

{ improving our world }



Ask IEEE members what first drew them to technology, and they are likely to mention problem solving and the magic of discovery. Early in life, the engineers and other technical professionals who belong to the IEEE learned that the excitement of innovation is matched only by creating solutions that improve our world.

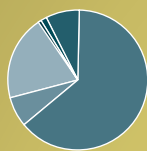
The child on the cover of this year's annual report, who is just learning about one of the natural forces with his kite, represents the spirit of discovery that is the essence of all scientific investigation. The kite also acknowledges the IEEE logo, which itself pays homage to the scientist-inventor Benjamin Franklin's experiments with electricity.

At year-end 2005, some 367,395 members in more than 150 countries were connected with each other – solving problems, making discoveries and continuing to share in the IEEE Vision to advance global prosperity by fostering technological innovation, enabling members' careers and promoting community worldwide.

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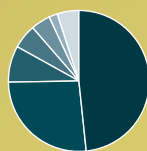
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{ who we are }



membership status

25	■ Honorary Members
5,777	■ Fellows
27,997	■ Senior Members
233,803	■ Members
25,923	■ Associates
73,870	■ Students
367,395	Total



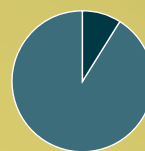
members in global workforce

48.4%	■ Industry
26.5%	■ Academia
8.2%	■ Government
5.7%	■ Self-employed
4.3%	■ Retired
2.0%	■ Unemployed
4.9%	■ Other



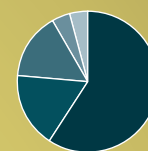
age of members

24.9%	■ Under 30
20.0%	■ 30-39
23.1%	■ 40-49
16.9%	■ 50-59
8.8%	■ 60-69
6.3%	■ 70 and over



gender of members

9.0%	■ Female
91.0%	■ Male



geographic distribution

59.4%	■ United States
17.0%	■ India, China, Pacific Rim
15.5%	■ Europe, Middle East, Africa
4.2%	■ Canada
3.9%	■ Latin America

society memberships

IEEE Aerospace and Electronic Systems Society	4,933	IEEE Lasers and Electro-Optics Society	7,609
IEEE Antennas and Propagation Society	8,078	IEEE Magnetics Society	2,905
IEEE Broadcast Technology Society	1,977	IEEE Microwave Theory and Techniques Society	11,852
IEEE Circuits and Systems Society	11,452	IEEE Nuclear and Plasma Sciences Society	2,744
IEEE Communications Society	41,968	IEEE Oceanic Engineering Society	1,595
IEEE Components, Packaging, and Manufacturing Technology	2,912	IEEE Power Electronics Society	5,632
IEEE Computational Intelligence Society	5,472	IEEE Power Engineering Society	21,341
IEEE Computer Society	94,698	IEEE Product Safety Engineering Society	560
IEEE Consumer Electronics Society	3,148	IEEE Professional Communication Society	1,204
IEEE Control Systems Society	8,482	IEEE Reliability Society	1,984
IEEE Dielectrics and Electrical Insulation Society	1,922	IEEE Robotics and Automation Society	6,334
IEEE Education Society	3,201	IEEE Signal Processing Society	15,404
IEEE Electromagnetic Compatibility Society	4,171	IEEE Society on Social Implications of Technology	1,982
IEEE Electron Devices Society	11,219	IEEE Solid-State Circuits Society	12,043
IEEE Engineering in Medicine and Biology Society	8,049	IEEE Systems, Man, and Cybernetics Society	3,803
IEEE Engineering Management Society	6,372	IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society	2,193
IEEE Geoscience and Remote Sensing Society	2,763	IEEE Vehicular Technology Society	4,290
IEEE Industrial Electronics Society	3,695		
IEEE Industry Applications Society	9,580		
IEEE Information Theory Society	3,608		
IEEE Instrumentation and Measurement Society	4,384		
IEEE Intelligent Transportation Systems Society	973		

Note: About 36 percent of IEEE members belong to at least one Society, while an additional 19 percent belong to two or more.

Sources: Members in Global Workforce data from 2005 Member Satisfaction Survey; age and gender data are from IEEE Membership. All other membership data are from the Annual Statistics of the IEEE – 2005.

	(US\$000)	2001	2002	2003	2004	2005
financial information 2001–2005	Total Assets	\$ 285,867	\$ 253,376	\$ 254,871	\$ 281,107	\$ 317,664
	Revenue	199,331	199,805	250,178	276,993	297,111
	Net Assets	92,350	91,011	116,602	138,588	168,724

{ 2005 highlights }

january

W. Cleon Anderson takes office
as 2005 IEEE President

myIEEE provides members with
customized Web portal

february

IEEE issues draft standard for cellular
telephone rechargeable batteries

Minoru "Sam" Araki, Edward Miller
and James Plummer receive NAE's
Charles Stark Draper Prize

Edward Coyle, Leah Jamieson
and William Oakes receive NAE's
Bernard M. Gordon Prize

march

First electrical property measurement
standard for carbon nanotubes is approved

Charles Townes receives the Templeton Prize

Jan Achenbach and Watts Humphrey
accept U.S. National Medal of Technology

april

IEEE Xplore® 2.0 launches graphic redesign,
improved navigation and new functions

IEEE Council for Electronic
Design Automation created

may

IEEE-USA Salary Service gives employers
advanced online compensation tools

RAMAC storage device and Popov wireless
communications honored as IEEE Milestones

Adam Daniel Sidman receives
IEEE Presidents' Scholarship

june

James Flanagan receives
2005 IEEE Medal of Honor

U.S. Supreme Court ruling on MGM vs.
Grokster electronic file-sharing backs
IEEE-USA's "active inducement" standard

Nelson River Transmission System
and Vučje Hydro Plant celebrated
as IEEE Milestones

july

IEEE Xplore® adds new research features

North Carolina State University
team wins IEEE Computer Society
Student Design Competition

august

ISI Journal Citation Report again ranks
IEEE journals highly, with IEEE producing
18 of the top 20 journals in their fields

september

Standards leaders meet
at IEEE-sponsored European conference
on global standardization

IEEE Spectrum hosts online
Career Accelerator Forum

Electronic Particle Detector at CERN
and Taum Sauk Power Plant honored
as IEEE Milestones

october

900 delegates convene for
2005 IEEE Sections Congress

IEEE Spectrum Online offers innovative,
interactive new Web community

november

Leah H. Jamieson chosen
2006 IEEE President-elect

Expert Now IEEE is launched for
institutional users

George Heilmeyer receives Kyoto Prize

Vinton Cerf and Robert Kahn accept
U.S. Presidential Medal of Freedom

Jeffrey Raynes joins IEEE as Executive Director

december

Hydro Québec and Samsung Electronic
Calculator honored as IEEE Milestones

{ message from the president }

2005 was a very good year for the IEEE – a remarkable year of exciting beginnings and continuing advances but marked by the difficulties and successes of our members in parts of the world that suffered natural disasters. Indeed, 2005 was a successful year for our organization worldwide, as shown in this report. Our achievements resulted from the dedication, strength and talent of the IEEE members, volunteers and staff who comprise this, the world's leading professional organization for the advancement of technology.

Further, we managed the financial side of our organization better than ever, as reflected in our strong operations and investment results.

Our accomplishments in 2005 were in consonance with the IEEE Vision: to advance global prosperity by fostering technological innovation, enabling members' careers and promoting community worldwide. For me, "enabling members' careers" embodies several concepts, starting with support for acquiring and sharing knowledge, as well as for the many IEEE communities – face-to-face and virtual – that help members practice the collaborative art of engineering. Enabling careers also means building an appreciation of engineering among young people and showing them that a gratifying career founded on engineering art, discipline and practice has unlimited possibilities to help humanity.

Several of our most notable achievements in 2005 reflect the global nature of our organization. We signed important new industry agreements, notably with AREVA Group, the French-based nuclear energy consortia, and with The Boeing Company in the U.S. We reached out to emerging economies such as India and Russia with new or renewed National Society Agreements, and we began exploring the feasibility of a China office to better serve our members there and enable working more effectively with China's technical and scientific organizations. In Nigeria, we partnered with the IEEE Foundation and the Hewlett-Packard Company Foundation to facilitate a state-of-the-art telecenter.

In May, after four years of discussions between the IEEE and the U.S. Treasury Department's Office of Foreign Assets Control (OFAC) to resolve key issues related to the U.S. embargo against Iran, OFAC ruled that the IEEE can legally recognize the Iran Section as one of our units.

Two significant IEEE events further underscored our IEEE Vision:

- At the 2005 IEEE Honors Ceremony, we presented the IEEE Medal of Honor to speech and acoustics pioneer James L. Flanagan of Rutgers University, Piscataway, New Jersey, and recognized 16 other notable engineers and scientists, two corporations and 268 new IEEE



Fellows – all of them leading technology innovators who have improved our worldwide community.

- The 2005 IEEE Sections Congress, our triennial meeting of local leadership, also reflected our efforts to promote community worldwide. A record 900 attendees from 272 IEEE sections attended a program designed to enhance their leadership skills as well as to share concerns and possible solutions to mutual issues.

Throughout IEEE operations, our devoted volunteers and staff delivered exceptional results. Thanks to their teamwork, we successfully introduced or enhanced a variety of products and services that are described in this annual report. Just a few examples include: the complete redesign of our highly regarded, online

delivery platform IEEE Xplore®; the launch of Expert Now IEEE, a set of online learning modules with the latest information on emerging technologies, and myIEEE, a members-only Web portal providing a wide range of useful information tailored to each person's needs. IEEE online information products grew significantly in 2005, especially the IEEE Electronic Library, the collection for large institutions, and IEEE Enterprise, developed for mid- to smaller-sized businesses. These products contributed to the continued growth of IEEE Xplore®, with an average 5.4 million full-text PDF documents downloaded each month.

As a result, and despite continued world tensions and competitive pressures surrounding IEEE products and services, IEEE operations ended 2005 favorable to budget by US\$28.4 million. In addition, net investment gains were US\$12.5 million.

After appropriate due diligence, the IEEE Board of Directors approved hiring a new chief operating officer, and in November, we welcomed Jeffrey W. Raynes, CAE, as IEEE Executive Director. His expertise in association leadership will better help the IEEE meet the needs and expectations of our more than 367,000 members worldwide.

It has truly been an honor to have served as the 2005 IEEE President and CEO. Together, we have a wonderfully strong and influential scientific, educational and professional organization. It is replete with challenges and excitement not only for the leadership, but also for all our members. I know that Michael R. Lightner and the 2006 Board of Directors will build on our 2005 performance and will continue to enable our members' careers in technological innovation.

A handwritten signature in blue ink, reading "W. Cleon Anderson".

W. Cleon Anderson, P.E.
2005 IEEE President and Chief Executive Officer

{ serving society }



Students from Republic Polytechnic (RP), Singapore, participated in a variety of projects to help communities in Thailand and Sri Lanka following the December 2004 tsunami. Here, in a heavily damaged Thai fishing village, an RP student works with a child on a group activity aimed at improving youngsters' spirits and helping to develop their skills.

Lending Many Helping Hands

IEEE members, their local sections, many employers, and thousands more in the global IEEE community responded to help rebuild lives, communities and infrastructures devastated by the natural disasters that marked much of 2005.

In India, several members of the IEEE Kerala Section rushed to the southeast coast after a giant tsunami struck nations surrounding the Indian Ocean on 26 December 2004. IEEE Members Amarnath Raja and Sathees Babu led efforts to coordinate the international donor agencies. Just three days after the massive tidal wave struck, volunteers – many of them IEEE members – established a Web site that became a central point for information on tsunami relief. At Nagapattinam, IEEE members including Sasi P. Meethal created a communications network using mobile phones and data lines to coordinate the distribution of relief materials. As of mid 2006, this strong data communications link was still providing information and resources to government and other organizations involved with rebuilding.

Technology corporations, including IBM India and Tata Consultancy Services (TCS) took major roles. At IBM, a crisis management team provided the hard-hit governments of India, Indonesia, Sri Lanka and Thailand with technological expertise. The company also sent teams to coordinate on-site relief, from collecting emergency provisions to developing applications to distribute supplies, assess damage and manage the relief camps. IBM employees, many of them IEEE members, used open-source platforms and technologies to create software applications that ranged from tracking victims to a telephone helpline service.

At TCS, the goals were short-term relief and long-term rehabilitation. One immediate concern – possible epidemics because of disrupted sewage and water lines – was immediately handled by distributing thousands of water filters. TCS also installed a mobile desalination plant strategically located between Keechankuppam and Akkarapettai, two of the most devastated communities on the



LEFT: Tata Consultancy Services chief executive and IEEE Fellow S. Ramadorai (blue shirt) and Mrs. Ramadorai tour a warehouse in Chennai, formerly Madras. From its location on the southeast Indian coast, the warehouse was the central point for distribution of relief supplies after the tsunami. **CENTER:** Damage is evident in New Orleans, Louisiana, after Hurricanes Katrina and Rita devastated much of the U.S. Gulf Coast. Complex power and communications networks required intensive restoration efforts, some of which is ongoing. **RIGHT:** IEEE Senior Member Teddy Wyatt (left) was presented with a special humanitarian award from 2006 IEEE Region 5 Director Robert Scollie on behalf of IEEE Region 5, which comprises much of the central United States. After Hurricane Katrina, Wyatt drove 500 miles from his home in Tulsa, Oklahoma, to Louisiana where he volunteered for a week to help distribute ice, water and food to thousands of victims.

Indian coast. Longer term, TCS is supporting two programs: psychological support for victims provided through Indian social workers and volunteers, and a model community being built with hurricane-resistant structures.

In the U.S., both IEEE-USA and local IEEE units quickly created resources to help Gulf Coast members and student members after Hurricane Katrina on 28–29 August, and Hurricane Rita on 20–21 September 2005. To help members who had lost their jobs or had relocated and needed to find new jobs, IEEE-USA arranged for free member access to CareerStar, a private, password-protected Web site with employment resources. IEEE-USA also contributed US\$5,000 to the American Red Cross and set up an online community for members affected by or concerned with the disaster.

Unlike the Asian tsunami, where many of the damaged areas had simpler power and communications infrastructures, the U.S. hurricanes struck a region that relies on complex power and communications networks. According to Entergy Corporation,

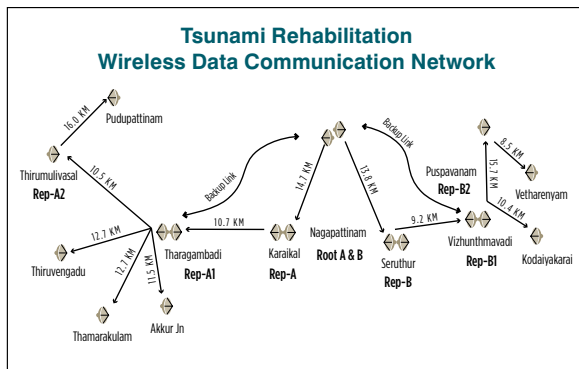
the power provider for some 2 million customers in the stricken Gulf Coast area, more than 832,000 were without service after the hurricanes. At BellSouth, the voice and data communications provider for 4.7 million access lines in the areas affected by the hurricanes, almost 50 percent of the lines were not working.

Engineers at both utility companies faced extraordinary difficulties. The amount of damage was unprecedented and population shifts – such as the 100,000 residents who evacuated the devastated city of New Orleans for temporary quarters in Baton Rouge, 80 miles inland – put new power and telecommunications demands on the utilities. At the same time, many Entergy and BellSouth employees – including some IEEE members – lost their homes and possessions, particularly during Hurricane Katrina. All, however, stayed on the job to help restore services.

According to IEEE Senior Member Richard W. Miller, who is area manager in BellSouth’s New Orleans capacity management, “The restoration effort in New Orleans is ongoing, but we do not have an estimated timeframe as to when it will be complete. These efforts depend largely upon the repopulation of the city.” Before Katrina hit, the population of the city of New Orleans was about 500,000, not including the nearby suburbs. A survey conducted in January 2006 by the city’s Emergency Operations Center estimated the population at between 160,000 and 202,000 residents.

Making a World of Difference

Just after New Year’s Day 2006, engineering students at the University of Ibadan in Nigeria received the gift of technology. 2005 IEEE President W. Cleon Anderson was among the dignitaries who helped to dedicate the new IEEE/Hewlett-Packard (HP) Telecenter at the university. Sponsored by the IEEE, the IEEE Foundation and the Hewlett-Packard Company Foundation, the new facility provides both computer technology and a place where students and faculty can conduct research and connect via the Internet with colleagues around the world.



A group of IEEE India members helped to create this wireless network to coordinate the distribution of relief supplies to communities along the nation’s Indian Ocean coastline.



The project was initiated by *IEEE Spectrum* Senior Editor Harry Goldstein, who visited Nigeria in 2003 while researching an article. After learning about students' lack of easy access to the Internet, he championed – for more than two years – the need for bringing technology to Ibadan's engineering students. Goldstein applied for and received grants from the HP Foundation and the IEEE Foundation totaling more than US\$150,000 to create a state-of-the-art, 60-seat facility. The IEEE donated a subscription to the IEEE/IET Electronic Library (see pages 14–15) that includes more than 1.1 million IEEE technical articles, and *IEEE Spectrum* helped to fund the director's salary during the start-up.

The new IEEE/HP Telecenter is the only one of its kind at a state university in this West African nation of 137 million people. The project could be a model for other African nations to better educate their engineers.

IEEE Standards Association Works to Strengthen Global Standards

The IEEE Standards Association (IEEE-SA) Corporate Program, which enables companies to have direct involvement in IEEE standards development, took a giant leap forward in 2005. At "Standards for Global Business: The European Conference on Collaborative Trends in Europe and Global Standardization," more than 80 senior-level participants from both corporations and international standards developing organizations (SDOs) gathered in Munich to candidly discuss forces influencing the fast-changing world of standards development. The conference, the first presented by IEEE-SA, offered insights into both future directions in global standardization and how to address awareness, participation and change.

IBM, Intel, Nokia, Siemens and Sony were among the companies represented at the conference. SDOs included the International

Electrical Technical Commission, the International Telecommunication Union, Information & Communications Technologies, European Committee for Electrotechnical Standardization, and European Telecommunications Standards Institute.

During 2005, the IEEE-SA Corporate Program, which fosters the development of industry-relevant global standards, grew to 78 member companies. At year's end they included Cablevision Systems, Lucent Technologies, Hewlett Packard, Microsoft, National Communications Systems and Panasonic.

Current IEEE standards activities represent new, non-traditional technology areas and reflect both the convergence of many technologies and the development of new ones. For example, three standards efforts are underway to support deploying broadband over installed electrical power lines. IEEE standards approved in 2005 include rechargeable batteries for cellular telephones and the first electrical property measurement standard for carbon nanotubes. The IEEE is taking the lead in nanotechnology-based electronics standards, encouraging both new standards to ease the movement of nanotechnology innovations from the research lab to a market environment, and establishing basic nanotechnology platforms that support growth of the sector.

A new IEEE Standards in Education Web portal was launched to provide U.S. undergraduate engineering programs with information about the history, use and application of standards. Created by members from IEEE-SA and the IEEE Educational Activities Board, the portal was funded by the IEEE Foundation and the U.S. National Science Foundation.

IEEE Members Work to Raise Technology Literacy

During 2005, more members joined an innovative IEEE program to increase technology literacy in their local schools. The Teacher In-Service Program (TISP) got a special boost in July,



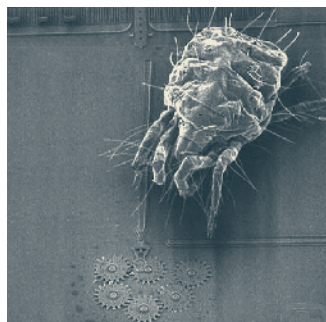
FACING PAGE: Speeches and special guests marked the grand opening of the IEEE/Hewlett-Packard Telecenter at the University of Ibadan in Nigeria. From left are: 2005 IEEE President W. Cleon Anderson, 2006 IEEE Nigeria Section Chair Tunde Salihu, University of Ibadan engineering chair Ola Fakolujo, *IEEE Spectrum* Senior Editor Harry Goldstein, University of Ibadan Vice Chancellor O.A. Bamiro, former Section Chair Isaac Adekayne and HP representative Stanley Muoneke. **LEFT:** During a break at IEEE-SA's global standards conference in Munich are, from left: Jack Sheldon of the International Electrotechnical Consortium and Ingo Rusch and Ben Johnson of IEEE-SA. **CENTER:** James Bell, director of Hewlett Packard's Industry Standards Program Office, accepts the 2005 Corporate Award on behalf of the company. **RIGHT:** During a workshop in Atlanta to train engineers how to teach technology basics to pre-university students, IEEE members designed, built and tested candy baskets using science, mathematics and engineering concepts and applications.

when 65 members from the southeastern United States and Jamaica participated in a special training workshop to teach them how to present TISP to local educators. The goal is to develop collaborative relationships with teachers through pre-defined lesson plans that present science and engineering topics to students. The diverse lesson plans, which are geared to different age groups, are available in both English and Spanish.

By year's end, IEEE members had launched TISP programs in Atlanta; Richmond, Virginia; Central North Carolina; and Jamaica. In Atlanta, some 40 TISP volunteers are presenting workshops throughout the city. IEEE Jamaica members have presented TISP to educators at several schools and expect to expand the program in the island nation.

Since TISP was launched in 2001, IEEE members have worked with more than 650 pre-university teachers who represent over 70,000 students. In 2006, the goal is to reach 1,000 additional educators through training sessions in the eastern and central U.S., South Africa and Malaysia. IEEE-USA gave a US\$50,000 grant last year for training in U.S. sections.

How small is small? The IEEE Virtual Museum exhibit on nanotechnology explains how microscopic mechanical devices are created. Here, a spider mite is placed next to tiny gears to demonstrate scale. *Courtesy of Sandia National Laboratories*



TISP is one of two major projects of the IEEE Center for Pre-University Engineering Education, an outreach organization that encourages students to consider engineering careers. The other project is a Web site, being developed with IBM, called "Try Engineering." The site, which will be launched in 2006, is geared to school counselors and pre-university students.

IEEE Virtual Museum Adds Exhibits on Electronic Music and Really Small Objects

The IEEE Virtual Museum, which has been recognized by educators and technology experts for its innovative approach to introducing people to technology, marked 2005 with two new exhibits. "Songs in the Key of E" explores electronic music from its accidental beginnings with a by-product of the first uses of alternating current to modern digital synthesizers. The other exhibit, "Small is Big: The Coming Nanotechnology Revolution," discusses the history and current applications of nanotechnology and offers possible future directions for the emerging field.

The Virtual Museum is aimed at pre-university students, educators and the general public, with the goal of enhancing their understanding of the principles of electrical and information sciences and technology, as well as placing inventions within their historical context. Supported by a grant from the IEEE Foundation, the Museum has more than 500 pages of content – up from just 75 when it was launched in 2002. More than half a million visitors have toured the site, which offers almost 100 films, video slide shows, audio clips and animations. Other current exhibits include the development of electricity, the world of micro-electronics, and women's historic achievements in math and science. The Virtual Museum is supported by the IEEE Foundation, the IEEE Life Members Committee and individual donors.



Adam Daniel Sidman won the 2005 IEEE Presidents' Scholarship for his innovative gyro-based servo stabilizer for use with handheld motion picture cameras. Established in 1999, the scholarship is presented annually at the Intel International Science and Engineering Fair.

Motion Picture Camera Stabilizer Wins IEEE Presidents' Scholarship

A stabilization device for professional, handheld motion picture cameras won Adam Daniel Sidman of Colorado Springs, Colorado, USA, the US\$10,000 IEEE Presidents' Scholarship. Sidman, who was 17 years old and had one year of pre-university studies remaining, received the award from 2005 IEEE President-Elect Michael R. Lightner during the 2005 Intel International Science and Engineering Fair in Phoenix. For his winning project, Sidman designed and built an inexpensive, lightweight and highly maneuverable gyro-based servo stabilizer for use by filmmakers. It eliminates the need for a body brace customarily used with such handheld cameras.

The teenager has been involved in filmmaking and engineering since he was about 10 years old. His patent-pending invention is the result of 700 hours of development, and he is working on improvements. Sidman expects to enroll in Harvard University in Cambridge, Massachusetts, USA, in September 2006, where he will major in engineering and film.

From Hydropower to Physics, IEEE Milestones Honor Historical Achievements

When IEEE members want to honor significant technological achievements that took place in their geographical areas, they turn to the IEEE Milestones Program. Since 1983, it has recognized more than 65 notable accomplishments in electrical engineering, and all were proposed to the IEEE History Committee by members, IEEE Sections, Societies or other organizational units. The Committee then evaluates the applications and forwards its recommendations to the IEEE Executive Committee for approval.

In 2005, eight new Milestones were dedicated – four of them honoring hydropower achievements. All IEEE Milestones encourage the preservation of their historic locations and help to reinforce the public's appreciation for engineers' contributions to society.



Vučje Hydroelectric Plant, Vučje, Serbia and Montenegro. In 1903, the power of the Vucjanka River began supplying the electricity that transformed the economy of a poor, rural area into a prosperous manufacturing center. The first hydroelectric power plant in southern Serbia and the largest in the region, the Vučje plant operated for more than a century, providing an initial 50 Hz at 7000 volts – high for the period – to nearby Leskovac.

Taum Sauk Pumped-Storage Electric Power Plant, Lesterville, Missouri, USA. When it began operating in 1963, the Taum Sauk plant was the largest pure pumped-storage water plant in North America. Besides its high-capacity turbine generators, upgraded in 1999 to generate 225 mW of power each, and its early remote-control system operated from 90 miles away in St. Louis, the system still draws water through its reservoir system during daytime power demands, pumping water back into the upper reservoir for nighttime storage.

Hydro Québec 750 kV System, Montreal, Quebec, Canada. The world's first 735-kV electrical transmission system began operating in 1965 and increased Hydro-Québec's power delivery by 50 percent. It also was the cornerstone of the huge energy transmission network that spread throughout the province. The system set a new standard for reliability despite great distances and harsh winter weather, transmitting power generated in northern tributaries of the St. Lawrence River to southern Québec.

Nelson River High Voltage Direct Current (HVDC) Transmission System, Winnipeg, Canada. Since 1972, the Nelson River in northern Manitoba has provided most of the province's electricity, carrying the hydropower generated some 600 miles away to Winnipeg and other load centers far to the south. For much of the distance, power is generated in alternating current (ac) and converted to direct current (dc) because of dc's stability and economy. The dc is converted back to ac for distribution via Manitoba Hydro's 230kV transmission line system.

His father is IEEE Senior Member Michael D. Sidman. This was the first time the Presidents' Scholarship was awarded to the child of an IEEE member. The IEEE Presidents' Scholarship, which was established in 1999, is supported by the IEEE Foundation and contributions.

Endangered Species Tracking System Wins Computer Society Student Competition

A GPS-based tracking system that promises a reliable, low-cost approach to help protect endangered animals took first place and US\$20,000 in the 2005 IEEE Computer Society International Design Competition (CSIDC). The victorious team from North Carolina State University (NCSU) also was the first from the United States to win the international event in its six-year history. The students' entry, Networks for Endangered Animal Tracking (NEAT), uses a battery-powered ad hoc wireless sensor network to acquire, store and relay GPS-based location data. The information is collected by wireless sensors attached to a customized collar, and when

the four-legged subjects are in range of NEAT's stationary network, the tracking units upload stored data for later collection and analysis by wildlife researchers.

A team from Poznan University of Technology in Poznan, Poland, won second place and US\$15,000 for ReadIT, a portable, lightweight system that enables vision-impaired people to obtain information from printed text by means of a tiny video camera mounted inside eyeglasses, a processor, a text-to-speech converter and an earphone. Third place and US\$10,000 went to a team from Politechnica University in Bucharest, Romania, for the NOMAD positioning system, created to provide the user with personal orientation information in almost any unmapped environment, including underground.

CSIDC encourages undergraduate engineering students to take on useful and marketable real-world projects. The 2005 competition generated 177 entries from 109 universities in 43 countries. Microsoft Corporation provided most of the financial support with additional funding from the ABB Group.



Electronic Particle Detector, CERN, the European Organization for Nuclear Research, Geneva, Switzerland. In the 1960s, physicist Georges Charpak developed a multi-wired proportional chamber to improve – by a factor of 1,000 – data collection of subatomic particles. His contribution, for which he received the 1992 Nobel Prize for Physics, revolutionized the field of electronic particle detectors and led to important new discoveries on the constitution of matter.

Electronic Calculator, Osaka, Japan. Introduced in 1964 by a Sharp Corporation project team, the all-transistor, desktop calculator was the forerunner of smaller, faster and virtually silent calculating equipment. In less than a decade, calculators developed into low-cost, pocket-size devices used worldwide. Related new technologies supporting their use – especially integrated circuit and liquid crystal diodes – contributed to other digital consumer electronics products.

A.S. Popov Contribution to the Development of Wireless Communication. While an instructor in the Russian Naval Department, Alexandr S. Popov demonstrated his invention to detect lightning at a May 1895 meeting of the Russia Physical and Chemical Society. Popov's receiver was not meant to transmit "intelligence," but his invention proved the feasibility of radio. Unfortunately, the non-disclosure statement he had signed while working for the Naval Department lessened his renown for his contributions to radio.

Random Access Method of Accounting and Control (RAMAC), San Jose, California, USA. The first computer created around a radically new magnetic disk storage device, IBM's RAMAC revolutionized computer architecture, performance and applications. Introduced in 1965, the new computer replaced magnetic tapes and coded punch cards, and quickly became a key technology for data and program storage. RAMAC offered extremely large capacity, rapid access and much lower cost for magnetic disk storage.