The History of the APL Colloquium

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ABSTRACT

The APL Colloquium is now in its 70th consecutive year of operation at the Johns Hopkins University Applied Physics Laboratory (APL). The colloquium lectures are held weekly, generally from September to June, and cover a range of topics of broad interest to the Laboratory staff and the surrounding technical and professional community. Two previous Johns Hopkins APL Technical Digest *articles described the history of the colloquium, covering the periods from its inception in 1947 to 1988 and from 1988 to 2006, respectively. This article discusses the history of the colloquium as one of APL's enduring institutions, presenting highlights from that history and a chronological listing for the most recent period from 2006 to 2016. In addition, a complete chronological listing of colloquium lectures to date has been assembled from available data and will be posted on APL's Colloquium website (http://www.jhuapl.edu/colloquium/).*

INTRODUCTION

The term *colloquium*, coming from the Latin root *colloqui* meaning to converse, describes a talk or discussion. More recently, the term *colloquium* frequently refers to an academic meeting where specialists deliver general-interest addresses and answer questions from the audience in an open format, a description that fits the APL Colloquium very well. First started in 1947, the APL Colloquium is one of the longest-running scientific and technical lecture series in the Baltimore–Washington area. Over its 70-year history, the Colloquium has presented close to 2000 speakers, including scientists, technologists, innovators, authors, and leaders of consequence, who have enlightened and informed their audiences on a broad range of topics of interest and importance to both the Laboratory and the nation. Those topics include, but are not exclusive to, recent scientific discoveries and research breakthroughs; new and emerging technical disciplines and recent innovations; scientific, technical, military, political, and historical events; national security and the evolving international landscape; and historical recollections, observations, and lessons learned from senior military, industrial, and political leaders. Among the colloquia presented by eminent scientists and senior government officials are 29 talks by Nobel laureates (see Box 1), two talks by presidential cabinet officers, three talks by ambassadors, and 25 talks by general officers in the U.S. and other nations' armed services—a truly remarkable record.

The colloquium is open to the public, and while the audience consists primarily of APL staff members and retirees, it frequently includes individuals from nearby schools, universities, companies, and government organizations. The audience ranges in size from 50 to as many as 500 and represents a wide variety of technical and profes-

sional disciplines. The colloquium is traditionally held in the Parsons Auditorium or the Kossiakoff Center Auditorium on APL's main campus at 2:00 p.m. on Friday afternoon. The colloquium season extends from September to June, with a break during the summer months to accommodate vacation schedules; typically, there are anywhere from 25 to 35 colloquia presented in a given colloquium year. The colloquium is not doctrinaire—to accommodate the speaker's schedule or a particularly timely topic, we occasionally schedule talks at other times, on other days of the week, or during the summer break.

Colloquium talks from 1961 to the present have been listed in the *Johns Hopkins APL Technical Digest*, beginning with the first issue of the precursor *APL Technical Digest*[1] published from 1961 to 1977. More recently the listings of colloquia have been included under the Miscellanea section of the *Johns Hopkins APL Technical Digest*, published from 1980 to the present.[2] The early history of the colloquium from its inception was documented in a 1989 *Digest* article by early chairs Ernest P. Gray and Albert M. Stone.[3] More recent history was documented in a 2005 *Digest* article by David M. Silver, chair from 2002 to 2014.[4] Portions of the material in this article have been excerpted or paraphrased from those earlier publications; for a more complete summary of those earlier time periods, please refer to these articles. Both previous historical articles are available on the *Digest* website (http://www.jhuapl.edu/techdigest/) and the APL Colloquium website (http://www.jhuapl.edu/colloquium).

In this article, we review the distinguished history of the APL Colloquium. We discuss the colloquium leaders and their impact, highlight themes and a few of the keynote talks, and describe recent developments, including the effect of new technology on the colloquium. We include in this article a complete listing of the colloquia from 2006 through 2016. A listing of colloquia over the time period 1958–2016 has also been assembled and will be available on the APL Colloquium website (http://www.jhuapl.edu/colloquium).

BOX 1. NOBEL LAUREATE SPEAKERS

Over its 70-year history, the APL Colloquium has featured 32 talks by current or future Nobel laureates.

Nobel laureates for Physics delivered 21 talks:

- One each by
  - Hannes Alfvén
  - Nicolaas Bloembergen
  - Steven Chu
  - Riccardo Giacconi
  - Vitaly L. Ginzburg
  - Theodor Hänsch
  - Henry W. Kendall
  - Polykarp Kusch
  - William D. Phillips
  - Norman F. Ramsey
  - Adam Riess
  - Joseph H. Taylor
  - Carl E. Wieman
  - Eugene P. Wigner
  - Chen-Ning Yang
- Two each by
  - Leon M. Lederman
  - John C. Mather
  - Horst L. Stormer

Nobel laureates in Chemistry delivered seven talks:

- One each by
  - Melvin Calvin
  - Peter J. Debye
  - Alan G. MacDiarmid
  - Ilya Prigogine
  - Richard E. Smalley
- Two by
  - John B. Fenn

Nobel laureates for Physiology or Medicine delivered three talks:

- One each by
  - Paul C. Lauterbur
  - Daniel Nathans
  - Marshall W. Nirenberg

Finally, Nobel laureates for Economics delivered two talks:

- One each by
  - Thomas C. Schelling
  - Herbert A. Simon

HIGHLIGHTS OF THE APL COLLOQUIUM HISTORY

1947–1955

The APL Colloquium was founded by Robert Herman in 1947, not long after APL's founding in 1942, as a means for the members of the APL Research Center to hear firsthand about the latest in scientific research and to maintain an awareness of the broad landscape of scientific and technical endeavor. Unfortunately, little survives from the earliest period, other than the remembrances of Herman, Ralph A. Alpher, Robert W. Hart, William H. Avery, and James W. Follin, collected and documented in the first published history of the colloquium.[3] At that time, the colloquium talks were presented in the original APL location at 8621 Georgia Avenue in Silver Spring at 3:30 p.m. on Fridays. Even in its youth, the colloquium featured scientists and leaders of great renown. Three speakers from the fragmentary recollections stand out in hindsight: famed theoretical physicist George Gamow of George Washington University, who speculated on the existence of and requirements for a genetic code following the discovery of DNA by James Watson and Francis Crick; U.S. Navy Captain Hyman G. Rickover, who discussed the possibility of missile-carrying nuclear-powered submarines and who was later promoted to admiral, directed naval reactors for three decades, and was the Navy's longest-serving officer; and Nobel laureate Harold Urey (1934, Chemistry) of the University

of Chicago, famed for the development of radioisotope separation methods and the discovery of deuterium, who discussed the possible origins of the moon.

1955–1960

In 1955, when Robert Herman left APL to join General Motors Research Laboratory, Albert M. Stone accepted leadership of the colloquium. That event coincided roughly with the opening of the APL Howard County facility in September 1954, which shortly afterward became APL's home campus and remains so today. The colloquium transitioned over 1955–1956 to Parsons Auditorium on the new campus, named for Rear Admiral William Sterling "Deak" Parsons, who led the development of the famed VT fuze together with APL founding director Merle A. Tuve. Parsons Auditorium offers seating for 147 attendees, excellent acoustics, and more modern projection facilities, including built-in slide and movie projectors. Records from the colloquium during the early Howard County years are also sparse, and much of what we know of this period is through the previously published recollections of those involved.[3] It was also during this transition period that the enduring tradition of the pre-colloquium luncheon for the speaker was established, during which a small group including APL leaders and staff members have the opportunity to meet the speaker over a meal and discuss Laboratory activities and research efforts, common interests, and opportunities for mutual collaboration and sharing.

The first colloquium at the new Howard County location was given on October 21, 1955, by Polykarp Kusch of Columbia University, who spoke about his work on atomic beams. Just 2 weeks later, Kusch received the 1955 Nobel Prize in Physics for the accurate determination of the magnetic moment of the electron, an early triumph for the theory of quantum electrodynamics.

Two other Nobel laureates also gave lectures during this period, C.-N. Yang (1957, Physics) from Princeton's Institute for Advanced Study, who addressed parity nonconservation in particle physics, and Eugene Wigner (1963, Physics) from Princeton, who discussed whether known chemistry and physics sufficed to explain the origins of life. Other prominent speakers and topics during this period included Hudson Institute founder Herman Kahn, who presented a 3-hour lecture about potential thermonuclear conflict, notably attended by Secretary of State Dean Acheson; famed geodesic-dome designer Buckminster Fuller of Southern Illinois University, on novel lightweight structures; Robert Dicke of Princeton, on his new radiometer design, which notably led to the discovery of the cosmic microwave background radiation by Nobel laureates Arno Penzias and Robert Wilson; C. Stark Draper of MIT, on inertial navigation using precision gyroscopes; John C. Slater of MIT, on his development of band theory in solids; and John Wheeler of Princeton, on Einstein's theory of general relativity.

Starting in 1956, Ernest P. Gray joined Albert Stone in arranging colloquia; in 1957 they were joined by James W. Follin Jr., forming the Lab's first informal colloquium committee. In 1961, they were joined by George Pieper and William Liben, and the group was formally appointed by Director Ralph E. Gibson as the APL colloquium committee. The creation of the committee both formalized the existence of the APL Colloquium as an APL institution and led to a natural expansion of speakers and topics into the eclectic collection we are familiar with today, having a broad appeal to both the technical and professional communities. An additional benefit of the APL colloquium committee is the ensured continuity of the APL Colloquium—departing members of the committee are replaced by new members with fresh ideas, different interests, and new suggestions for speakers, thus ensuring that the colloquium as an institution is continually renewed.

1960–1970

In 1961, Albert Stone relinquished the chairmanship of the colloquium committee to Ernest P. Gray, who remained as committee chair until 1994—a remarkable 33-year tenure, particularly considering that the original concept for the chair was a 2-year term. During Gray's chairmanship, 965 colloquium lectures were given, an average of more than 29 per year for the period in which he led the series.

Beginning in November 1961, colloquia were audio recorded, and in 1962, lectures began to be video recorded. Technology also became available to transmit audio and video from the Parsons Auditorium to the cafeteria next door. Those who were unable to obtain seating in the auditorium thus had the opportunity to experience the colloquium via the live video link, and those who had schedule conflicts were able to view the video recording at a later time. Those recording capabilities, much improved, are still being used today, streaming digitized audio and video recordings of colloquia to APL staff via the colloquium website.[5]

In 1966, the committee moved the colloquium presentation to 2:00 p.m. with refreshments following, reducing the impact of the late-afternoon 3:30 p.m. time slot on the colloquium audience. That schedule remains in place today, giving those who have late-afternoon commitments or those who wish to avoid rush-hour traffic in the metropolitan Baltimore–Washington area greater opportunity to attend.

The 1960s featured a number of noteworthy talks and topics. Six were given by Nobel laureates, including Norman F. Ramsey (1989, Physics) of Harvard, on the significance of potentials in quantum theory; Peter J. Debye (1936, Chemistry) of Cornell, on critical opalescence and molecular interactions; Marshall W. Nirenberg (1968, Physiology or Medicine) of the National Institutes of Health, on progress toward cracking the

genetic code; Leon M. Lederman (1988, Physics) of Columbia, on experiments with high-energy neutrinos; John B. Fenn (2002, Chemistry) of Princeton, on the utility of high-intensity molecular beams; and Nicolaas Bloembergen (1981, Physics) of Harvard, on the stimulated Raman effect. We were also honored to have Robert Wood (secretary of the Department of Housing and Urban Development) speak on the use of technology to solve urban problems. Additional well-known speakers and topics included Gordon Gould, on the recent invention of the laser; Johns Hopkins University (JHU) President Milton S. Eisenhower, on Latin America on the verge of revolution; P. James Peebles of Princeton, on the potential for a cosmic microwave background radiation (prior to its discovery by Penzias and Wilson); real-estate developer James Rouse, on the planned community of Columbia, Maryland; Richard Courant of New York University, on numerical analysis of the equations of physics; and famed anthropologist Margaret Mead of the American Museum of Natural History, on cultural factors in population control.

1970–1980

Several speakers and topics stand out during the decade of the 1970s. Six Nobel laureates gave colloquia: Hannes Alfvén (1970, Physics) of University of California, San Diego, on a potential space mission to an asteroid; Leon Lederman (1988, Physics) of Columbia, on speculations regarding elementary particles; Theodor Hänsch (2005, Physics) of Stanford, on spectroscopy with tunable dye lasers; Paul Lauterbur (2003, Physiology or Medicine) of SUNY Stony Brook, on magnetic resonance imaging; Ilya Prigogine (1977, Chemistry) of the University of Texas and the University of Brussels, on determinism and probability; and Daniel Nathans (1978, Physiology or Medicine) of JHU, on the "new" genetics. Other notable speakers and topics included U.S. Senator Paul Sarbanes, on current trends and issues in Congress; U.S. Senator Joseph Tydings, on crime, judicial reform, and urban problems; anthropologist Louis B. Leakey, on his career and human fossil discoveries in Olduvai Gorge; Wernher von Braun of Fairchild Industries, on the relationship between space science and the needs of man; and CEO Norman A. Augustine of Martin Marietta, on "Augustine's Laws"—a series of tongue-in-cheek observations on business and the defense industry still widely quoted today. Notable Hopkins and APL speakers included JHU President Milton S. Eisenhower, on the final report of the National Commission on the Prevention of Violence; APL alumnus James Van Allen of the University of Iowa, on the Pioneer 10 probe's encounter with Jupiter; and retired APL director Ralph E. Gibson, on the origins and growth of the Laboratory.

Two themes appear repeatedly among the talks over the decade of the 1970s, representing an expansion of APL interests and activities into new areas driven by events of that time. The first relates to domestic issues, urban planning, and transportation; some examples are talks by Robert H. Cannon of the U.S. Department of Transportation, on advanced transportation programs; Leo P. Kadanoff of Brown University, on uses and abuses of urban growth models; New Jersey Commissioner of Transportation John C. Kohl, on urban transit; and B. R. Stokes of the American Public Transit Association, on problems with mass transit.

A second theme relates to a new sensitivity to environmental issues, sustainability, and energy resources; examples include Arthur Squires of the City University of New York, on clean power from coal; Chungming Wong of the U.S. Department of the Interior, on environmental challenges for scientists and engineers; Roger F. Naill of MIT, on system dynamics of nonrenewable resources; Clifford S. Russell and others from Resources for the Future, on environmental quality monitoring; K. C. Hoffman of Brookhaven National Laboratory, on hydrogen energy systems; and K. W. Boer of the University of Delaware, on an experimental solar house.

1980–1990

In 1983, the Laboratory opened the Kossiakoff Center, named for Alexander I. Kossiakoff, director of the Laboratory from 1969 to 1979. The Kossiakoff Center auditorium seats 500 and has the extensive audiovisual resources required for such large audiences. It provides adequate seating for our most popular colloquia, such as those given by senior military and government leaders, well-known scientists, and popular public figures.

In 1984, a microwave audio and video link between APL and Maryland Hall on the JHU Homewood Campus was established to enable the faculty, staff, and

BOX 2. PROLIFIC SPEAKERS

Several speakers have given multiple colloquium talks. Leading the list is S. Fred Singer, who gave a total of 11 APL Colloquia over a 49-year period on topics ranging from space science to environmental concerns, including two talks on the origin of Earth's moon—38 years apart! Following him are APL's Stamatios "Tom" Krimigis who delivered six talks on various topics in space science, and APL's Robert E. Fischell who delivered six talks, two of which covered space science topics and four of which focused on his interest in medical applications of electronic technology—with the latter ultimately leading to his founding of Fischell Biomedical. Joseph Weber of the University of Maryland delivered five APL Colloquia, four of which were on the topic of gravitational wave detection spanning a 25-year period. APL's Andrew Cheng delivered four talks on topics in space science, and Robert Newton delivered four talks on topics in geodesy and ballistic trajectories. Eight speakers have given three talks, and more than 100 have given two.

students at Homewood to listen to and participate in the colloquium, and in 1989, the early history of the APL Colloquium from its inception was documented in a *Digest* article by Colloquium chair Ernest P. Gray and the previous chair Albert M. Stone.[3]

The decade's highlights included colloquia by eight Nobel laureates: Joseph H. Taylor (1993, Physics) of the University of Massachusetts, on indirect detection of gravitational waves from a binary pulsar; Alan G. MacDiarmid (2000, Chemistry) of the University of Pennsylvania, on the electrochemistry of polyacetylene and organic batteries; Melvin Calvin (1961, Chemistry) of the University of California, on capturing the sun's energy; William D. Phillips (1997, Physics) of the National Bureau of Standards, on laser cooling with an atomic beam; John C. Mather (2006, Physics) of NASA, on the Cosmic Background Explorer (COBE) mission; Riccardo Giacconi (2002, Physics) of the Space Telescope Science Institute, on the Hubble Space Telescope; Horst L. Stormer (1998, Physics) of Bell Labs, on the fractional quantized Hall effect; and Herbert A. Simon (1978, Economics) of Carnegie Mellon, on the psychology of scientific discovery. Other speakers of note include famous quality consultant and engineer W. Edwards Deming, on "some problems that hinder productivity;" Richard Garwin of IBM Research, on the "Star Wars" ballistic missile defense program; Robert P. Kirshner of Harvard, on the remarkable once-in-a-lifetime supernova SN 1987A; and John Bahcall of the Institute for Advanced Study, on the unexpectedly low observed flux of solar neutrinos (now understood to be caused by neutrino flavor oscillations).

A new theme began to appear in the 1980s—electronics, computing, communications, data processing, and the Internet; a few examples among many include Ronald D. Levine of Technology Development of California, on supercomputers; John M. McQuillan of Bolt, Beranek, and Newman, on electronic mail; and Larry W. Sumney of the U.S. Department of Defense, on the DoD Very High Speed Integrated Circuit (VHSIC) program.

1990–2000

The decade of the 1990s saw Ernest P. Gray step down in 1994 as APL Colloquium chair after 33 remarkable years of service, succeeded by Kishin W. Moorjani. In 1995, a website was established for the APL Colloquium, www.jhuapl.edu/colloquium, providing a schedule of upcoming talks and an archive of previous talks including the speaker, his/her affiliation, and the topic. In 1999, the colloquium website was expanded to include a brief abstract and a short biography of the speaker.

Highlights from the 1990s featured talks by seven Nobel laureates, including Carl E. Wieman (2001, Physics) of JILA and the University of Colorado, on recent developments in laser ion trapping and cooling; Horst L. Stormer (1998, Physics) of Bell Labs, on optics with two-dimensional electrons; Richard E. Smalley (1996, Chemistry) of Rice University, on C_{60} (buckminsterfullerene); Thomas C. Schelling (2005, Economics) of the University of Maryland, on meeting the greenhouse climate challenge; Vitaly L. Ginzburg (2003, Physics) of the Russian Academy of Sciences, on high-temperature superconductivity; John B. Fenn (2002, Chemistry) of Yale, on electrospray mass spectrometry; and Henry W. Kendall (1990, Physics) of MIT, on the disposal challenges of nuclear waste. Other presentations of note included JHU President William R. Brody, on the "quantum physics" model of the university in the new millennium; APL Director Richard Roca, on telecommunications architecture for the 21st century; and recently retired Colloquium chair Ernest P. Gray, reminiscing about his association with the colloquium.

Several other themes appeared regularly during the decade of the 1990s. One theme was concern with human-induced changes in climate, including talks given by Joseph J. Tribbia of the National Center for Atmospheric Research, on modern weather prediction; Alfred Y. Wong of University of California, Los Angeles, on preserving the ozone layer; S. Fred Singer of the University of Virginia, on whether human activities are affecting the climate; Joel Darmstadter of Resources for the Future, on policy options for managing the greenhouse problem; and four separate speakers giving talks on global warming (in addition to the previously mentioned talk by Nobel laureate Thomas C. Schelling).

Another theme was the collapse of the Soviet Union in 1991 and the aftermath, as exemplified in talks by consultant Theodore Taylor, on nuclear disarmament; Paul H. Nitze of the JHU School of Advanced International Studies (SAIS), on the four perilous Cold War decades between Hiroshima and Glasnost; Barbara G. Levi of *Physics Today*, on limits on land-based missiles; Roald Z. Sagdeev of the University of Maryland, on the crisis in the Soviet space program; Stephen H. Hanke of JHU, on transforming the Russian economy; and Murray Feshbach of Georgetown University on health and environmental crises in the former Soviet Union.

The theme of quality standards and the emerging challenge of economic competition from Asian economies emerged in talks by Richard Samuels of the MIT Japan Program, on getting America ready for Japanese science and technology; Jan Hines of AT&T Microelectronics, on Japanese manufacturing methodologies; and V. Daniel Hunt of Technology Research Corporation, on quality management.

The newly emerging field of quantum information was highlighted by talks by Wayne M. Itano of the National Institute of Standards and Technology (NIST), on the quantum Zeno effect; APL's James D. Franson, on nonlocality in quantum optics; Peter Shor of AT&T Laboratories, on quantum computing and error correction; and Charles H. Bennett of IBM on quantum computers.

Finally, a number of momentous accomplishments and significant events in space science were covered in

the colloquium series, with examples including talks by Edward C. Stone of Caltech, on the Voyager encounter with Neptune; Nancy W. Boggess of NASA, on initial Cosmic Background Explorer (COBE) results; Stephen P. Maran of NASA, on Hubble Space Telescope results; APL's Donald J. Williams, on the NASA Galileo mission to Jupiter; Eugene W. Shoemaker of the U.S. Geological Survey, on the crash of periodic comet Shoemaker-Levy 9 into Jupiter; APL's Andrew F. Cheng, on the Near Earth Asteroid Rendezvous (NEAR) mission; and Claude R. Canizares of MIT, on early results from the Chandra X-ray observatory.

2000–2005

In 2001, the Colloquium Information Sheet and the monthly colloquium schedule that had been mailed to APL staff transitioned to e-mail distribution. Those on the external distribution list continued to receive paper copies of the schedule until 2003 when this communication also began being sent by e-mail, completing the transition of all colloquium announcements to fully electronic distribution methods. In 2003, a feedback page was created on the website to provide a mechanism for attendees to send comments, suggestions, and evaluations to the colloquium committee.

In 2002, Kishin W. Moorjani retired from APL after serving for 8 years as the colloquium chair, and David M. Silver was appointed in his place. Silver later documented the colloquium history in the *Digest*, focusing on the period from 1988 through 2006.[4]

Notable speakers and topics during this period included NASA Director Daniel S. Goldin, on NASA in the 21st century; Admiral Stansfield Turner, on the dilemma of nuclear weapons in the 21st century; Admiral Dennis C. Blair, on future strategic strike forces; Major General Robert H. Scales Jr., on lessons learned from the Iraq war; former Assistant Secretary of Defense for Command, Control, Communications and Intelligence John Stenbit, on net-centric warfare; and Vice Admiral Arthur K. Cebrowski on force transformation.

Several talks during this period focused on space science, including presentations by Alexander Szalay of JHU, on the Sloan digital sky survey; Aprille Ericsson-Jackson of NASA, on the Wilkinson microwave anisotropy probe (WMAP); APL's Andrew F. Cheng, on the NEAR mission at Eros; APL's Stamatios M. Krimigis, on Cassini at Saturn; Orlando Figueroa from NASA Headquarters, on science and the vision for space exploration; and SETI Institute Director Jill Tarter on the search for extraterrestrial intelligence.

The dominant theme during this period related to the September 11, 2001, terror attacks, the global war on terrorism, and asymmetric warfare threats. A small sampling of talks includes Tee L. Guidotti of George Washington University and Bradley Roberts of Institute for Defense Analyses, both speaking on bioterrorism; APL's Michael Vlahos delivering two talks, one on terror threats and another on progress in the Afghan war; Marius Deeb of JHU SAIS, on Osama bin Laden; Vicki Freimuth of the Centers for Disease Control and Prevention (CDC), on the anthrax attacks and CDC's response; Ruth Wedgwood of JHU SAIS, on preemptive self-defense and the United Nations Charter; Knox Andress of the Christus Schumpert Health System, on hospital emergency management for weapons of mass destruction; and Colonel James B. Hickey, on the capture of Saddam Hussein.

RECENT HIGHLIGHTS FROM THE APL COLLOQUIUM: 2005–2016

Relatively minor technical changes have occurred since 2005. With better video editing software, increased network bandwidth, and technical improvements in video streaming technology, the quality of recorded videos has steadily improved. In an effort to reduce the volume of internal e-mails, colloquium electronic announcements transitioned from all-staff broadcasts to a user-managed subscription service, known internally as MyLists. One year after instituting the MyLists subscription process, approximately 3100 APL staff members subscribe to the colloquium distribution, evidence of the enduring popularity of the APL Colloquium series. We also continue to maintain an active external e-mail distribution list of colloquium announcements, currently serving more than 400 recipients.

In 2014, David M. Silver retired from APL after serving for 12 years as the colloquium chair, and I was appointed in his place. After two whirlwind years, I can even more greatly appreciate what my predecessors accomplished and the high standards they set for the colloquium. (See Fig. 1 for a graphical representation of the history.)

Three Nobel laureates have given colloquia since 2005, Adam Riess (2011, Physics) of JHU, on dark energy and the cosmological constant; Secretary of Energy Steven Chu (1997, Physics), on America's role in meeting the energy challenge; and John C. Mather (2006, Physics) of NASA, on beneficial catastrophes in cosmology. Prominent speakers included Lieutenant Generals Ronnie Hawkins Jr. and Vincent Stewart delivering Black History Month lectures; U.S. Surgeon General Richard H. Carmona, U.S. Treasurer Anna Escobedo Cabral, Rear Admiral Jay A. DeLoach, and Lieutenant General Rhett Hernandez delivering Hispanic Heritage Month lectures; and Vice Chief of Naval Operations Admiral Michele Howard delivering a Women's History Month lecture.

Other speakers and topics of note included Rear Admiral William J. McDaniel, on the efforts of the hospital ship USNS *Mercy* in Indonesia following the earthquake and tsunami of December 2004; Lieutenant General James A. Abrahamson, on the history of the Strategic Defense Initiative; Rear Admiral David Titley, on the U.S. Navy Task Force on Climate Change; Former

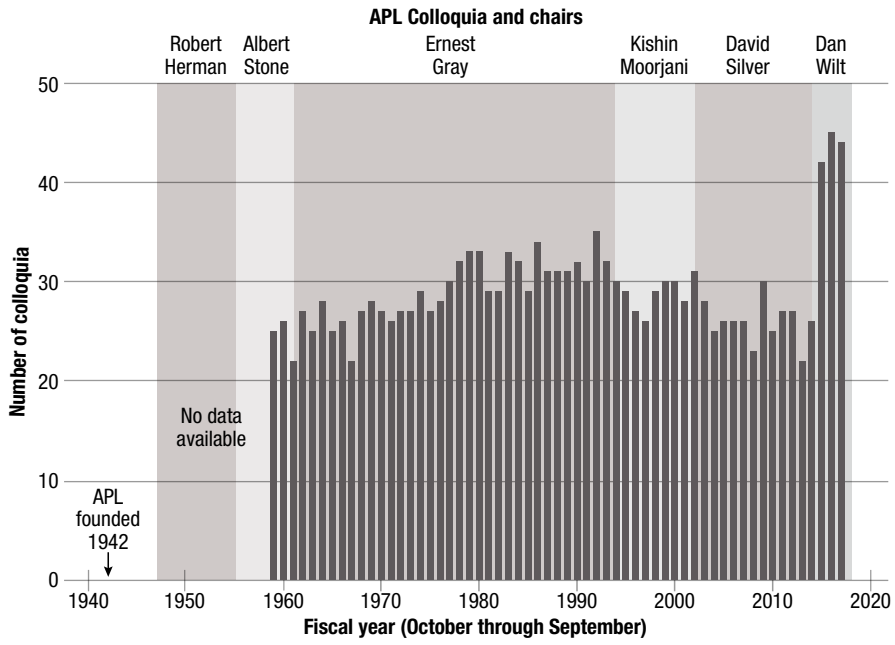

Figure 1. The APL Colloquium began in 1947 and was chaired by Robert Herman from 1947 to 1955. Albert Stone served as chair from 1955 to 1961, and Ernest Gray served as chair from 1961 to 1994—33 years! Kishin Moorjani served as chair from 1994 to 2002, and David Silver served as chair from 2002 to 2014. Dan Wilt has served as chair since 2014. Speaker and topic data are not available prior to 1959. Over the period from 1959 to the present, more than 1700 APL Colloquia have been presented at an average of 29 per year.

Secretary of the Navy Richard Danzig, on the risk of bioterrorism and later speaking as a newly appointed APL senior fellow on the national security consequences of technological change; Lieutenant General Michael D. Barbero, on the "global and enduring" improvised explosive device (IED) challenge; Ambassador Donald Gregg, on the future of North Korea; U.S. Naval Academy Superintendent Vice Admiral Walter E. Carter Jr., on the academy's approach to producing future leaders of consequence; and Ambassador John M. Koenig, on opportunities to resolve the conflicts in Cyprus.

An ongoing theme during this period was counterterrorism operations, asymmetric warfare, the wars and counterinsurgency actions in Afghanistan and Iraq, and unrest in the Middle East and South Asia. A few example speakers and topics included Pakistani Ambassador Husain Haqqani, analyst Shuja Nawaz, and John R. Schmidt of George Washington University, each providing a perspective on Pakistan; Theodor Krauthammer of Penn State, on research and development needs for blast, shock, and impact mitigation; Barry Rubin of the Global Research in International Affairs (GLORIA) Center, on the struggle for democracy in the Middle East; FBI's Ronald Kelly on forensics in bombing investigations; Marcus Noland of the Peterson Institute for International Economics, on long-term challenges for Arab economies; and Colonel Timothy P. Alben of the Massachusetts State Police, on the response to the Boston Marathon attack.

Space exploration continued as an important topic, as illustrated by speakers and topics such as APL's Carey Lisse, on the Deep Impact mission to Comet 9P/Tempel 1; Barry Geldzahler of NASA, on plans for the next-generation deep-space network; Mattias Mountain and Kathryn Flanagan of the Space Telescope Science Institute, on future space telescopes and plans for the James Webb Space Telescope; APL's Stamatios M. Krimigis, on Voyager's continuing 35-year mission to the galaxy; APL's Nicky Fox, on plans for the Solar Probe Plus (now Parker Solar Probe) mission; APL's Jeff Plescia, on the search for lost lunar landers, spurring an APL Intelligent Systems Center challenge to find the few whose exact locations are still unknown; and Principal Investigator S. Alan Stern, on the New Horizons mission to Pluto and the Kuiper Belt, 1 month before the spectacular flyby of the Pluto-Charon system.

A new theme emerging during this period included biological systems, advances in medicine, and national health as a new APL critical challenge. Speakers and topics included Frank Doyle of the University of California, Santa Barbara, on a systems approach to modeling biological systems; Aravinda Chakravarti of the JHU School of Medicine, on knowledge of genes for common chronic diseases; Steven Benner of the Foundation for Applied Molecular Evolution, on unconventional forms of life; JHU's Peter Pronovost, on smart hospitals; and DARPA Biological Technologies Office Director Geoffrey Ling, who provided a thrilling perspective on the future of medicine.

SPECIAL COLLOQUIA

Every year, we hold a number of special colloquia (see Fig. 2). One of them is the Archie I. Mahan Colloquium, held annually since its inauguration in December 1991. Under the provisions of his will, former APL staff member Mahan bequeathed a sum of money to APL to establish and maintain "an annual Christmas lecture on scientific subjects." The Laboratory has honored this request by designating a colloquium lecture close to Christmastime as the Archie I. Mahan Colloquium.

In addition, starting in October 1994, in honor of longtime colloquium committee chair Ernest P. Gray, we

have held a colloquium in his name. The Ernest P. Gray Colloquium is typically held early in the colloquium year and is presented by an APL staff member who highlights his or her outstanding technical achievements.

In 2000, APL held a special series, the "Millennial Challenges Colloquia 2000," featuring the thoughts of senior leaders within APL, academia, and government on the upcoming challenges facing us in the new century. Following the events of September 11, 2001, APL held another series of 15 colloquia labeled "The New Critical Challenge: The War on Terrorism," dealing with aspects of the terrorist threat.

Since 2006, we have featured a colloquium presentation by the winners of the APL Hart Prizes for Excellence in Research and Development. Originally held in the November–December time frame, in 2013 the colloquium presentation was moved to the May–July time frame to consolidate it with the APL annual publication and patent awards presentation.

In 2011, APL created Ignition Grants, a means to obtain short-term seedling research and development funding for novel ideas. Following completion of the grants, recipients presented the results of their work during colloquia. Over the 4-year period from 2011 to 2015, there were a total of 11 Ignition Grants colloquia before the Ignition Grants presentations were spun out as an independent series.

APL values the diversity in its staff, and the colloquium planners are committed to featuring the many contributions of our diverse community in the colloquium series as well. A particularly important feature of these presentations is the opportunity for prominent members of these communities to share their career choices, experiences, insights, and advice with APL early-career staff.

Starting in 2000, we partnered with the APL African American Culture Club to include a colloquium as part of our Black History Month celebration. In 2003, together with the APL Hispanic Awareness Club, we added a colloquium as part of our Hispanic Heritage Month celebra-

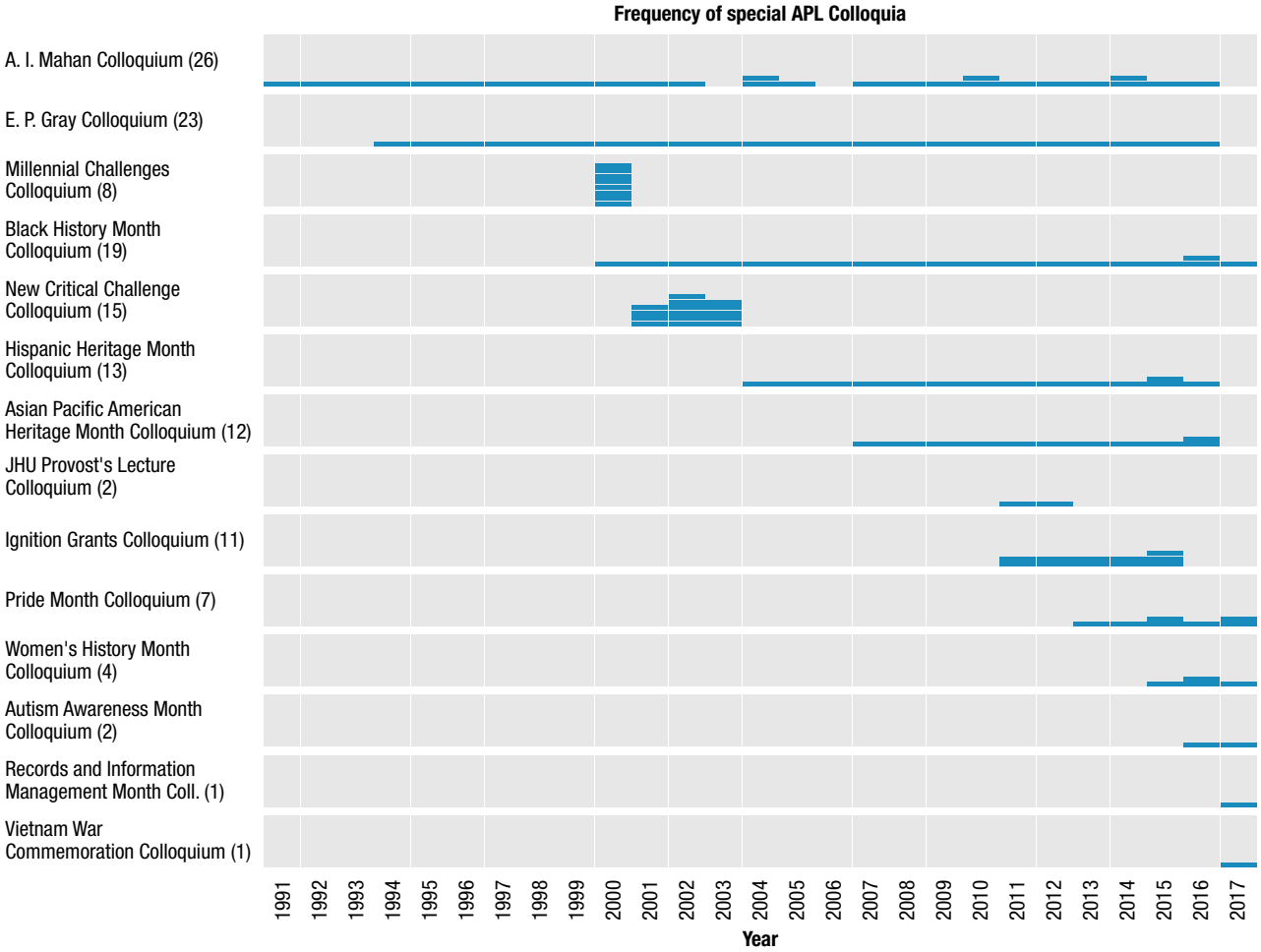

Figure 2. APL has presented a number of special colloquia. The Archie Mahan Colloquium, "an annual Christmas lecture on scientific topics," began in 1991. The Ernest Gray Colloquium began in 1994 and highlights technical achievements of APL staff. In 2000, a series of 8 Millennial Challenges colloquia were held, followed by a series of 15 New Critical Challenge colloquia following the events of September 11, 2001. Annual colloquia honoring the contributions of APL's diverse community began in 2000 with Black History Month, followed by Hispanic Heritage Month (2004), Asian Pacific American Heritage Month (2007), Pride Month (2013), and Women's History Month (2015). Most recently we began a series of Vietnam War 50th Anniversary Commemoration Lectures (2017).

tion; and in 2007, together with the APL Asian American Heritage Club, we added a colloquium as part of our Asian Pacific American Heritage Month celebration.

More recently, in 2013, together with the APL Allies in the Workplace, we added a colloquium to our Pride Month celebration; additionally, although the colloquium has frequently featured prominent female speakers, starting in 2015, together with the APL chapter of the Society of Women Engineers, we began including a colloquium as part of our Women's History Month celebration.

COLLOQUIUM ARCHIVAL CHRONOLOGY

As part of the preparation for this article celebrating the 75th anniversary of APL and the 70th anniversary of the APL Colloquium, an archival listing of APL Colloquia was assembled, extending from October 1958 to the present. The list was prepared from lists[1,2] and the two prior histories of the APL Colloquium[3,4] previously published in the *Digest*. Additional information was obtained from the APL Colloquium website (http://www.jhuapl.edu/colloquium/) and from the archival colloquium audiotapes and videotapes preserved by the APL audiovisual services group. For the 3-year period between October 1958 and the earliest published colloquium listing in the *Digest* for October 1961, the sole source is the APL archival recordings. Some typographical errors and inconsistencies between data sets were noted and where possible have been corrected through comparison of sources. The archival chronology will be available on the APL Colloquium website.

CONCLUSION

What makes the APL Colloquium series so successful? Several reasons come to mind. The first is the enduring support of the Laboratory's senior leaders, who have consistently devoted Laboratory resources to ensure the continuity and quality of the presentation series. Presenting new ideas, insights, and perspectives from leading scientists, technologists, and senior leaders in the military and government is one of the ways that the Lab tries to encourage innovation, fresh perspectives, and continuous learning among its staff—an admirable goal at any time but increasingly important as the pace of technological change continues to accelerate.

Another important factor in the colloquium series' success is its committee. Drawn from the senior scientists, technologists, and managers of the Lab, this dedicated group has consistently brought in senior thought leaders to deliver informative, high-quality presentations throughout the colloquium series. It is clear in retrospect that the series has continually evolved and improved to better fit the needs of the Lab over the 70 years of its existence, largely due to the enthusiasm and vitality of the committee.

The colloquium audiences are another very important reason the colloquium has been so successful. The colloquium audience consistently fills Parsons Auditorium, pays close attention to the speakers, asks probing questions, and engages in enthusiastic discussion and dialogue with speakers. The lively audience at the colloquium is a highlight cited by many of our speakers, and this active engagement is part of what we hope to achieve by hosting the colloquium.

Finally, and most importantly, we could not have a colloquium without excellent speakers presenting thought-provoking material and unique perspectives. We have had a long history of speakers who have achieved momentous successes and high honors in their fields of endeavor—Nobel laureates, senior scientists, senior military officers, and high-ranking government officials. They make great efforts to share their knowledge and thoughts and consistently make the colloquium worth attending.

All of the aspects mentioned above combine and reinforce each other to make a virtuous circle of the APL Colloquium—and I expect these aspects will continue to ensure its success in the future.

ACKNOWLEDGMENTS: I acknowledge the contributions of Judith Theodori and several others in helping to assemble the listing of historical colloquia. Much of the material regarding the earlier history of the APL Colloquium (1947–2006) was incorporated from previous articles in the *Digest*, included in the references.[3,4]

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COLLOQUIUM CHRONOLOGY: 2006–2016

2006–2007

James Bamford, *Author,* "NSA: A History of Domestic Eavesdropping."

Jeff Barr, *Amazon Web Services,* "Building a Web-Scale Computing Architecture."

John R. Benedict Jr., *APL,* "Taking a Long-Term Perspective on U.S. Navy ASW Objectives, Capabilities, and Trends: Historical Survey and Projections, 1940–2020."

Isaiah Blankson, *NASA Glenn Research Center,* "Aeronautical Research Activities in Hypersonics at the NASA Glenn Research Center."

Anna Escobedo Cabral, *U.S. Treasurer,* "Hispanic Heritage Month Colloquium."

Bruce Campbell, *Smithsonian Institution,* "What Lies Beneath? Using Radar to Look Below the Surface of the Moon and Mars."

Aravinda Chakravarti, *JHU School of Medicine,* "Genes for Common, Chronic Diseases."

William Dunham, *Muhlenberg College,* "A Tribute to Euler."

Zee Duron, *Harvey Mudd College,* "Field Procedures for Tracking Stability in Burning Buildings."16 2007

Gadi Evron, *Security Evangelist, Beyond Security,* "Estonia: Information Warfare and Strategic Lessons."

Robert W. Farquhar and Joseph Veverka, *APL and Cornell University,* "The Next Steps in Human Space Exploration: What Are the Alternatives?"

MG David P. Fridovich, *U.S. Army, USSOCPAC,* "War on Terror in Asia, 'Basilan Model' and Indirect Approach."

Barry Geldzahler, *NASA,* "Next Generation Deep Space Network: Vision for the Next 100 Years."

Greg Jackson, *University of Maryland, College Park,* "Solid Oxide Fuel Cells: Challenges for Applications Beyond Hydrogen."

David Jacobson, *National Institute of Standards and Technology,* "Using Neutron Radiography to Study Hydrogen Fuel Cells."

Ronald Kelly, *Federal Bureau of Investigation,* "Forensic Aspects of Explosion/Bombing Investigations."

R. Alan King, *Author,* "Iraq: The Past, the Present, and the Way Ahead."

Michael Krieger, *Office of the DoD Chief Information Officer,* "Transforming the Way DoD Shares Information."

Dwayne Meadows, *National Oceanic and Atmospheric Administration,* "Riding the World's Biggest Wave: Preparedness and Recovery Lessons from the 2004 Indian Ocean Tsunami in Thailand."

Alan Moloff, *Consultant,* "Special Operations and Disaster Medicine, Common Challenges! Common Solutions?"

James G. Rickards, *Global-I Advisors, LLC,* "Theory and Practice of the New Science of Market Intelligence."

S. Fred Singer, *Science and Environmental Policy Project,* "Origin of the Moon."

Michael Vlahos, *APL,* "Productive Deterrence: Preserving America at Modernity's End."

Robb Wilcox, *APL,* "The Chief of Naval Operations Strategic Studies Group—Science Advisor's Perspective."

2006 Hart Prize Winners, *APL,* "The Hart Prizes for Excellence in Independent Research and Development."

2007–2008

Sky Alibhai and Zoe Jewell, *WildTrack,* "WildTrack: A Synergy of Wild Beasts, Ancient Tracking Skills, and Modern Techniques for Footprint Identification."

Jo Anne B. Barnhart, *Former Commissioner, Social Security Administration,* "Challenges Facing Social Security."

Steven Benner, *Foundation for Applied Molecular Evolution,* "Unconventional Forms of Life and Life Detection."

George Bibel, *University of North Dakota,* "Beyond the Black Box: The Forensics of Airplane Crashes."

Alan Brandt, *APL,* "Waves, Fish, and Submarines: Thirty Years of Hydrodynamics Research at APL."

Kenneth Budka, *Alcatel-Lucent Bell Labs,* "Public Safety Wireless Broadband."

Andrew F. Cheng, *APL,* "A Tale of Two Asteroids, or Catastrophic Disruption Revisited."

Anh N. Duong, *Science Advisor, Office of the CNO, Pentagon,* "Naval Explosives."

Bradley Layton, *Drexel University,* "Bionanotechnology and Mechanoevolution."

Juan Maldacena, *Institute for Advanced Study,* "QCD, Strings, and Black Holes: A Duality Between Gravity and Field Theory."

David Mindell, *Massachusetts Institute of Technology,* "Digital Apollo: Human and Machine in Six Lunar Landings."

Mattias Mountain, *Space Telescope Science Institute,* "The Hubble, the James Webb Space Telescope, and Looking to the Future: Space Science at a Cross Road?"

Sten Odenwald, *NASA Goddard Space Flight Center,* "The Superstorm of 1859: Learning from the Past to Anticipate Future Consequences."

Beth Laura O'Leary, *New Mexico State University,* "Space Archaeology and the Lunar Legacy: One Giant Leap for Historic Preservation."

William B. Scott, *Author,* "Space Wars: The First Six Hours of World War III."

Ernest A. Seglie, *Office of the Secretary of Defense, Director of Operational Test and Evaluation,* "The Costs of Unsuitability and Benefits of Building—In Reliability, Availability, and Maintainability."

Col. Michael A. Shupp, *U.S. Marine Corps, Legislative Assistant for the Chairman of the Joint Chiefs of Staff,* "The Battle of Falluja."

Brandon Southall, *National Oceanic and Atmospheric Administration,* "Marine Mammals and Noise: Science Applications and Perspectives on a Contentious (and Misrepresented) Issue."

Robert Strom, *University of Arizona,* "Global Warming and the Human Condition."

Peter Thomson, *Author,* "Sacred Sea: A Journey to Lake Baikal."

James Turner, *National Institute of Standards and Technology,* "African-American Technological Contributions: Past, Present, and Future."

Spencer Wells, *National Geographic Society,* "Deep Ancestry: Inside the Genographic Project."

Sam Yee, *APL,* "Upper Atmosphere: Gateway Region for Solar-Terrestrial Interaction."

2007 Hart Prize Winners, *APL,* "The Hart Prizes for Excellence in Independent Research and Development."

2008–2009

Waleed Abdalati, *University of Colorado, Cooperative Institute for Research in Environmental Sciences,* "Dramatic Changes in Polar Ice: Are We Waking Sleeping Giants?"

John Adam, *Old Dominion University,* ""Guesstimation:" Fermi Problems, Orders of Magnitude, and the Goldilocks Principle."

Sudip Bose, *Advocate Christ Medical Center,* "On Call in Iraq."

Steven Brams, *New York University,* "Mathematics and Democracy: Designing Better Voting and Fair-Division Procedures."

Joseph D'Aleo, *Meteorologist,* "Climate Change."

Giles Dorronsoro, *Carnegie Endowment for International Peace,* "Focus and Exit: An Alternative Strategy for the Afghan War."

Denise Gray, *General Motors Engineering,* "Reinventing GM and the Automobile: From Batteries to Sustainability."

Martin P. Harmer, *Lehigh University,* "Complexions: New States of Matter at Interfaces."

George Helfrich, *APL,* "APL and the U.S. Navy in the Deserts of New Mexico."

James C. M. Hwang, *Lehigh University,* "RF MEMS Technology for Space Applications."

Marcus Jones, *U.S. Naval Academy,* "U.S. Strategic Bombing in Doctrine and Practice in World War II: The Case of the European Theater."

Col. David W. Lamm, *U.S. Army, National Defense University,* "Asymmetry and Change in Future Warfare."

Mario Livio, *Space Telescope Science Institute,* "Is God a Mathematician?"

Michael C. MacCracken, *Climate Institute,* "Climate Change—A Challenge We Must Address."

Shuja Nawaz, *Strategic Analyst,* "Crossed Swords: Pakistan, Its Army, and the Wars Within."

Marcus Noland, *Peterson Institute for International Economics,* "Arab Economies: Recent Accomplishments and Long-Term Challenges."

Ellen Ochoa, *Astronaut, NASA Johnson Space Center,* "Hispanic Heritage Month Colloquium."

Erik van Ommeren, *Sogeti U.S.A. LLC,* "Me the Media: Rise of the Conversation Society."

Reuben Pitts, *NSWC Dahlgren,* "The USS *Vincennes* Incident—The Data."

Slava Rotkin, *Lehigh University,* "Transistor Channels 'Flying' a Few Nanometers Above the Surface: Novel Physics of 'Empty' Space."

Charles Seife, *New York University,* "Fusion, Politics, and the Press."

Kal Shastri, *Lightwire,* "Journey of a Physicist in the Engineering World."

Shanker Singham, *International Law,* "A General Theory of Trade and Competition: Trade Liberalization and Competitive Markets."

Richard Talbott, *APL,* "Information Assurance Lessons from the Past, WWII, and Today."

Ned Tillman, *Growth Adventures,* "The Chesapeake Watershed—Past, Present, and Future."

Tom Vanderbilt, *Author,* "Objects in Mirror Are More Complicated Than They Appear: Looking into Traffic."

Robin Wright, *Journalist,* "The Future of the Middle East."

2008 Hart Prize Winners, *APL,* "The Hart Prizes for Excellence in Independent Research and Development."

2009–2010

LTG James A. Abrahamson, *U.S. Air Force, former director of the Strategic Defense Initiative Organization,* "The Strategic Defense Initiative, APL, and the Cold War."

Jeffrey S. Bardin, *ITSolutions,* "Extremist Jihadi Social Networks."

Michael Berman, *Catbird,* "Security, Protection, and Compliance for Virtual Infrastructure (and the Cloud)—Building Security into the Fabric."

Christos Bolakis and Gamani Karunasiri, *Naval Postgraduate School,* "MEMS Based Sensors for THz Imaging."

Howard Cox, *U.S. Department of Justice,* "Cybercrime Trends 2010."

RADM Jay A. DeLoach, *U.S. Navy, Naval History and Heritage Command,* "Hispanic Americans in American Naval History."

Deborah Elam, *General Electric Company,* "Leadership: Transforming Diversity into Inclusion."

Joshua Epstein, *Brookings Institution,* "Agent-Based Computational Modeling in Public Health: From Playground to Planet."

Joseph S. Francisco, *President, American Chemical Society,* "Chemistry and Its Role in National Security and the STEM Challenge."

Richard Howard, *Verisign iDefense,* "2010 Cyber Threats and Trends."

Hrvoje Jasak, *University of Zagreb,* "OpenFOAM: Object-Oriented Software in Computational Continuum Mechanics."

Jin U. Kang, *JHU Department of Electrical and Computer Engineering,* "Photonics Applications: Past, Present, and Future."

Nirdhar Khazanie, *Northrop Grumman,* "Information Sharing Behind Firewalls."

Roger D. Launius, *National Air and Space Museum,* "Perspectives on the Past, Present, and Future of Human Spaceflight."

Capt. Mark B. Lyles, *U.S. Navy Bureau of Medicine and Surgery,* "Medical Geology: Dust Exposure and Potential Health Risks in the Middle East."

Ronald Marcell, *Immigration and Customs Enforcement,* "Undercover Operations in Counter-Proliferation Investigations."

Peter J. McDonnell, *JHU Wilmer Eye Institute,* "The Wilmer Eye Institute and Health Care Reform."

Naim Merheb, *APL,* "Doing APL Stuff in Baghdad."

Martin Murphy, *Center for Strategic and Budgetary Assessments,* "Somali Piracy: The Implications for International Security."

Scott Pace, *George Washington University,* "International Opportunities and Challenges for U.S. Space Policy."

Brad Parkinson, *Stanford University,* "The Origins of GPS and the Role of APL in the Technology."

George F. Riley, *Georgia Institute of Technology,* "Network Simulation with NS3."

Stephen C. Schimpff, *University of Maryland Medical Center,* "The Future of Medicine—Megatrends in Medical Science and in Healthcare Delivery."

RADM David Titley, *Oceanographer and Navigator of the Navy,* "The U.S. Navy's Task Force on Climate Change."

Joel S. Wit, *JHU School of Advanced International Studies,* "Will North Korea Give Up Its Nuclear Weapons?"

2009 Hart Prize Winners, *APL,* "The Hart Prizes for Excellence in Independent Research and Development."

2010–2011

David Alberts, *Office of the Assistant Secretary of Defense (Networks and Information Integration) and DoD Chief Information Officer,* "The Agility Imperative."

Marvin W. Barrash, *Author,* "USS Cyclops—Lost without a Trace."

Charles L. Bennett, *JHU Department of Physics and Astronomy,* "Big Bang for the Buck: Cosmology from WMAP."

Bob Buus, *Former Bell Labs,* "The Forefathers of Radio."

Ren Cahoon, *Archivist,* "Gaping Holes in Our History: A Story of Impetuous Innovation."

Rama Chellappa, *University of Maryland,* "Compressive Sensing for Computer Vision."

Richard Danzig, *Former Secretary of the Navy,* "Bioterrorism: How Should We Assess the Risk, and How Should We Prepare for It?"

Patricia P. Driscoll, *Frontline Defense Systems,* "The Art of the Possible."

Kathryn Flanagan, *Space Telescope Science Institute,* "The James Webb Space Telescope: We Can See the Beginning."

Michael Greenberger, *University of Maryland,* "Our Economic Insecurity and Its Relationship to the Overall Security of the Nation."

David Harriman, *Author,* "Do Scientists Need Philosophy?"

David E. Hoffman, *Journalist,* "Two Sides of Mikhail Gorbachev at the End of the Cold War: Decisions on Strategic Defenses and Biological Weapons, 1985–1991."

LCDR Robert Kerchner and Nancy M. Haegel, *Naval Postgraduate School,* "Vehicle Mounted Identification Friend or Foe (VMIFF): Leveraging Existing Targeting Systems for Fratricide Mitigation."

Marc A. Kolodner, *APL,* "APL Signatures Exploitation Program."

Virginia W. Lunsford, *United States Naval Academy,* "The War Against Piracy: The Golden Age and Now."

Dennis McCarthy, *U.S. Naval Observatory,* "Evolution of Timekeeping."

Jonathan Pevsner, *Kennedy Krieger Institute,* "The Mind of Leonardo Da Vinci."

Darryll J. Pines, *University of Maryland,* "Emerging Non-GPS Navigation Technology for Aerospace Systems."

Norman Polmar, *Analyst,* "Project Azorian: The CIA and the Raising of the K-129."

Peter Pronovost, *Johns Hopkins Medical Institutions,* "Safe Patients, Smart Hospitals."

Rob Randell, *VMware,* "Architecting and Building a Secure Virtual Infrastructure and Private Cloud."

Larry Robinson, *National Oceanic and Atmospheric Administration,* "Role of NOAA after the BP Deepwater Horizon Oil Spill."

Joe Rosen, *George Washington University,* "Other Universes."

LCDR Mike Touse, *Naval Postgraduate School,* "Design, Fabrication, and Characterization of a Micromechanical Directional Microphone."

Peter Volkovitsky, *National Institute of Standards and Technology,* "History of the Soviet Nuclear Weapon Project."

2010 Hart Prize Winners, *APL,* "The Hart Prizes for Excellence in Independent Research and Development."

Ignition Grants Winners, *APL,* "Ignition Grants Cycle 1 Colloquium."

2011–2012

Kelly Brunt, *NASA GESTAR–Morgan State University*, "Antarctic Ice-Shelf Calving Triggered by the Japanese Earthquake and Tsunami, March 2011."

Robert Cahalan, *NASA Goddard Space Flight Center*, "Solar Irradiance and Climate—What's New? What's Next?"

Steven Chu, *Secretary of Energy, 1997 Nobel Prize for Physics*, "America's Role in Meeting the Energy Challenge."

Carolina Cruz-Neira, *University of Louisiana at Lafayette*, "A Digital Wonderland: Virtual Reality Applications for Everybody."

Vanda Felbab-Brown, *Brookings Institution*, "The Crime-Militancy Nexus: A Witch's Brew or a Myth?"

Isaac Gertman, *Israel Oceanographic and Limnological Research*, "Amazing Interannual Variability of the Dead Sea Hydrological Regime."

Richard Gilly, *Patent Attorney*, "Weathering the Storm: Patents in the Cloud."

Ayanna Howard, *Georgia Institute of Technology*, "SnoMotes: Robotic Scientific Explorers for Understanding Climate Change."

W. P. Andrew Lee, *JHU School of Medicine*, "Immune Modulation for Hand Transplantation."

VADM Walter B. Massenburg, *U.S. Navy; President, Association of Naval Aviation and Raytheon Integrated Defense Systems*, "Centennial of Naval Aviation . . . the Next 100 Years?"

Mark T. Maybury, *U.S. Air Force Chief Scientist*, "Cyber Vision 2025: Air Force Cyber S&T Vision."

John Nagl, *Center for a New American Security*, "Learning to Eat Soup with a Knife: Counterinsurgency Lessons from Iraq and Afghanistan."

Michael E. O'Hanlon, *Brookings Institution*, "Bending History?"

David W. Orr, *Oberlin College*, "Twenty-First Century Sustainability, Resilience, and National Security."

Adam Riess, *JHU Department of Physics and Astronomy and the Space Telescope Science Institute, 2011 Nobel Prize for Physics*, "Dark Energy and the Cosmic Expansion History."

John R. Schmidt, *George Washington University*, "The Unraveling: Pakistan in the Age of Jihad."

Dan Sievenpiper, *University of California, San Diego*, "Artificial Impedance Surfaces: Passive, Active, and Nonlinear Periodic Structures for Controlling Electromagnetic Surface Currents."

Barbara Slavin, *Atlantic Council*, "What Should We Do about Iran?"

Rengaswamy Srinivasan, *APL*, "Advanced Lithium Batteries: One Way to Use, Many Ways to Abuse."

Randolph L. Sullivan, *Nuclear Regulatory Commission*, "Overview of the Fukushima Daiichi Accident."

Russell H. Taylor, *JHU Department of Computer Science*, "Medical Robotics and Computer-Integrated Interventional Medicine."

Maj. Joe Thomas and Marc A. Kolodner, *U.S. Army and APL*, "Signatures Exploitation in the Transshipment Zone."

Scott M. Tyson, *Author*, "Pardon Me, but Your Paradoxes Are Showing!"

2011 Hart Prize Winners, *APL*, "The Hart Prizes for Excellence in Independent Research and Development."

Ignition Grants Winners, *APL*, "Ignition Grants Cycle 2 Colloquium."

Ignition Grants Winners, *APL*, "Ignition Grants Cycle 3 Colloquium."

2012–2013

Edward G. Amoroso, *AT&T*, "Reinventing Enterprise Network Security."

LTG Michael D. Barbero, *U.S. Army; Former Director, Joint IED Defeat Organization*, "The Global and Enduring IED Challenge."

John Boice, *National Council on Radiation Protection and Measurements*, "NCRP and the Study of a Million U.S. Radiation Workers and Veterans."

Soner Cagaptay, *The Washington Institute*, "Turkey's Foreign Policy Pivot."

Vinton G. Cerf, *Google*, "Re-Inventing the Internet."

Vincent W. S. Chan, *Massachusetts Institute of Technology*, "Optical Flow Switching."

Nader Engheta, *University of Pennsylvania*, "Of Waves, Electrons, and Metamaterials."

Norman Friedman, *Defense Analyst*, "UAVs in Strike Warfare."

Jason Heikenfeld, *University of Cincinnati Novel Devices Laboratory*, "Fluidic Devices for Tomorrow's Defense Applications: Displays, Electronics, Biosensors, and More . . . ."

Stephanie Hill, *Lockheed Martin*, "Information Technology Systems and Services and STEM."

Kevin Kallaugher, *The Economist*, "From Pen to Pixel: Political Cartoons and the Future of Satire."

Jason Landrum, *National Oceanic and Atmospheric Administration*, "Federal Action to Reduce the Impacts of Marine Debris: Responses to Pervasive Problems and Natural Disaster Events."

Carey M. Lisse, *APL*, "Prospects for Life and Human Habitability Around Nearby Stars: Many Possible Homes for Our Elder (?) Race, but the Neighbors Are Likely Bacteria."

Ramon E. Lopez, *University of Texas at Arlington*, "The Science of Space Weather."

George Lucas, *Naval Postgraduate School*, "Legal and Ethical Precepts Guiding Research and Use of Emerging Military Technologies."

Nergis Mavalvala, *Massachusetts Institute of Technology*, "Beyond the Quantum Limit in Gravitational Wave Detectors."

Polly Nayak, *Independent Consultant*, "India: Decision Making on External Security Issues."

B. B. Rath, *Naval Research Laboratory*, "Energy after Oil."

Capt. Michael Weiner, *U.S. Navy, DoD/Veterans Affairs Interagency Program Office*, "DoD Electronic Health Records."

2012 Hart Prize Winners, *APL*, "The Hart Prizes for Excellence in Independent Research and Development."

2013 Hart Prize Winners, *APL*, "The Hart Prizes for Excellence in Independent Research and Development."

Ignition Grants Winners, *APL*, "APL STEM Ignition Grants."

Ignition Grants Winners, *APL*, "Ignition Grants Cycle 5 Colloquium."

Ignition Grants Winners, *APL*, "Ignition Grants Spring 2013 Edition."

2013–2014

Col. Timothy P. Alben, *Massachusetts State Police*, "Managing Risk: The Boston Marathon and Changing Security for Large Public Gatherings."

Dawn Biehler, *University of Maryland, Baltimore County*, "Back-Alley Ecology: Rats, Homes, and Community in 1940s Baltimore, and Lessons for Urban Ecology Today."

Jeff J. S. Black, *St. John's College*, "Privacy, Ancient and Modern."

Eric W. Boyle, *National Museum of Health and Medicine*, "From Quackery to Complementary Medicine: A History of Combating Alleged Health Fraud Since the Early 20th Century."

Jerry Buckley, Margo Tank, and Steve Bisbee, *BuckleySandler LLC and eOriginal*, "Electronic Signatures and Records: The Intersection of Law and Technology."

Giuseppe D'Aguanno, *Aegis Technologies*, "Extraordinary Optical and Acoustic Transmission in Metamaterials."

Jon Gertner, *Author*, "Revisiting the Idea Factory: What Can Bell Labs Teach Us about Innovation and the Management of Ideas?"

Amb. Donald P. Gregg, *Former Ambassador to the Republic of Korea*, "Korea."

Thomas Hazlett, *George Mason University*, "The Political Spectrum: Regulators, Interest Groups, and the Struggle to Liberate Wireless Technologies of Freedom."

Stamatios M. Krimigis, *APL*, "Voyager's Odyssey: From Earth to the Galaxy in Thirty-Five Years."

Ralph Langner, *Langner Group*, "Cyber-Physical Attack Engineering."

Stuart W. Leslie, *JHU Department of History of Science and Technology*, "Spaces for the Space Age: Southern California's Architecture of Innovation."

Herbert S. Lin, *National Research Council*, "Reflections on Cyber Warfare: Some Unresolved Policy and Strategic Issues."

Willie E. May, *National Institute of Standards and Technology*, "The National Institute of Standards and Technology (NIST): Its Impact on Innovation, Economic Security, and Quality of Life."

Barton P. Miller, *University of Wisconsin–Madison*, "Software Assurance Marketplace."

Willie Padilla, *Boston College*, "Electromagnetic Metamaterials."

Alfredo Quiñones-Hinojosa, *Johns Hopkins Medical Institutions*, "Engines of Brain Cancer Migration."

David Robarge, *Central Intelligence Agency*, "Archangel: CIA's Supersonic A-12 Reconnaissance Aircraft."

Paul Rosenzweig, *Professorial Lecturer in Law, George Washington University School of Law*, "Cyber Warfare: The Economics, Policy, and Law of Cyber Conflict."

Amanda Simpson, *Army Energy Initiatives Task Force*, "Intersection of Test Flight, Energy, and Vacuum Tubes."

Anne Speckhard, *Georgetown University Medical School*, "Talking to Terrorists: Understanding the Psycho-Social Motivations of Militant Jihadi Terrorists."

Thomas H. Staal, *U.S. Agency for International Development*, "Syria: Origins of the Conflict."

2014 Hart Prize Winners, *APL*, "The Hart Prizes for Excellence in Independent Research and Development."

Ignition Grants Winners, *APL*, "Ignition Grants Fall 2013 Edition."

2014–2015

Hassan Abbas, *National Defense University*, "The Taliban Revival: The India-Pakistan Nuclear Rivalry and U.S. Drawdown in Afghanistan."

Neal S. Bergano, *TE Connectivity Subcom*, "Undersea Fiber Optic Cables—Enabling a Connected World."

William Braniff, *National Consortium for the Study of Terrorism and Responses to Terrorism (START)*, "Al Qaeda's Jihadism—ISIL's Jihadism: The Making and Remaking of a Modern Ideology."

VADM Walter E. Carter Jr., *U.S. Naval Academy*, "Producing Future Leaders of Consequence."

Mary Cummings, *Duke University Humans and Autonomy Laboratory*, "Man vs. Machine or Man + Machine?"

Robert Ehrlich, *George Mason University*, "The Hunt for the Tachyon."

Michael Eisenstadt, *The Washington Institute for Near East Policy*, "Martyrdom, Victory, and Expediency in the Decisionmaking of the Islamic Republic of Iran (IRI)."

Mica R. Endsley, *U.S. Air Force Chief Scientist*, "Situation Awareness: Current and Future Challenges."

Christine Fox, *APL*, "X11 Strategy Analysis—What Is It, and What Did We Learn?"

Nicky Fox, *APL*, "Solar Probe Plus: Humanity's First Visit to Our Star."

James L. Green, *NASA Headquarters*, "Thaddeus Lowe: Mr. Lincoln's Chief Aeronaut."

LtCol William Hagestad II, *U.S. Marine Corps, Red Dragon Rising*, "International Binary Battlefield—Focus the People's Republic of China."

LTG Ronnie Hawkins Jr., *U.S. Air Force; Director, Defense Information Systems Agency*, "Mentoring and Developing Diverse Scientists and Engineers."

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John Steinbruner, *Director, Center for International and Security Studies at Maryland (CISSM)*, "Anticipating Climate Change Mitigation."

S. Alan Stern, *Southwest Research Institute*, "New Horizons: Nothing Like It in the World—The Exploration of Pluto: July 2015."

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2015–2016

BG Harold "Buck" Adams, *U.S. Air Force, The Potomac Institute*, "Operating at the Edge of Space at 2,200 MPH."

Wanda Austin, *Aerospace Corporation*, "Diversity and STEM—Building a More Inclusive Future."

Jason Benkoski, *APL*, "Mimicking Skin: Multifunctional Coatings That Adapt to the Environment and Undergo Self-Repair."

Sarah Bergbreiter, *University of Maryland, College Park*, "Tiny Leaps for Robot Kind: Mixing Microfabrication and Robotics."

Gene J. Blatt, *Hussman Institute for Autism*, "The Science of Autism."

GEN Bruce Carlson, *U.S. Air Force; Former Director, NRO*, "Learning Leadership—We Can All Get Better."

Michael A. Caruso, *Independent Consultant*, "EMP and the Concern for Data Center Protection."

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Charles Clark, *Joint Quantum Institute, University of Maryland and National Institute of Standards and Technology*, "How Quantum Mechanics Cracked the Nuclear Code."

MG Richard J. Cripwell CBE, *Defence Attaché and Head of the British Defence Staff in the United States*, "Better Together?—Lessons and Reflections from a Career in Coalitions."

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LtCol Seth Folsom, *U.S. Marine Corps*, "Where Youth and Laughter Go: with 'The Cutting Edge' in Afghanistan."

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Daniel Friedman, *National Renewable Energy Laboratory*, "Progress and Opportunities for Next-Generation Ultrahigh-Efficiency Multijunction Solar Cells."

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John C. Mather, *NASA Goddard Space Flight Center, 2006 Nobel Prize for Physics*, "Beneficial Catastrophes from the Big Bang to the End: How Far Can We Go?"

Brian R. McEnany, *Author*, "For Brotherhood and Duty: The Civil War History of the West Point Class of 1862."

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Philip Mudd, *Consultant; Central Intelligence Agency*, "The HEAD Game: Become a High Efficiency Analytic Decision Maker."

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K. T. Ramesh, *JHU Decker Professor of Science & Engineering and Director, Hopkins Extreme Materials Institute*, "Keeping Your Head in the Game: The Dynamics of Traumatic Brain Injury."

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