Geo-Registration in GPS-Denied Environments”



From left to right, Gregory Barr and Mason Baron. Not pictured: James Cochran.

Two separate algorithms were developed to perform geo-registration for aerial surveillance and reconnaissance in a GPS-denied environment. The “scan-to-reference” registers a single radar scan to a reference image, and the “scan-to-scan” registers the current radar scan to a previous one. The implementation of these two algorithms significantly improves the geo-location accuracy.

Mason M. Baron, Principal Professional Staff, Air and Missile Defense Sector, M.S., Johns Hopkins Univ., Electrical and Computer Engineering; **Gregory H. Barr**, Associate Professional Staff, Force Projection Sector, B.S., Univ. of Maryland, College Park, Mechanical Engineering; **James G. Cochran**, Senior Professional Staff, Asymmetric Operations Sector, M.S., Georgia Institute of Technology, Electrical Engineering

MASTER INVENTOR AWARD FOR 2013

Rengaswamy “Srin” Srinivasan, a battery specialist and electrochemist, was awarded the Master Inventor Award in recognition for his 10 U.S. patents issued while he was employed at APL. He is only the 25th person in the history of the Laboratory to qualify for this prestigious award.



Srin Srinivasan.

IGNITION GRANT PRIZE FOR INNOVATION FOR 2013

For “APL Maker Exploitation, Maker Movement or ‘MEME’”



From left to right, Robert Osiander, Colin Taylor, Robert Berardino, and Kimberly Griffin.

The Maker Movement embraces do-it-yourself techniques and a learning culture in which makers teach one another skills such as 3-D printing, programming hardware, rapid prototyping, and laser cutting. MEME brings this movement to APL by promoting the culture and providing resources to staff.

Robert Osiander, Principal Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Technical Univ. of Munich, Physics; **Kimberly M. Griffin**, Senior Professional Staff, Space Exploration Sector (SES), B.S., Virginia Polytechnic Institute and State Univ., Finance; **Robert A. Berardino**, Senior Professional Staff, SES, B.S., Strayer Univ., Computer and Information System; **Colin J. Taylor**, Associate Professional Staff, REDD, B.S., Univ. of Maryland Baltimore County, Computer Science

R. W. HART PRIZES FOR 2013

Excellence in Research

For “High-Energy Laser (HEL) Effects on Space Systems and Materials”

This project started from what is known and modeled of a high-energy laser encounter with a spacecraft. Using experimental data and physics modeling, the team examined the effects of a laser attack on the materials and functions of a spacecraft. This new understanding and modeling capability will enable the design of spacecraft defenses and protections against lasers.

Kaushik A. Iyer, Senior Professional Staff, Space Exploration Sector (SES), Ph.D., Vanderbilt Univ., Materials Science and Engineering; **John J. Aiello**, Senior Professional Staff, SES, M.S., Johns Hopkins Univ., Applied Physics; **O. Manny Uy**, Principal Professional Staff, Research and Exploratory Development Department, B.S., Case Institute of Technology, Chemical Engineering

Excellence in Development

For “Offensive Operations in an Anti-Access/Area Denial (A2AD) Environment”

This multifaceted project featured design, simulation, and field experiments for novel, affordable counters to A2AD threat environments. Significant accomplishments were made in the offensive areas of large-volume fire swarming vehicle control, small-platform confusers, and joint electronic attack/cyber operations, and to APL capabilities to model complex multi-domain system-versus-system interactions.

David M. Van Wie, Principal Professional Staff, Force Projection Sector (FPS), Ph.D., Univ. of Maryland, College Park, Aerospace Engineering; **Jeffrey D. Barton**, Principal Professional Staff, FPS, M.S., Johns Hopkins Univ., Mathematics/Applied Mathematics; **Cameron K. Peterson**, Senior Professional Staff, FPS, Ph.D., Univ. of Maryland, College Park, Aerospace Engineering; **Hans P. Widmer**, Principal Professional Staff, FPS, M.S., Johns Hopkins Univ., Engineering and Applied Physics of Biomedicine; **Mark A. Oursler**, Principal Professional Staff, FPS, M.S., Univ. of Virginia, Mechanical Engineering; **Treven P. Wall**, Senior Professional Staff, FPS, Ph.D., Cornell Univ., Mathematics; **Brian L. Geesaman**, Principal Professional Staff, FPS, M.S. Johns Hopkins Univ., Electrical Engineering; **Coire J. Maranzano**, Senior Professional Staff, FPS, Ph.D., Univ. of Virginia, Systems Engineering; **Daniel J. Silvera**, Senior Professional Staff, Asymmetric Operations Sector, M.S., Johns Hopkins Univ., Electrical and Computer Engineering; **Edmund H. Nowicki**, Principal Professional Staff, FPS, M.S., Pennsylvania State Univ., Engineering Science

For “Agile Infrared Scene Projector on Carbon Nanotubes”

An array of vertically aligned carbon nanotubes was fabricated to create a new class of infrared scene projectors with highly responsive frame rates and very high resolution. The resulting technology will enable Standard Missile-3 seekers to be tested against highly advanced emulations of future ballistic missile threats. The technology also offers to advance high-resolution image sensor capabilities.

Raul Fainchtein, Principal Professional Staff, Air and Missile Defense Sector (AMDS), Ph.D., Univ. of Texas, Physics; **David M. Brown**, Senior Professional Staff, AMDS, Ph.D., Pennsylvania State Univ., Electrical Engineering; **Karen M. Siegrist**, Senior Professional Staff, AMDS, Ph.D., Univ. of Maryland, College Park, Physics; **Ryan P. DiNello-Fass**, Senior Professional Staff, AMDS, M.S., Columbia Univ., Electrical Engineering; **Terry E. Phillips**, Principal Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Johns Hopkins Univ., Chemistry; **Andrew H. Monica**, Senior Professional Staff, REDD, Ph.D., Georgetown Univ., Physics; **David M. Deglau**, Associate Professional Staff, REDD, M.S., Johns Hopkins Univ., Chemical and Biomolecular Engineering

OUTSTANDING MISSION ACCOMPLISHMENT AWARDS FOR 2013

Current Defense Operational Challenge

For "Minotaur Mission Processor"

Minotaur is a transformational capability for the Navy, Coast Guard, and Customs and Border patrol. It enables interconnecting a diverse set of sensors and data sources across a wide operational area for automatic tracking, identification, and interdiction support, especially for airborne surveillance of maritime surface traffic.

Mason M. Baron, Principal Professional Staff, Air and Missile Defense Sector (AMDS), M.S., Johns Hopkins Univ., Electrical and Computer Engineering; **Weston R. Boyd**, Associate Professional Staff, AMDS, M.S., Johns Hopkins Univ., Computer Science; **Daniel J. Christine**, Senior Professional Staff, AMDS, M.S., Johns Hopkins Univ., Computer Science; **James G. Cochran**, Senior Professional Staff, Asymmetric Operations Sector (AOS), M.S., Georgia Institute of Technology, Electrical Engineering; **Michael A. Delaney**, Principal Professional Staff, AMDS, M.S., Naval War College, National Security and Strategic Studies; **Scott D. Heitkamp**, Senior Professional Staff, Force Projection Sector, M.S., Johns Hopkins Univ., Computer Science; **Larry W. Nemsick**, Principal Professional Staff, AOS, M.S., Univ. of Maryland, College Park, Electrical Engineering; **Conor R. Scott**, Associate Professional Staff, AMDS, B.S., Virginia Polytechnic Institute and State Univ., Computer Science/Mathematics; **Mark A. Swana**, Principal Professional Staff, AOS, M.S., Johns Hopkins Univ., Computer Science



From left to right, **Conor Scott**, **Mason Baron**, **Mark Swana**, **Michael Delaney**, **Larry Nemsick**, **Weston Boyd**, **Nicholas Francoski**, and **Scott Heitkamp**. Not pictured: **Daniel Christine** and **James Cochran**.

Emerging Challenge

For “Naval Integrated Fire Control–Counter Air (NIFC-CA)”

NIFC-CA was conceived by APL in the 1970s and developed over decades to greatly extend the engagement range against incoming air threats by networking both ships and aircraft. As the Technical Direction Agent for three of the four elements of this family of systems, AEGIS, the new Standard Missile-6, and the Cooperative Engagement Capability, APL played a lead role in demonstrating engagement of air threats beyond the firing ship’s horizon, even over land. Testing this year culminated in a major milestone toward fleet operation.

Jeffrey C. Mitchell, Senior Professional Staff, Air and Missile Defense Sector (AMDS), M.S., Johns Hopkins Univ., Engineering; **William C. Hughes**, Principal Professional Staff, AMDS, **Dwayne A. Hawbaker**, M.S., Virginia Polytechnic Institute and State Univ., Electrical Engineering; **Kenneth A. Plantz**, Principal Professional Staff, AMDS, M.S., Michigan State Univ., Mathematics/ Applied Mathematics; **Matthew J. Kazanas**, Principal Professional Staff, AMDS, M.S., Georgia Institute of Technology, Electrical Engineering; **Lorenzo R. Brooks**, Senior Professional Staff, AMDS, B.S., Tuskegee University, Electrical Engineering



From left to right, **Kenneth Plantz**, **Dwayne Hawbaker**, and **Jeffrey Mitchell**. Not pictured: **William Hughes**, **Matthew Kazanas**, and **Lorenzo Brooks**.

PUBLICATION AWARDS FOR 2013

Author’s First Paper in a Journal or Proceedings



Grant Stephens.

For “Empirical Reconstruction of Storm Time Steady Magnetospheric Convection Events,” *Journal of Geophysical Research Space Physics* **118**(10), 6434–6456 (2013).

The Tsyganenko magnetic field models have been legendary for 20 years in space physics. Now, APL has brought the models to new levels of usability and predictive power. Detailed features of Earth’s otherwise invisible magnetic field are now accessible, and these features are revealing new modes of global magnetospheric configuration.

Grant K. Stephens, Associate Professional Staff, Space Exploration Sector (SES), M.S., Johns Hopkins Univ., Applied Physics; **Mikhail I. Sitnov**, Senior Professional Staff, SES, Ph.D., Moscow State Univ., Physics; **J. Kissinger** (non-APL staff); **N. A. Tsyganenko** (non-APL staff); **R. L. McPherron** (non-APL staff); **Haje Korth**, Senior Professional Staff, SES, Ph.D., Technical Univ. of Braunschweig, Physics; **Brian J. Anderson**, Principal Professional Staff, SES, Ph.D., Univ. of Minnesota, Physics

Outstanding Paper in the *Johns Hopkins APL Technical Digest*

The Walter G. Berl Award

For “Implementing Genome-Informed Personalized Medicine in the US Air Force Medical Service via the Patient-Centered Precision Care Research Program,” *Johns Hopkins APL Technical Digest* **31(4)**, 333–344 (2013)

This paper describes an approach for incorporating genomic information into personalized health care for active duty Air Force and DoD personnel. It describes the overall program, the clinical utility study infrastructure, and other components critical to implementation such as provider education, policy issues, and integration with the electronic healthcare record.

Christopher E. Bradburne, Senior Professional Staff, Asymmetric Operations Sector (AOS), Ph.D., George Mason Univ., Bioscience; **Lucy M. Carruth**, Senior Professional Staff, AOS, Ph.D., Wake Forest Univ., Microbiology; **John H. Benson**, Principal Professional Staff, Research and Exploratory Development Department (REDD), M.S., Univ. of Maryland, College Park, Civil Engineering; **Jeffrey S. Lin**, Principal Professional Staff, REDD, M.S., Johns Hopkins Univ., Computer Science; **Ashok Sivakumar**, Senior Professional Staff, REDD, M.E., Massachusetts Inst. of Technology, Electrical Engineering; **Ruth A. Vogel**, Senior Professional Staff, REDD, B.S., Univ. of North Dakota, Epidemiology

Outstanding Research Paper in an Externally Refereed Publication

For “Evidence for Water Ice Near Mercury’s North Pole from MESSENGER Neutron Spectrometer Measurements,” in *Science* **339(6117)**, 292–2906 (2013).

This paper describes the first direct measurement of ice deposits in Mercury’s permanently shadowed polar craters. These ground-breaking results include the location, purity, stratigraphy, and amount of these deposits. These results fulfill important MESSENGER mission goals and provide information on the Mercurial impact flux.

David J. Lawrence, Principal Professional Staff, Space Exploration Sector (SES), Ph.D., Washington Univ., Physics; William C. Feldman (non-APL staff); **John O. Goldsten**, Principal Professional Staff, SES, M.S., Johns Hopkins Univ., Electrical Engineering; Sylvestre Maurice (non-APL staff); **Patrick N. Peplowski**, Senior Professional Staff, SES, Ph.D., Florida State, Experimental Nuclear Physics; **Brian J. Anderson**, Principal Professional Staff, SES, Ph.D., Univ. of Minnesota, Physics; **David Bazell**, Senior Professional Staff, SES, Ph.D., Univ. of Maryland, College Park, Physics; **Ralph L. McNutt Jr.**, Principal Professional Staff, SES, Ph.D., Massachusetts Inst. Technology, Physics; Larry R. Nittler (non-APL staff); Thomas H. Prettyman (non-APL staff); **Douglas J. Rodgers**, Senior Professional Staff, SES, Ph.D., Univ. of Delaware, Physics; Sean C. Solomon (non-APL staff); Shoshana Z. Weider (non-APL staff)

Outstanding Development Paper in an Externally Refereed Publication

For “Bayesian Context-Dependent Learning for Anomaly Classification in Hyperspectral Imagery,” *IEEE Transactions on Geoscience and Remote Sensing* **52(4)**, 1969–1981 (2013)

Automatic context-based target discrimination is a significant step forward in the remote sensing community. This paper proposes an algorithm for exploiting environmental context in hyperspectral imagery and demonstrates its efficacy for airborne countermeasure operations. Results demonstrate a substantial improvement over the current standard by exploiting context.

Christopher R. Ratto, Senior Professional Staff, Force Projection Sector, Ph.D., Duke Univ., Electrical and Computer Engineering; Kenneth D. Morton Jr. (non-APL staff); Leslie M. Collins (non-APL staff); Peter A. Torrione (non-APL staff)

Outstanding Professional Book

For *Wireless Networking: Understanding Internetworking Challenges*, Wiley–IEEE Press, Hoboken, New Jersey (2013)

This book provides a concise yet comprehensive summary of the key current and emerging technologies that make up the commercial wireless networking landscape. It bridges the often-disparate communities of wireless networking and cellular technologies in a novel way.

Jack L. Burbank, Principal Professional Staff, Asymmetric Operations Sector (AOS), M.S., North Carolina State Univ., Electrical Engineering; **Julia Andrusenko**, Senior Professional Staff, AOS, M.S., Drexel Univ., Electrical Engineering; **Jared S. Everett**, Associate Professional Staff, AOS, M.S., North Carolina State Univ., Electrical Engineering; **William T. M. Kasch**, Senior Professional Staff, AOS, M.S., Johns Hopkins Univ., Electrical Engineering

Outstanding Special Publication

For “A Continuum Manipulator Made of Interlocking Fibers,” *Proceedings of the 2013 IEEE International Conference on Robotics and Automation*, Karlsruhe, Germany, May 6–10, 2013, IEEE, pp. 4008–4015 (2013).

This work clearly presents a novel, biologically inspired approach to manipulation with applications to computer-assisted surgical systems. Manipulator modeling and associated equations are described and justified. Prototype hardware is detailed and design parameters are provided. A straightforward method for controlling the manipulator is described.

Matthew S. Moses (non-APL staff); **Michael D. M. Kutzer**, Senior Professional Staff, Research and Exploratory Development Department (REDD), Ph.D., Johns Hopkins Univ., Mechanical Engineering; Hans Ma (non-APL staff); **Mehran Armand**, Principal Professional Staff, REDD, Ph.D., Univ. of Waterloo, Mechanical Engineering