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the Bent of Tau Beta Pi
The Engineering Honor Society

Fall 2012
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founded at Lehigh University, South Bethlehem, Pennsylvania, June 15, 1885, by Edward H. Williams Jr., A.B., A.C., E.M., Sc.D., LL.D. (1849-1933). Key and name registered in U.S. Patent Office. Member, American Society for Engineering Education and (co-founder) Association of College Honor Societies. Affiliate, American Association for the Advancement of Science.

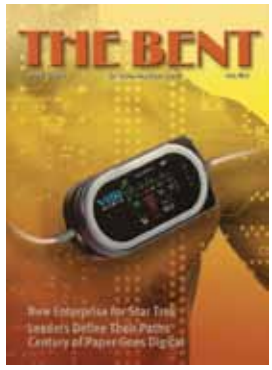
Features

ON THE COVER:

Alan Brown explores how a science fiction concept is becoming reality in the world of medicine.

We begin a series which will look at what it means to be a leader

Cover artist: Dali Polivka



Reports

Departments

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THE BENT

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The Tau Beta Pi Association was founded at Lehigh University in 1885 by Edward Higginson Williams Jr. to mark in a fitting manner those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as students in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in engineering colleges. —Preamble to the Constitution

A Legacy of Service

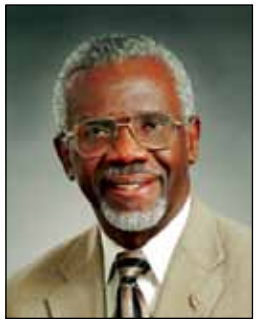
The 20th century is considered the threshold of the "age of modern technology". This observation is reinforced by the rapid rate of development ushered in with arrival of the 21st century. As our nation focuses on the transition from an agrarian to a post-industrial society, it is generally recognized that a new approach to educational preparation is needed, to ensure that the required workforce is adequately-prepared for the demands of this new world. This workforce is required to have a background that demonstrates knowledge and capability related to concepts founded on math, science, engineering and technology.

For several decades, our nation has led the world in research and development. This has resulted in tremendous expansion of technological knowledge, as demonstrated by advancement in astronautics and aeronautics, space travel, communication and computational capabilities, environmental and health-related sciences, and other areas. In addition, our research and capability in scientific, engineering, and mathematical (STEM) areas, have contributed significantly to the launching of the new era, and provided an undergirding of a new thrust in entrepreneurship.

As we seek to expand our technically prepared workforce, it has been observed that there is a significant decline in the interest of students to pursue STEM-based careers at the post-secondary level. Among engineering graduates in the USA, we have moved from a peak graduation of about 78,000 engineers with B.S. degrees in 1985, to a low of approximately 62,500 engineers in the early 1990s, increasing to about 79,000 graduates in 2010. This reduction was primarily driven by the fact that many of our K-12 graduates had not been motivated to pursue the level of preparation needed for successful careers in current and emerging technology. In addition, the rigorous engineering curriculum pursued by engineering students provides little accommodation for the under-prepared, who tend to bypass engineering and other STEM-related programs of study. Furthermore, many of our K-12 students have relatively little knowledge of the connection between math, science and their daily lives.

Much concern has been expressed about this situation, and corporations, foundations, academic institutions, professional groups, and various other agencies have responded to the national call for action to address the challenge of STEM preparation. With its launching of the MindSET program, following a survey of Chapters, Tau Beta Pi proudly joined the aforementioned groups in response to the call for national action to address the STEM preparation challenges we face.

The ΤΒΠ MindSET K-12 Math & Science Initiative was introduced in 2007. Program design adopted for this purpose comprises collaborative partnerships with local school districts. It includes: **a)** teacher training in use of kinesthetics in classroom delivery of math and science; **b)** parent development component for improved student support from families; **c)** hands-on engineering labs; **d)** performance data tracking in math and science skills development and **e)** student completion of algebra 1 in the 8th grade and calculus by the 12th grade. The engineering labs are hands-on projects which are created to demonstrate application of math and science concepts in engineering design. Also, the program is intended to highlight educational pathways for our participants, emphasis of new career fields, and stimulation of interest in STEM careers.



To meet workforce demands, there is need for a cadre of highly-trained professionals equipped to lead the technological thrust and provide the guidance to face increasing challenges. For example, manufacturing and similar types of operations are almost all robotics-driven; information and electrical developments generate jobs in the areas of instrumentation and controls, including hyperspectral and multispectral imaging, biorobotic sensors, machine vision, bioimaging, biomedical engineering, and wireless networking. There is also an increasing demand for bio-based products, with expanding importance of bioprocessing and renewable energy.

Why did we get involved? *The Vision of Tau Beta Pi is to be universally recognized as the premier honor society*. Greater public visibility through programs such as MindSET, will help us to achieve this. Our organization seeks to give members opportunities for personal growth and rewarding experiences on a continuing basis, both as college students and as alumni members. Included among these opportunities is community involvement. Secondly, the engineering profession is faced with the challenges of attracting suitably-qualified candidates to engineering, and our organization has the qualifications and quality of

Mindset Summaries

March 2012—FL Alpha MindSET LEGO module.

The Tau Beta Pi MindSET program is expanding each semester as more student chapters and alumni get involved with the K-12 program. At this time, 26 Chapters are hosting or have hosted hands-on activities with K-12 schools.

More than 750 elementary, middle, and high school students have participated in MindSET activity sessions. In the past eight months, seven ΤΒΠ chapters have applied and received grants to fund their own MindSET projects. Here are details of recently hosted sessions as they were submitted by MindSET chairs:

•Alabama Gamma at the University of Alabama at Birmingham—worked with Teach For America and the Huffman Academy to present the toothpick bridge building module to more than 100 elementary school students. ΤΒΠ students were asked and succeeded in integrating basic Spanish language vocabulary into the session.

•California Gamma at Stanford University—partnered with the after school program at East Palo Alto Charter School to teach 5th grade students about the science of rockets and building rockets.

•Florida Epsilon at Florida Atlantic University—targeted the on-campus laboratory school, A.D. Henderson, for several activity sessions, including a structures module and a catapult building module. This project received the FAU Student Organization Program of the Year award.

•Maryland Beta at the University of Maryland—partnered with the Drew Freeman Middle School and Teach For America to host two MindSET activity sessions and provided invaluable assistance at the *USA Science & Engineering Festival* (April 27-29).

•New York Gamma at Rensselaer Polytechnic Institute—working with the Troy City School District offered weekly MindSET sessions in partnership with the 21st Century Program to middle school students. The Chapter implementation team developed a successful module on static electricity.

•Pennsylvania Beta at Pennsylvania State University—targeted the Bellefonte Area Middle School and hosted an intermediate airplane production module.

•Tennessee Alpha at the University of Tennessee—supported by the local Alumnus Chapter—hosted a session at Holston Middle School, hosted a summer school session at Pond Gap Elementary, and volunteered man hours in preparation for the *USA Science & Engineering Festival*.

In addition to the projects summarized here, several other Chapters put in valuable work to broaden the reach of the program. They are—*DC Alpha* at Howard University; *Florida Alpha* at the University of Florida; *Georgia Alpha* at Georgia Tech; *Michigan Gamma* at the University of Michigan; and *New York Tau* at Binghamton University.

June 2012—TN Alpha MindSET bridge module.

membership to assist in this endeavor. Also, our members can contribute as volunteers, by playing significant roles in the MindSET program.

Since its establishment, MindSET has made steady progress in its development and implementation. Through the hard work of our participating Chapters, and the strong support of our very dedicated alumni and staff, we have impacted students and teachers in many school districts in which they are located. About 25% of our 238 Collegiate Chapters are at different stages of planning and program implementation. With growth, we are generating a steady demand for alumni volunteers to work with them. Alumni living or working close to Chapters are being sought to be "team coaches". The role is essentially that of an advisor/program supporter who will mentor the team, and help interfacing with school districts and other groups. If you are interested in gett involved, send an email to TBPMindSET@tbp.org.

As we contemplate our future, let us think of the Legacy of Service which could be left, by significantly impacting the lives of others, and the success and accomplishments of our profession, our country, and the world. Driven by this perspective, imagine what can be achieved in the next 127 years, based on the foundation laid over the past 127.

Imagine our Legacy of Service to others!

—Jonathan F.K. Earle, Ph.D., P.E., *Florida Alpha '65,* Councillor

EDITORIAL

One Down, Forty to Go?

President Simonson likes to point out that in the first 126 years of the Association, we only had three people serve as Secretary-Treasurer. By his reckoning, I have 40 more years before I can retire! As I like to point out, the Association lacked a Secretary or a Treasurer during its first ten years, and several different people held these separate positions over the next ten. R.C. Matthews was elected Secretary in 1905 and became Secretary-Treasurer in 1912 when the roles were combined. Hence, we have actually had three Secretary-Treasurers in a 99-year period. Perhaps I'll stick around for another 32 or so.

August 1 marked my one-year anniversary of arriving in Knoxville. Spending the first three months under Jim Froula's tutelage was invaluable, and his continued support after taking over at the end of October has been extremely generous. I also want to thank the Headquarters staff for all of their support, the Executive Council for their outstanding leadership, and the many members who have shared their thoughts and hopes with me over the past year.

This first year has been educational and very rewarding. There are good days, and there are stressful days; however, working for this outstanding organization is truly wonderful. I encourage you to take a look at some of the thoughtful letters on page 45 from some of the 2012-13 scholarship recipients; they represent a small fraction of those we received. Providing nearly $600,000 this year in scholarships and fellowships to engineering students makes a real impact. It also makes the difficult days seem like a distant memory.

Lyle's Laws & New Features

As Lyle and I indicated in the last issue, the popular series of Lyle's Laws is no more. For those of you who are still interested in Lyle and his Laws, he is indeed working on a book. We'll let you know when it becomes available. While nothing can replace them, we are working on a couple of new articles that I hope you find interesting. In this issue, we begin a new series on Leadership. Trudy Bell, one of our feature writers, profiles Maria M. Klawe, current president of Harvey Mudd College. Our hope is to share with you some examples of inspiring engineers who have excelled as leaders in academia, business, or other areas. We've also added a new section called *Association Briefs* to provide information on the many different things going on in Tau Beta Pi.

Catalog Cards

Someone with inside knowledge read my summer editorial and questioned my comment about "no plans to eliminate our existing paper catalog cards." What I should have said is that we have no plans to destroy them. Once the scanning and indexing of the cards is complete, they will remain at Headquarters until we ensure that physical access is no longer needed. At that point, options to store them permanently and securely will be investigated.

Earlier this year, I attended three District Conferences and floated the idea of replacing the paper catalog card that each candidate fills out in duplicate with an electronic web-based card. I wasn't prepared for the response of universal applause at each conference. After receiving this positive feedback from our student members, our mission was clear. Ray Thompson, ΤΒΠ System Administrator, began work on a robust system to implement this change. After consulting with the Headquarters staff, alumni volunteers, and current officers, a new web-based member record was brought online in August. The first chapter has already submitted these new catalog cards, and the initial response has been very favorable.

Photo by Chris Wooten

The catalog card is an indelible part of ΤΒΠ history. I know many of you may experience a sense of nostalgia thinking back on them. Ray collaborated with current and past ΤΒΠ staff members to write an article detailing its history and providing an inside look at the new system. As we move into a new era for ΤΒΠ, I hope you enjoy a look back at the historical significance of the catalog card.

Lexington Convention

This year's Convention will be in Lexington, KY, on September 27-29, 2012. A reception is being planned for area alumni on Saturday afternoon. More details can be found in the new *Association Briefs*. If you are within a short drive of Lexington, I encourage you to stop by and meet some of your outstanding fellow Tau Bate students and alumni.

Until Later,

Engineering the Heavens

•I really enjoyed this article. The comment that "Defects that can be measured and allowed for are as good as nonexistent" stirred my memory. During the time when I was designing hardware for space-borne optical systems, I built a fine-pointing system that compensated for the error in pointing of a satellite-borne telescope due to diurnal heating and cooling of the structure between the star sensors and the telescope. This involved characterizing the error by observing a target on the ground and programming my system to deflect the telescope by the complement of the error. Let me tell you again how much I have enjoyed and admired all of Trudy's articles.

Robert O. Woods, Ph.D., P.E. (Ret.)
NJ Δ '62

Units

• I see a bunch of inch-pound units in the Brain Ticklers in the Summer 2012 issue. Can you help us all by using only metric units? The U.S. is way behind the rest of the world in use of metric units. THE BENT can help by showing its readers (the best engineers) where metric numbers fit in all kinds of problems.

Robert H. Bushnell, Ph.D., P.E.
OH Γ '47

[Editor's Note: We've passed your comments on to the Brain Ticklers team for review. Use of the metric system continues to be debated, and while we agree on the value of the metric system, it is critical that engineers understand and can apply English units as long as they are still in use. The loss of the Mars Orbiter *in 1999 is just one example.]*

Statistics

•The short note "Chinese Students Trend" in Spotlight on p. 46 of the Summer 2012 issue states that the number of Chinese students increased more than 400% during the last four years, but it doesn't indicate the number of Chinese students. According to the MSU website, there are about 47,800 students. The important thing is the fraction of these 47,800 that are Chinese. If the original number was small (e.g., 100) then increasing it 400% (to 500) leaves it at a small number. Increasing it from 1000 to 5000 is much more significant.

I've seen this misuse of fractions used in newspapers and legal statements in pharmaceutical company "descriptions" of testing their products (it said that their product reduced the problem by 50%—it took careful reading, but they did actually say that it went from 2 to 1, out of several thousand test subjects).

E. Ted Grinthal, NY E '62

Authors

•On page 20 of the Spring 2011 issue of THE BENT, there was an Authors page of recently published books by members of Tau Beta Pi. I believe this is a great idea and that it should be continued, perhaps in one issue each year.

Forrest W. Schultz, PA Z '62

[Editor's Note: We plan to continue to run the Authors section in each Spring issue.]

Lyle's Last Law

• Lyle's last column was the best of all!

Arthur D. Delagrange, Ph.D.
MA B '62

•I have read Lyle's article for ten years, and it was one of the first pieces that I looked for when THE BENT arrived.

William J. Kusner, IL B '59

•Unfortunately, Dr. Feisel left a very critical question unanswered; did he get the red Schwinn?

Robert M. Perry, MI A '91

[Lyle Responds: I did indeed get the red Schwinn. I couldn't purchase it outright but the hardware man and I made a rather complex financial arrangement that today would probably be called a subprime mortgage. The bike proved itself worthy of my affection. I was the envy of the bicycle crowd for a year or two and I rode it as needed until I joined the Navy, many years later. While I was at sea, it disappeared into the oblivion that awaits all bicycles, probably something like the bicycle equivalent of the fabled elephant graveyard.]

•Yesterday was a sad day for me. I received my copy of the latest issue of THE BENT announcing the end of Lyle's Law as a regular feature of the magazine. For ten years I have read these laws and have enjoyed each and every one of them. His articles have been appreciated and will be sorely missed.

Joe H. Exum, TN A '52

•It is with a little sadness that I read Dr. Lyle Feisel's "Final Law of Love" in the Summer 2012 issue of THE BENT. This final law means that an era has come to an end. However, I can happily say "Mission Accomplished," as Dr. Feisel proposed and completed forty installments of his article over ten years. It has been a pleasure to regularly anticipate and enjoy the insight of each installment, and I have been lucky enough to be in attendance at an event where Dr. Feisel previewed one of his laws. In September 2009, Morgan State University celebrated the 25th anniversary of the Clarence M. Mitchell Jr. School of Engineering, at which time the Maryland Epsilon chapter dedicated its Bent monument. It was during this dedication ceremony that Dr. Feisel gave a beautiful oral presentation of what would later be published in the Winter 2010 issue as "Lyle's Law of Rocketry" in which he stated "Everybody needs a booster." This law is particularly touching as it makes an indirect reference to the mission of our school of engineering, a reference which I may

(Continued on page 45.)





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100 YEARS OF ACCELERATING TOMORROW

William S. Chen, *Michigan Gamma '60*, completed over 50 years in the U.S. Army, attaining the rank of Major General, and defense industry and has retired in Edina, MN. His 32 years of active duty included service as commanding general, U.S. Army Missile Command, Redstone Arsenal, AL, and program executive officer for missile defense. He spent 18 years in the defense industry, retiring as vice president and general manager at BAE Systems, Inc.

Adi B. Godrej, *Massachusetts Beta '63*, top, has been elected president of the Confederation of Indian Industry. He is chairman of the 113-year-old Godrej Group, which he restructured to meet the challenges of globalization and achieve revenues of $2.6 billion. His brother, **Nadir B. Godrej,** *Massachusetts Beta '73*, is managing director of Godrej Industries, which focuses on agricultural and other areas of chemical engineering.

Deborah L. Grubbe, P.E., *Indiana Alpha '77*, has received the NASA exceptional public service medal. A consultant in safety culture to the *Columbia* shuttle accident investigation board, she was a member of the NASA aerospace safety advisory panel from 2003-12. Grubbe is owner and president of Operations and Safety Solutions, a consultancy focused on the improvement of hard and soft assets. From 2005-08, she was employed by BP in London where she was VP of group safety. Before BP, she spent 27 years at DuPont, where she was a corporate director.

Ronald S. Kane, Ph.D., P.E., *New York Eta '65*, has retired after 21 years as dean of graduate studies, emeritus, at New Jersey Institute of Technology, where he is an Advisor with New Jersey Gamma. Kane is a Fellow of ASME and of ASEE, and served in many leadership positions with them, as well as numerous graduate and minority education organizations and activities.

Robert D. Kersten, Ph.D., P.E., *Arizona Beta '49*, has been honored by the Pan American Association of Engineering Societies (UPADI) with the Pan American Golden Vector Award. This is given biannually to engineers selected from throughout the Americas. Kersten is now dean and professor emeritus at the University of Central Florida, and represents NSPE on the AAES Task Force on UPADI. This group is supporting the Engineering for the Americas Initiative, in cooperation with the Organization of American States.

Julia G. Lyon, *Arkansas Alpha '12*, was recently recognized by the White House's Campus Champions of Change Challenge. She was one of five winners and attended a White House event. Lyon is student president of the University of Arkansas' Full Circle Food Pantry. She will be attending medical school this year.

National Academy of Engineering Council

Arnold F. Stancell, Sc.D., *New York Eta '58*, top, has been re-elected to a second term on the NAE council. He is a retired vice president of Mobil Oil and professor emeritus of chemical engineering at the Georgia Institute of Technology.

G. Wayne Clough, Ph.D., P.E., *Virginia Beta '64*, secretary of the Smithsonian Institution, retired from the council after four years' continuous service.

"THE BEST PEOPLE" ENGINEERING JOB BOARD

Through a partnership with JobTarget, Tau Beta Pi has a state-of-the-art job board. Members can post resumes, browse over 1,700 engineering jobs, faculty positions, and internships, and employers may browse resumes.

New opportunities are posted on our home page daily and a full list of openings are available by visiting *tbp.org/pages/ForMembers*.

POWERED BY JOBTARGET

Established in 2006, the Tau Beta Pi-McDonald Mentor Award celebrates excellence in mentoring and advising among educators and engineers who have consistently supported the personal and professional development of their students and colleagues. It recognizes those who have shown true concern for individuals, supported an environment for developing talents, and earned respect and recognition for their contributions to their field and the greater community.

2012 TBΠ-MCDONALD MENTOR

Dr. Derrick K. Rollins

For his outstanding success in mentoring engineering students, **Dr. Derrick K. Rollins,** *Iowa Alpha '79,* is the 2012 TBΠ-McDonald Mentor. He is professor of chemical and biological engineering, and professor-in-charge of community based recruitment and transition, at Iowa State University.

Dr. Rollins received his B.S. in chemical engineering from the University of Kansas, two master's degrees in chemical engineering and statistics, respectively, from The Ohio State University, and a Ph.D. in chemical engineering from Ohio State. He spent time working in industry for DuPont before joining academia.

Dr. Rollins joined the faculty at Iowa State in 1990. He is an outstanding teacher, educator, and researcher. His research focus is on bridging the gap between chemical engineering and statistics to emphasize statistical methods of quality control of practicing engineers.

As an advisor, he has served 35 graduate students, more than 130 undergraduate research students and 50 summer interns, and as a faculty advisor to 11 campus organizations. A particular focus of his work has been encouraging and empowering women, minorities, and youth from disadvantaged groups to pursue and succeed in careers related to engineering and science.

His nomination statement declared: "Professor Rollins has consistently supported the personal and professional development of students, including Iowa Alpha members through the Iowa Alpha Scholars Program. He has given back to the community through his tireless efforts to help others in disadvantaged situations overcome the odds and succeed in life through education."

He has founded or co-founded several programs at ISU, including the LEAD program to promote the retention of minorities through pairing up with faculty members; the SPEED summer bridge program to help incoming underrepresented freshmen students become acclimated to life on campus, and the rigors of engineering study; and the establishment of a chapter for the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers at ISU.

His life of service has been recognized through several awards, including the prestigious mentor award from the American Association for the Advancement of Science, and the National Science Foundation Presidential Faculty Fellows Award.

He has also served as diversity advisor to the president's cabinet at ISU. At home, he is the proud father of five children: Adina, Cherise, Derrick, Diandra, and Janielle, and husband to wife Anita.

The chapter nomination concludes, "We believe that Dr. Rollins' leadership and commitment to assisting minority youth to pursue the study of science and engineering, his counseling and mentoring of engineering students both academically and personally, and his caring and unselfish devotion to helping students, friends, and associates makes him an outstanding candidate for this award."

Dr. Rollins' enthusiastic commitment has made him a leader and champion for the advancement of minorities in engineering education. For these contributions as an advisor and educator developing talented leaders and promoting the growth of students and faculty, Dr. Derrick K. Rollins is the 2012 Tau Beta Pi-McDonald Mentor.

The Tau Beta Pi Outstanding Advisor has been recognized every year since 1994. Selection is made by a national committee of deans of engineering colleges.

2012 OUTSTANDING ADVISOR

Dr. Abigail M. Richards

In recognition of service to her chapter and the Association, **Dr. Abigail (Abbie) M. Richards,** *Washington Beta '99,* is named the 2012 Tau Beta Pi Outstanding Advisor. An assistant professor and biological engineering program coordinator at Montana State University, she is Chief Advisor to the Montana Alpha Chapter.

Dr. Richards was cited in her nomination for her dedication to improving her chapter, recruiting qualified students, encouraging involvement with the Association on a national level, and mentoring students interested in the pursuit of learning and service to the engineering profession.

Dr. Richards received her bachelor's, master's, and Ph.D. degrees from Washington State University (WSU).

She joined the engineering department at Montana State University (MSU) in 2007. Previously, she was part of the Idaho National Laboratory biotechnologies department, a graduate researcher at the Universidad de Sevilla (Seville, Spain), and an NSF-IGERT Fellow at WSU. Her research focuses on the isolation and characterization of iron-chelating molecules called siderophores.

Leadership Transition

She has been Chief Advisor since 2008. After facing uncertain times with the transition of new leadership, Dr. Richards has instilled stability, confidence, and excitement in the chapter officers. After her second year as Chief Advisor, the MT Alpha chapter received the 2009-10 R.H. Nagel Most Improved Chapter Award.

In the fall 2011 semester, nearly 70 new members were initiated and another forty joined in the spring 2012 semester. In addition to supporting the growth of membership, Dr. Richards helped identify and work with the chapter to elect two additional faculty advisors for the chapter.

Dr. Richards strongly supports the Tau Beta Pi Engineering Futures program. Each semester, the chapter hosts two sessions, which Dr. Richards attends. Her encouragement of student members to apply for TBP fellowships and scholarships has resulted in four recent award recipients.

In the upcoming fall semester, the MT Alpha chapter plans to host its first ever social event, a barbecue and series of engineering challenges with the goal of raising awareness of the organization on campus in a fun and competitive setting.

"Above and Beyond"

Frequently demonstrating her excellent character and selflessness, she helped several Tau Beta Pi initiates with the fees needed to join the Association.

The chapter's nomination stated: "Dr. Richards deserves the outstanding advisor award because she goes above and beyond in every facet of her life. In addition to inspiring students to attain high academic standards, she has spent endless hours coordinating with the college of engineering to establish the importance of our engineering society.

"She has maintained this significant interface, and Tau Beta Pi has become an extension of the college itself. She has done an excellent job fostering leadership and filling an advisory team that is likewise supportive of the Association and its mission."

In recognition of her efforts to improve the image of the student chapter and the Association, numerous contributions as a mentor and leader, and talent for motivating students and promoting excellence in engineering, Tau Beta Pi hereby recognizes Abigail (Abbie) M. Richards as the 2012 Tau Beta Pi Outstanding Advisor.

DISTINGUISHED ALUMNUS

The Association wishes to recognize alumni who have demonstrated integrity, breadth of interest both inside and outside engineering, adaptability, and unselfish activity as cited in our Eligibility Code and who have fostered a spirit of liberal culture on local, national, and/or international scales. Their personal qualities of excellence and leadership serve as examples to influence the professional careers and lives of our collegiate members.

Any individual member or any ΤΒΠ chapter may nominate any alumnus member, except an Association official. There is no limit on the number of nominations—only minimal information is required in the nomination. Submit to the Executive Director (tbp@tbp.org) by February 1. See *www.tbp.org* for details on the Distinguished Alumnus Award.

ACHS ADVISOR GRANTS

Tau Beta Pi is a founding member of the Association of College Honor Societies. ACHS offers grants to Chapter Advisors interested in facilitating a project related to social responsibility. The goal of the program is to encourage cross-campus collaboration and new initiatives among student organizations related to social responsibility.

Six $500 grants are available this year, and proposals must be received by October 15, 2012. Student members who are interested in this program should work with their chapter advisor to submit a proposal. More information is available at the ACHS website, *www.achsnatl.org*.

NEW MEMBER BENEFIT

Tau Beta Pi has added a new travel benefit for members and their families. Through a partnership with Local Hospitality, Inc., members now have access to a worldwide inventory of hotels at exclusively discounted rates. Take advantage of average savings of 10-20 percent anytime at any hotel. Visit *www.tbp.org* to find out more information.

Star Trek Comes Back to Earth

Powered by a $10 million X Prize, researchers believe the TV show's tricorder diagnostic device may soon reach a hospital near you

by **Alan S. Brown**

ANYONE WHO watched *Star Trek* surely remembers the tricorder. The show's doctor, McCoy, would wave it over a patient (or pull out a sensor wirelessly connected to the tricorder) and come back with a complete diagnosis.

Today, *Star Trek's* tricorders look a little clunky. A typical smartphone is slimmer and has a larger display. It also has Bluetooth wireless and touch screens, two technologies that were apparently unknown in the show's 23rd century.

Yet those tricorders packed a lot of diagnostic power into a very small package. Although *Star Trek* debuted nearly 50 years ago, the tricorder's functionality still feels like science fiction.

This is about to change.

In January, the X Prize Foundation announced a $10 million competition to build a real tricorder in little more than three-and-one-half years. The winner of the Qualcomm Tricorder X Prize will bring the same powerful diagnostics, now found only in hospitals and medical laboratories, to everyone from suburban moms and camp counselors, to ER doctors and isolated caregivers in developing nations.

The announcement generated enthusiasm as well as skepticism. Roughly 200 teams and individuals have already signed up for the competition. On the other hand, we're talking about waving a black box at a patient and coming back with a diagnosis. Does anybody do that at your local hospital?

X Prizes often spark incredulity. They are designed to encourage giant leaps, and their goals naturally arouse doubts. Similar skepticism greeted the $10 million Ansari X Prize for a private spacecraft. Many claimed the costs and technical hurdles were too high. Others argued that they just needed to reimagine technologies NASA had already pioneered.

Burt Rutan and Scaled Composites won the prize by doing just that in 2004. His SpaceShipOne took off from underneath its mother ship, just as NASA's *X-15* did 45 years earlier. Rutan built his craft by taking advantage of modern materials, engines, and electronics.

The tricorder could trace a similar arc. This is because many experts believe we already have the technology needed to build one.

Generations of *Star Trek* fans have marveled at the show's futuristic technology. This toy tricorder hinted at the science fiction.

Sotera's wireless vital signs recorders are already in use. They are early signposts on the road to tricorder technology.

"I think the pieces exist. The real question is how they are assembled together," said Don Jones, a vice president of global strategy and market development at Qualcomm Life. The company develops wireless technologies for health, fitness, and the life sciences. Its parent company, wireless infrastructure giant Qualcomm, is bankrolling the Tricorder X Prize.

In 2005, Jones founded the Wireless-Life Sciences Alliance (WLSA) to promote the use of wireless technologies in healthcare. The association addresses everything from regulatory and privacy issues to reliability and medical device networking standards. WLSA may not have had tricorders in mind, but it has helped define the infrastructure a tricorder might use.

"The tricorder is a metaphor for what we're all about," Robert McCray, the organization's current president, said.

Convergence

There is an almost palpable belief among experts that the tricorder is close to a reality. Ask why, and they are likely to mention "convergence." This is shorthand for the way many factors—powerful computer processors, data analytics, sensors, artificial intelligence, cloud computing, and smartphones—are reinforcing one another to change what is possible.

Convergence, however, is not just about technology. It includes healthcare economics. Almost everyone involved in the Tricorder X Prize believes that the U.S. healthcare system is broken and that putting medical information in people's hands might fix it.

Take, for example, emergency room visits. In 2011, the insurance company Excellus, estimated that 44 percent of

Bottom photo courtesy of Sotera / Top photo Ray Thompson

emergency room visits in upstate New York were unnecessary. Those visits cost $160 million to $215 million per year. Another survey by PriceWaterhouseCooper estimated the nation spent $16 billion nationally on unnecessary ER visits.

Should patients see their doctors instead? Not necessarily. The Wellness Council of America estimated that 70 percent of doctors' visits are not needed.

Wireless diagnostics could help people determine when to visit an ER or doctor by accurately assessing conditions. It is not hard to imagine a system that analyzes coronary data and calls an ambulance before a stroke or heart attack even occurs.

Insurance companies could save billions of dollars by avoiding unneeded visits and intervening before emergencies arise. By ensuring patients take their medication properly, they could save many billions more by properly preventing or treating illnesses.

The economics are so compelling, Scanadu, a startup competing for the Tricorder X Prize, believes insurance companies will one day underwrite the cost of wireless medical technology to avoid unnecessary costs.

If economics are providing the push for personal diagnostics, then technology has created the pull. When Jones and McCray founded WLSA in 2005, most members envisioned linking wireless sensors with dedicated medical devices powerful enough to capture, analyze, and communicate sensor output.

That changed two years later when Steve Jobs unveiled Apple's iPhone. An explosion of apps followed. Many are now health-related, monitoring calorie intake, tracking daily jogs, taking pulses, and using AI to diagnose symptoms.

Apps are limited by phone memories and processors. Move the application to a server in the cloud and the possibilities are limitless.

Database In The Cloud

"Separate the box—the brains of the application—from the sensor, and you can make sensors small, light, and cheap enough to deploy broadly. Once you get that sensor data into the phone, it can send it to a database in the cloud, where it can be crunched and all the actionable items extracted," McCray explained.

The ability of the cloud to store and mine massive amounts of data will enable future diagnostic apps to do more than warn about heart arrhythmia, respiratory problems, infection, or fever.

What visionaries really want to do is to aggregate data from millions and even hundreds of millions of individuals. They will then mine it with learning machine software, which, like an autistic savant, randomly seeks correlations between different types of data to unearth patterns.

Predictive Medical Technologies, a San Francisco startup, has used this approach to generate powerful models that predict heart attacks or respiratory failure within 24 hours. Developed for hospitals, it mines patient lab reports, monitor output, nurse notes, blood tests, and other factors for warning signs. It is easy to imagine a similar cloud-based service.

It will take a body-wide network of sensors to pull this off. Surprisingly, the network infrastructure already exists. It is the Medical Implant Communication Service (MICS) band, which was originally developed for pacemakers and other implants.

"The bands were recently expanded to add on-body as well as in-body sensors. It's an internationally accepted standard, and a cornerstone on which we can build," Jones said.

Several small companies have already received Food and Drug Administration approval for wireless products connected to dedicated medical devices. These include Dexcom's glucose meter, Corventis' wearable electrocardiogram (ECG) device, and Sotera Wireless' vital signs monitor.

"These were concepts we talked about five years ago, prototypes three years ago, commercial products within the past two years, and now in clinical use," Jones said. The next step, he believes, will be to connect those sensors to apps using Bluetooth, which is cheap, energy efficient, and connects to virtually all smartphones.

Multiple Ideas

It was the growth of all those technologies that caught the X Prize Foundation's attention in 2010. "We were trying to think of how these different strands fit together. Someone mentioned the tricorder, and that concept seemed to bring together these multiple ideas," said Eileen Bartholomew, the organization's vice president of prize design.

Once she outlined the concept, she went looking for funding. Qualcomm was a natural. In addition to funding the prize, Qualcomm also underwrote the intellectual legwork needed to define the prize's sweet spot, where it could make a difference in technology development.

"For the tricorder, it was about advancing consumer-oriented tools that can predict and help manage medical conditions and also compile medical information," Bartholomew said.

In practice, this means the winning team must diagnose

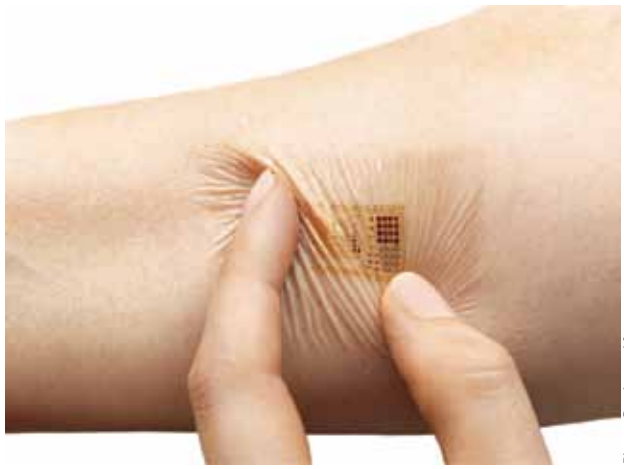


Photo Credit: mc10

The next generation? New and advanced technologies may not resemble their classic science fiction counterparts. For example, mc10's adhesive diagnostic systems flex and bend.

a set of 15 distinct conditions over three days. The diagnoses must be accurate, and the tricorder itself must be simple enough for a consumer to use without extensive training. Also, it must weigh no more than 5 pounds.

The foundation chose 15 conditions that push the limits of sensor technology and integration. These range from anemia, diabetes, thyroid irregularities, and sleep apnea to urinary tract infection, strep throat, and leukocytosis. They also include such life-threatening conditions as melanoma, atrial fibrillation, and chronic obstructive pulmonary disease (COPD).

The tricorder must also identify metabolic abnormalities, determine the absence of disease, and continuously monitor and log five vital signs, including heart electrocardiogram and oxygen content of the blood. Finally, it must diagnose at least three "elective" conditions that it choses for itself.

This is an impressive set of capabilities. To meet them, the winning tricorder must integrate a diverse set of sophisticated sensors and supporting technologies. Fortunately, researchers appear up for the challenge.

One example is the wireless flexible sensors developed by mc10 of Cambridge, MA (see pictures). Scarcely thicker than the plastic film used to transfer temporary tattoos to a child's arm, they attach directly to the body like a smart Band-Aid. They can sense changes in the body or accept data from other sensors and retransmit the information to a medical device or app.

At first glance, they look like flexible printed circuits. On closer inspection, they contain processing units, memory, sensor elements, a battery, and Bluetooth connectivity.

"Our adhesive sensors have all the components needed to build complete systems," said Kevin Dowling, mc10's vice president of research and development. Dowling likes to talk about freeing electronics from the tyranny of the wafer. "We're wrapping electronics in new form so we can put them on or in the body. They are designed to stretch and bend," he said.

Near right and opposite page: Flexible circuits adhere to the skin like band-aids, but behave like sophisticated medical instruments to monitor and communicate vital signs.

Photo Credit: mc10

This is not an easy thing to pull off. Granted, the thinner a material, the more flexible it becomes. This is true even for glass and brittle silicon. Yet to make its flexible sensors work, mc10 had to develop a new library of unusual structures—spring-shaped metals, buckling interconnects, silicon microribbons—to handle the body's full range of motion.

Dowling deposits the circuits on the top of conventional silicon wafers. He then grinds or etches away the bottom of the wafer until only a 20-micron-thin sliver is left, and transfers this to an adhesive-backed flexible plastic film.

While these chiplets are measured in fractions of a millimeter, Dowling can combine them to form flexible circuits that pick up electrical activity over large areas of the body.

"We can measure things we've never measured before, like electronic currents as they race across the surface of the heart. We can start to think about creating large arrays, and use strain-induced changes in the resistivity of the circuits to measure forces," Dowling said.

Dowling thinks his sticky sensors will prove popular with people who require medical monitoring, since they are unobtrusive and wireless. He is also teaming with Medtronic, a major medical device company, to create smart stents that can determine the effectiveness of heart surgery.

"We can add electronics to medical instruments any time someone needs in situ measurements, or use the electronics to help deliver medicine," Dowling said.

Chip-sized Laboratory

Others are working on similar, if larger, wearable sensors. Some may include a microelectromechanical system (MEMS) accelerometer to measure respiration, blood pressure, and heart rate. Others could use microneedles to draw tiny amounts of blood for analysis on a chip-sized chemical laboratory called (surprise) a lab-on-a-chip.

These sensors all involve contact. That may feel like cheating. After all, *Star Trek's* McCoy just had to wave his tricorder over a patient to get a diagnosis. The good news is that tricorder contestants have several powerful non-contact technologies they can work with.

One is simple visualization. Since primitive times, healers have relied on their eyes to diagnose certain problems. Smartphone cameras and AI software could do something similar, such as analyzing photos to identify skin cancer or strep throat. Add a wireless microscope and perhaps it could count white blood cells to check for anemia. More intriguing is hyperspectral imaging. Originally developed for NASA earth observatories, it captures hundreds of different spectra from a single image. Software could then analyze the data to determine the severity of wounds, burns, and infections; check the likelihood of ear and throat infections; and test for diabetic retinopathy, macular degeneration, and other eye diseases.

Thermography, which uses infrared sensors to measure heat distribution, has been used to take temperatures

and detect excess heat generated by breast cancer for more than 50 years. Airports used it to screen passengers for atypical pneumonia during the SARS scare. It could check for influenza and bronchitis as well. By imaging blood vessels in the head, neck, and limbs, thermography could warn of stroke or deep vein thrombosis.

Lasers have attracted attention. Holy Cross University and the Naval Research Laboratory used a laser Doppler vibrometer to measure heart rate and blood pressure by clocking the speed of pulsing blood. At Princeton University, mid-infrared lasers measure blood sugar levels and diabetes by scanning the skin. Other Princeton researchers use lasers to detect exhaled nitric acid and ammonia to monitor asthma and kidney function.

There are many technologies to choose from. The challenge will be combining them in ways that monitor all the required conditions and vital signs in a device that weighs less than 5 pounds.

Then there are the optional conditions. A tricorder team could opt to merely add on three other diseases. Or it could try creating an entirely new type of medical service.

They could start by calling **Dr. George M. Savage,** *Massachusetts Eta '81,* chief medical officer of Proteus Digital Health of Redwood City, CA. His company makes edible circuits that can be taken with medication. Once in the stomach, the circuit signals that it has been swallowed. When used with an oral medicine and a smartphone app, it could track when patients take their medication, send reminders when they do not, and warn doctors if they go off their meds.

Photo Credit: mc10

Compliance may not seem like a problem worthy of *Star Trek* technology, but Dr. Savage disagrees. He argues that FDA approves all drugs only after they are tested under controlled conditions. This shows their absolute theoretical capabilities. Unfortunately, this is not how they are used in the real world.

"Half of all medicines are not taken correctly or not taken at all. This is especially true for people who are really sick and taking a lot of medicines," Dr. Savage explained.

Proteus' roadmap for the future calls for a tiny radio transmitter in each pill to turn on when the pill is ingested.

Photo Credit: Proteus Digital Health

This presents problems for doctors. "They see the patient is not looking good, but they are not sure if it's because of how the patient is taking the medication, the effectiveness of drug, or something else entirely."

Monitoring compliance could answer their questions objectively. Equally important, by clocking when a patient takes a pill and monitoring vital signs, it becomes possible to measure exactly how a medication affects an individual. This opens the door to truly personalized medicine.

"We want to create an objective, informative system to help patients and physicians make better recommendations based on a real understanding of what's going on," Dr. Savage added.

The thinking behind the sensor is a clever twist on wireless technology. It is made primarily from silicon and copper, two nontoxic materials, and encapsulated. The micron-scale chip is big enough to hold 5,000 transistors and a radio transmitter, yet small enough to fit inside a capsule or pill.

Potato Battery Projects

For power, Proteus' technology has more in common with science fair potato battery projects than high-tech electronics. Two dissimilar metals stick out of the chip. When they contact stomach acids, the redox reaction between them generates enough power to activate the chip. Using voltage modulation, each chip broadcasts its unique code to a wearable patch receiver that can retransmit the data to a medical device or smartphone.

This past August, the Food and Drug Administration approved the sensor's use in a capsule that can be taken with medicine. Proteus has applied for approval of the sensor in capsules that contain medication.

Proteus' ingestible sensor opens an entirely new way

of doing medicine. So do mc10's flexible sensors, as well as the non-contact sensors under development in labs around the world.

Despite all these new technologies, the winner of the Tricorder X Prize will have to overcome many hurdles. On the technical side, no one has ever combined so many different sensors into a single device, much less one that is affordable, easy to use, and lightweight.

Others worry that potential glitches in apps could cause the healthcare equivalent of a stock market computer trading meltdown. Privacy advocates worry about massive amounts of personal medical information floating around in the cloud, and whether it could be used by insurance companies to set rates or by employers to make hiring decisions.

Profoundly Democratic

Medical technologies have always been highly regulated. Yet the tricorder is profoundly democratic. It will ultimately give anyone with a smartphone more access to medical information than the best hospitals had two decades ago. Who knows where that will lead?

And that is the point, Bartholomew said. "We're starting with diagnosis, but one day it may help manage diseases. It may one day be as ubiquitous as your phone. No one imagined how smartphones and apps would evolve. The tricorder is going to live and breathe with you, and it will also evolve."

Like many people in the United States, she believes the national healthcare system is broken. Unlike nearly everyone else, the X Prize Foundation is not trying to fix the system by improving its components.

"We don't give a damn about the system as it is now. We're working from the outside in," she said.

Graphic courtesy of Sotera

This graphic shows how today's wired "tricorder" technology could be put into use. Tomorrow's technology will scan vital signs without contact.

Photo courtesy of NUVANT

This PiiX wearable device, above, from NUVANT MCT/ Corventis can monitor vital signs while concealed beneath clothing, below.

Photo courtesy of NUVANT

Alan S. Brown has been an editor and freelance writer for more than 30 years and lives in Dayton, NJ (**insight01@verizon.net**). A member of the National Association of Science Writers and former co-chair of the Science Writers in New York, he graduated *magna cum laude* from New College at Hofstra University in 1974. He is an associate editor of *Mechanical Engineering* and contributes to a wide range of engineering and scientific publications.

ENGINEERING FUTURES GOES INTERNATIONAL

I had the privilege of facilitating an Engineering Futures (EF) session at Texas A&M's Doha, Qatar, campus on April 27-28, 2012. It was the first EF session presented outside the United States.

In the more than twenty years that the EF Program has been in existence, our volunteer Facilitators have introduced thousands of students across the United States, from Fairbanks, Alaska, to Mayaguez, Puerto Rico, and every state in between, to the non-technical skills they need to be successful. The program comprises five modules: Interpersonal Problem Solving, Team Building, Planning and Conducting Effective Meetings, Problem Solving in a Team Environment, and Effective Presentations.

Members of the Texas Delta at Qatar Chapter participate in the tower building exercise as part of the Team Chartering module.

At the 2011 Convention, I was asked by the then president of the newly-established Texas Delta at Qatar Chapter (TX Δq), Anas I. Al Bastami, if it would be possible to present an EF session in Doha. I told him that it would not be feasible to send a Facilitator to conduct a single session but we could possibly organize a "marathon" session where we present all five modules over a two-day period.

Over the ensuing weeks Al Bastami, Hamid R. Parsaei Ph.D., the chief advisor to TX Δq, and I negotiated a schedule and cost-sharing agreement for the session.

After a 17-hour flight from Seattle via Amsterdam, I arrived on the evening of April 26 and was met at Doha International Airport by Dr. Parsaei. We went directly to the student center to attend an awards banquet where I was welcomed by Mark H. Weichold, Ph.D., the Dean and CEO of Texas A&M University, Qatar, and several members of the faculty and staff.

The EF session started the following morning. Twenty-one students participated in a very successful session that spanned all day Friday and Saturday. The schedule was interrupted on Saturday due to an unplanned inspection of the fire suppression system in the building, but we were able to adjust accordingly.

After the session, on Saturday evening, the chapter conducted its initiation, and I had the honor of participating in the ceremony that brought 16 new members into the Association.

The first international EF session was extremely well received by the participants, and negotiations are already underway for another session in 2013.

—**Russell W. Pierce**, *WA A '70*
Director of Engineering Futures

GIVING BY ALUMNI DECLINES—INCREASE IN BEQUESTS

Generous Tau Bates Gave $881,896 in the annual giving program during the year that ended July 31, 2012. The average gift from 11,082 donors was $80.12, the second-highest figure to date. Total giving fell by 6 percent in this year of economic uncertainty. In 2010-11, 11,460 donors gave $938,409 for an $81.89 average gift.

Included in these figures is $37,430 allocated to the Fellowship and Scholarship Programs from the 234 companies and foundations that match gifts made by their employees to ΤΒΠ.

Additionally, a gift of $14,000 was received from GEICO to support the Engineering Futures Program. Generous bequests were received from the estates of **Charles O. Forge,** *CA Γ '56,* for $268,000; Kathleen A. & **Robert D. Sickafoose,** *IL B '50,* for $448,000; **Charles M. Webster,** *OH B '50,* for $10,000; and Arline I. & **Jack B. Hart,** *ΣΤ Φ '43,* for $2,500.

Contributions from alumni are used for Fellowships, Scholarships, and the Engineering Futures, K-12 MindSET, and Laureate Programs, training chapter advisors at the Convention, visits by ΤΒΠ officers to chapters, and for supporting ΤΒΠ. The giving program began in 1963-64 when $7,860 was contributed. Cumulative gifts since 1963 have reached $23 million.

Tau Beta Pi received its first bequest in 1963 from **Henry B. Evans,** *PA A 1893,* who was ΤΒΠ's first President in 1895-96. The cumulative value of bequests and capital gifts is now $12,540,000. These gifts have been used to establish the following named scholarship and fellowship funds: M. Anderson Fellowship, D.L. Arm Fellowship, Best Fellowship, Deuchler Fellowship, C.R. Dodson Fellowship/Scholarship, C.O. Forge Fellowship, E.P. Hanley Fellowship, Stark Fellowship, M.U. Zimmerman Jr. Fellowship, Alabama Power Scholarship, H.M. Alford Scholarship, E.E. Althouse Scholarship, R.A. Curtis Scholarship, C.O. Forge Scholarship, L.E. Record Scholarship, R.D. Sickafoose Scholarship, A.C. Scribner Scholarship, V.A. Stabile Scholarship. Together with funds invested to support other ΤΒΠ programs, they generated $406,000 in earnings used for activities of the collegiate chapters.

During the year, ΤΒΠ received $183,000 from an irrevocable trust restricted to Fellowships or Scholarships—left to ΤΒΠ by the late **William Fife,** *CA A '21.*

Profiles in Leadership #1

Maria M. Klawe: Welcoming the Excluded

Battling early ostracism and prejudice against women becoming mathematicians or computer engineers, Maria M. Klawe, Ph.D., California Omega '73, achieved both—and now heads a college dedicated to nurturing all undergraduates to fulfill their potential

by **Trudy E. Bell**

"I WAS MY FATHER'S SON," declared Maria Klawe, president of Harvey Mudd College, a small private undergraduate college of engineering, science, and mathematics in Claremont, California, 35 miles due east of Los Angeles. Born in 1951 in Toronto, Canada, the second daughter of four girls, she recalls "society in the 1950s was so highly gendered that I was convinced I'd grown up in the wrong body. I used to go to sleep every night praying to wake up the next morning as a boy."

"Both my parents thought I was extraordinarily gifted, which was hard on my sisters," Klawe continued. She loved the arts—a safe choice for girls in the 1950s and early 1960s—and began painting in oils and acrylics and later watercolors, a lifelong avocation. But she also loved the sciences, and mathematics came with ease. The dark side of her talents and self-image conflicting with stereotyped gender roles, however, was that she felt lonely and isolated from both boys and girls.

By the late 1960s, when Klawe entered the University of Alberta, the hippie movement was in full swing, with its emphasis on social relevance and political action. "I couldn't figure out how math could make the world a better place," Klawe recalled. So Christmas 1970, halfway through her third year toward an honors degree, she dropped out of the university and went to live with a Yale dropout. In summer 1971, the pair headed overseas, hitchhiking from Scotland to Venice, taking trains and buses through Turkey and Iran, lingering a month in Afghanistan, and bumping along in a donkey cart from Pakistan to India. There they got married and settled for six months. "We lived on 25 cents per day, experimenting with different cultures," Klawe recounted.

In India, Klawe found herself craving mathematics—

What does it mean to be a leader? A successful leader sees what needs to be done and is willing to make tough decisions. Anyone can sail in calm seas and fair weather. It is one who can navigate through storms with crew and cargo safe that people recognize as a true captain. In this new series, *Profiles in Leadership,* Tau Beta Pi is exploring the essence of leadership through the lives of eminent engineers who have attained leadership positions in their respective fields. Each has journeyed to insight through a unique series of challenges, opportunities, accidents, serendipity, stumbles, and personal gifts—which also shaped their drive to help and guide others. This series of profiles highlights the individual backstories of acknowledged leaders, distilling their discoveries and convictions.

Klawe interviews Microsoft founder Bill Gates during his visit to Harvey Mudd and Pomona College in southern California in March 2011. Klawe has served on the board of Microsoft since 2009.

playing chess daily and buying recreational math books. Realizing finally that she was unwilling to give up math, she returned to the University of Alberta in fall 1972. After finishing her bachelor's degree in May 1973, she went straight on to grad school at Alberta, earning her Ph.D. in mathematics in 1977, and getting divorced in 1978. Hearing of booming job opportunities in theoretical computer science, she enrolled at the University of Toronto, one of the three best programs in the world (along with Stanford University and the Massachusetts Institute of Technology). By summer 1979, she was named assistant professor at Toronto.

That fall, a young hotshot theoretical computer scientist named Nick Pippenger from IBM Research in Yorktown Heights, New York, flew to Toronto to give a colloquium at the university. "He was extraordinarily shy, extraordinarily bright, and extraordinarily nice," she recalled. The two young mathematicians rapidly developed a long-distance romance, flying between Toronto and New York every week or two. When they announced their engagement, "IBM Research was so afraid of losing Nick that they made me an offer to join either Yorktown Heights or a new theory group in San Jose." Klawe and Pippenger married in May 1980 and moved to California in July.

Relations Had Deteriorated

"At first, I did not realize how little value my manager put on me as a woman," Klawe reflected. "I could have been anyone, and he would have hired me to keep Nick." By 1984, relations with her manager had deteriorated so bitterly that Klawe started her own research group in discrete mathematics. In 1985, she was promoted to head all mathematical research within the computer science division at what became the IBM Almaden Research Center—leading what was regarded as one of the three best theoretical computer science research groups in the world and becoming manager of her former manager.

Ultimately the two became lifelong friends. At the time, however, the confrontation with gender discrimination left Klawe both angry and thoughtful—and led her to discover a major goal. "I began to wonder: How can we build institutions and groups to create a culture within science and engineering to nurture all people, beginning with undergraduates?" She began thinking about returning to academia.

Committing to Shared Values

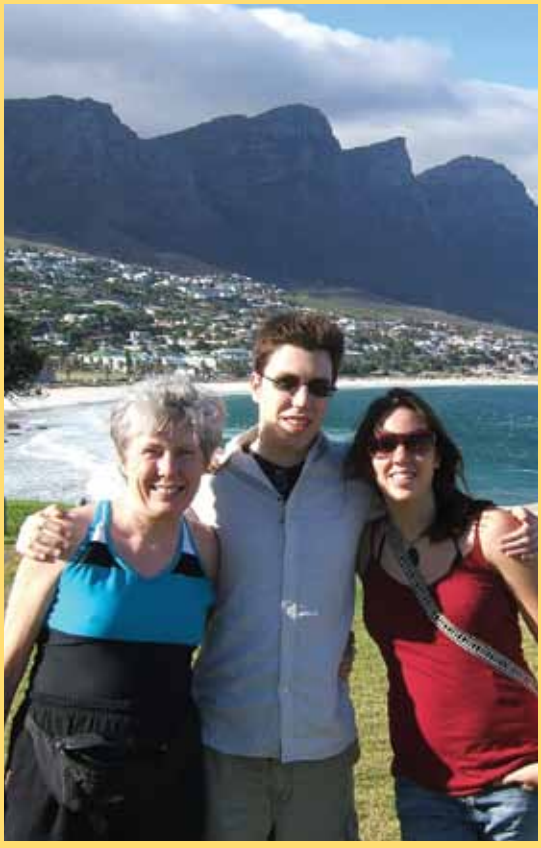
By 1988, among the shower of offers that Klawe and Pippenger had received from IBM Almaden, DEC Research in Cambridge, Mass., the University of Texas in Austin, and the University of California at San Diego was one from the University of British Columbia in Vancouver, Canada. "Of all the options, UBC paid the least, and had only an annual budget of only $4,000 for computers for the entire department," Klawe recounted. "Then Nick said, 'We claim to be idealistic. Maybe we should make the idealistic choice and do what nobody in their right mind would do.' "

So they went to UBC. Although Vancouver was a safe, child-centered city with great schools—"a fabulous place to

Klawe speaks in her office in front of one of her own paintings, showing daughter Sasha with a friend's baby. *Photo: Trudy E. Bell*

This Leader In Brief:

Full professional name: Maria Margaret Klawe
Current position: President, Harvey Mudd College
Birthplace: Toronto, Canada
Highest degree: Ph.D., University of Alberta, 1977, Mathematics
Major career highlights: Manager of Mathematically Related Computer Science, IBM Almaden Research Center, 1985; Head of Computer Science, University of British Columbia (UBC), 1988; Vice President, Student and Academic Services, UBC, 1995; Dean of Science, UBC, 1998; Dean of Engineering, Princeton University, 2002; President, Harvey Mudd College, 2006
Board memberships: Microsoft Corp. since March 2009; Broadcom Corp. since May 2011. "Serving on the boards of leading tech companies is extremely interesting, plus an excellent opportunity to increase the visibility of Harvey Mudd College."
Honors: Ten honorary doctorates; Fellow of American Association for the Advancement of Science (AAAS), Association for Computing Machinery (ACM), and the Canadian Information Processing Society; Awards include *Wired* Woman Pioneer (2007) and A. Nico Habermann (2004). Initiated into Tau Beta Pi as an Eminent Engineer (2007).
Greatest accomplishments: "Building the computer science department at UBC, creating strategic visions at Princeton and Harvey Mudd."
Family: Husband Nick Pippenger; son Janek Klawe; daughter Sasha Pippenger
Hobbies: watercolor painting, running, kayaking, hiking, reading, skateboarding, electric guitar
Favorite books: *Anathem* by Neal Stephenson; *The Black Prince* by Iris Murdoch; *The Blind Assassin* by Margaret Atwood
Personal motto: "If I'm not failing, I'm not aiming high enough."
If you could do one thing over again: "I wouldn't take the vice presidency at UBC because it absorbed too much of my attention and energy while Sasha was becoming a teenager."



Top: Klawe conversing with engineering and science undergraduates at Harvey Mudd. Middle: Klawe with son Janek and daughter Sasha in Cape Town, South Africa, during Sasha's semester at the University of Cape Town. Bottom: Klawe with her husband, fellow mathematician and computer scientist Nick Pippenger, while waiting for a ferry in British Columbia.

grow up" for their two children—at the university, "funding, salaries, and facilities were not competitive. If we were going to attract new faculty to build a great department, we would have to get creative." Klawe and her colleagues committed themselves to four core values in recruiting faculty: to hire people who 1) were outstanding researchers, 2) cared deeply about teaching, 3) were excited to join a team building a world-class department, and 4) valued a workplace where all faculty, staff, and students were supported. With those four values front and center, Klawe figured potential faculty "will self-select."

The approach was even more successful than anyone anticipated. "In five years, we hired 15 faculty, doubling the graduate program, tripling the research program, and getting a new building. When I left after six and a half years as department chair, we had 30 faculty. Now there are well over 50. Best of all," Klawe added, "those same four values still drive the department today." From that longevity, she reached two further discoveries about leadership: "You have to be very clear about your values. And for an institution to be self-sustaining, the values must be something communal that everyone shares."

In early 1995, Klawe became UBC's first female vice president. She had two objectives: to make all students university-wide feel as valued as they did in the computer science department, and to network the entire campus so that everyone who needed access to a computer could get it. In fall 1998, she became dean of science, and set out to increase the number of female faculty members in the sciences, who then numbered under 10 percent (only 24 of 285). The rest of the university was fully behind the aim: indeed, UBC became a leader in finding ways to hire couples. By late 2002, the number of female science faculty had doubled to 48, including in traditionally male departments such as mathematics, physics, chemistry, and computer science.

Tactics for strategy

In January 2003, Klawe became dean of engineering at Princeton University, which had just named a new president committed to encouraging women in science and engineering. She was charged with creating a strategic plan for making Princeton's engineering school one of the top in the world. Klawe felt "we needed to engage all faculty, staff, trustees, alumni, and students so the plan would be embraced by everyone." Over 90 percent of Princeton's faculty participated in one or more day-long workshops to chart the future of the school. All discussions were published on the web, as were the many drafts of the eventual plan, encouraging input from the entire community. The open approach was enthusiastically received: "the strategic plan 'Engineering for a Better World: The Princeton Vision' is still driving the school forward today."

In 2005, Klawe was approached by a search firm seeking a new president for Harvey Mudd College. Having so recently arrived at Princeton, neither Klawe nor Pippenger wanted to leave. Eventually, the firm flew them to Claremont to meet Mudd students and faculty. "They were phenomenal—unlike any I've met anywhere else," Klawe exclaimed. "Both are simultaneously very bright and very

humble—there is no arrogance. The faculty are committed to being the best science and engineering teachers on the face of the earth, and the students are committed to being the best learners on the face of the earth." Those explicit commitments, the legacy of the school's founding president, Joe Platt, "make the college an extraordinary learning community."

After Klawe joined Mudd in 2006, the community developed a strategic vision using a process similar to the one at Princeton. One of the vision's six themes is "Unsurpassed excellence and diversity at all levels." In 2006, 30 percent of the students and faculty were female. Today (2012), 40 percent of the faculty and over 45 percent of the students are female. More impressively, 40 percent of the computer science majors are female, up from 10 percent in 2006.

Encouraging Students

Klawe is focusing now on encouraging students of color, especially African-American students. That is a challenge for all science and engineering colleges: even today, only a small percentage of African-American students nationwide graduate from high school with both an interest in science and engineering and a level of preparation that would allow them to succeed at a college such as Mudd. Thus, Klawe and Mudd actively participate in pre-college STEM preparation programs such as Math for America, the Claremont–Long Beach Math Collaborative, and Homework Hotline. She has recruited African-American leaders in science and engineering to advise the college, which has launched several new initiatives. They include Future Achievers in Science and Technology (a program for bringing high-achieving students from under-represented groups to Mudd for a weekend) and the President's Scholars Program (which provides full tuition each year to several incoming students who both demonstrate exceptional leadership ability and increase the diversity of the student body).

"I want to change the culture of science and engineering to be supportive of all people" regardless of gender, ethnicity, or background, Klawe declared. Recalling her own early-career battles against gender discrimination, she affirms: "It doesn't matter what you look like. What matters is what you have to contribute."

Trudy E. Bell *(t.e.bell@ieee.org, www.trudyebell.com)* is a former editor for *Scientific American* and *IEEE Spectrum,* and earned an M.A. in the history of science and American intellectual history. The author of *Weather* (part of the Smithsonian Science 101 set, HarperCollins 2007), lead writer for the IEEE's millennium book *Engineering Tomorrow: Today's Technology Experts Envision the Twenty-First Century* (IEEE Press 2000), and author of 10 other books and 450 articles, she is senior writer for the University of California High-Performance AstroComputing Center.

Silent Kayaker

Art Was Kept 'In The Closet'

"I took a number of fine arts courses while in university but was quite discouraged by the attitude of the faculty toward students majoring in science (they felt science students shouldn't be allowed in courses for those majoring in fine arts). As I became a professional mathematician and then a computer scientist, it became clear that also being an artist would diminish my credibility (already in question because of being female), so I kept my painting secret. When I turned 40, I decided to come out of the closet, and I hung several of my paintings in my office as well as in my home."

Play

Reassembly Required

2012 LAUREATES

Five Laureates have been selected in the 31st year of Tau Beta Pi's annual program to recognize gifted engineering students who have excelled in non-technical areas. Award categories include arts, athletics, diverse achievements, and service. The Laureates join 79 other outstanding Tau Bates who have been cited since the program began in 1982. They will be honored during ceremonies on September 29, 2012, at the 107th annual Convention in Lexington, KY, where they will each receive a $2,500 check and a commemorative plaque.

The Laureate Program was inaugurated to further Tau Beta Pi's second basic purpose as stated in the preamble to the Constitution: "to foster a spirit of liberal culture in engineering colleges." A committee of District Directors considered 15 nominees from 14 chapters.

Carl J. Kirpes

CARL J. KIRPES, *Iowa Alpha '12,* has been named a 2012 Tau Beta Pi Laureate for his diverse achievements. He graduated this year with degrees in mechanical and industrial engineering at Iowa State University. He demonstrated a breadth of involvement that ranged from being a varsity athlete on the ISU football team to authorship of a novel as part of his university honors program. He has made substantial contributions to departmental and residence hall groups, college of engineering and university organizations, as well as professional and honor societies. Contributions to the community included volunteering at the YMCA, and he has been recognized as the United Way youth volunteer of the year. Carl has been named to the dean's list each semester he has been a student, and has also been recognized as a high scholar athlete. He successfully applied what he calls "reflective leadership" as president of multiple student groups, team leader of undergraduate research projects, and as an applications engineer employed by a process engineering and management software company. Carl's leadership approach focuses on the achievement of team goals by empowering individual team members. He has made significant contributions to his chapter as an initiate small group leader and as a distinguished member. An early diverse achievement came at the age of 16, when his poem *River Run* received first place recognition in a statewide competition. He was described by a presenter of his senior award as being the epitome of a well-rounded ISU student.

Steven Limpert

STEVEN LIMPERT, *Arizona Beta '12,* is a 2012 Tau Beta Pi Laureate for his achievements in the arts. The electrical engineering graduate of Arizona State University is a nationally recognized jazz trumpeter and has excelled as a performer, composer, recorder, compiler, and publisher of music. During his time at ASU, Steven performed in more than 100 shows with a variety of musical ensembles, most notably the ASU Concert Jazz Band and the Bad Cactus Brass Band. Last year, Steven spent three months traveling around the world after winning a scholarship from the Circumnavigators Club Foundation to study the development and commercialization of solar energy technologies in six countries. As a committed student leader, he has served as president and industrial relations coordinator of the collegiate chapter of Eta Kappa Nu, the electrical engineering honor society. Steven has played an important role in organizing industry recruiting and educational outreach events for the ASU engineering community. As a leader in engineering and the arts, he excels in giving fellow students the opportunity to give back to the community. Steven revels in the formation and enrichment of communities which is inherent to the musical process, as individuals work together to perform as a single team. He was described by his chapter as displaying the spirit of insatiable thirst for knowledge and new experiences which is at the heart of fostering a spirit of liberal culture. They added that he is an exemplary individual who they believe embodies all the qualities sought in a Tau Beta Pi Laureate.

Jason D. Metzger

JASON D. METZGER, *Maryland Gamma '12*, was chosen a 2012 Tau Beta Pi Laureate for his achievements in the arts. He is an aerospace engineering graduate of The United States Naval Academy (USNA), where he was a Trident Scholar. This is a program where exceptional students engage in independent study and research during their senior year. He has always embraced the performing arts. At the age of 16, he voluntarily assumed the role of choir director at his church, planning the musical liturgy for each service, and leading weekly rehearsals and Sunday Mass. At the academy, all music and art courses are performed on a voluntary basis. Jason has been a member of the men's glee club since his freshman year. He served as president of the USNA Catholic Chapel Choir, as well as producer and show director of the academy's annual Halloween Concert for two consecutive years. He also was the president and producer of a winter musical production of *South Pacific* in his senior year. He served as the president of the Maryland Gamma Chapter of Tau Beta Pi during 2011-12. Jason becomes a leader in all of his activities, promoting the success of all participants and sharing his love of the arts with others. He was described as a team member who will not only make sure that the mission is accomplished but will also bring an individuality that enriches the experience.

Steven D. Prendergast

STEVEN D. PRENDERGAST, *Indiana Gamma '12*, is a 2012 Tau Beta Pi Laureate for his diverse achievements. Prendergast, who received his bachelor's degree in aerospace engineering in May from Notre Dame University, was selected for his contributions as a volunteer, researcher, and leader. An Eagle Scout and James L. Holloway Jr. Award winner, he has served in numerous leadership positions through the Naval Reserve Officer Training Corps at Notre Dame, including battalion commanding officer. He has been resident assistant in the residence halls on campus, and was a core band member and trumpet section leader, with the University of Notre Dame marching band. His research activities while at the university have focused on the nanoscale chemistry of uranium and its applications to the reprocessing of spent nuclear fuel in the energy frontier research center at Notre Dame. In addition to his activities through the Indiana Gamma Chapter, Steven has volunteered in the Salvation Army Band-Link program as an after school mentor, teaching underprivileged students in South Bend to read and play music. He has also served in the Trident Naval Society, helping to host fundraisers for charities like the Wounded Warrior Project. After graduation, he is committed to four years of active naval service, followed by four years in the reserves, planning to continue his studies at the Naval Nuclear Power School.

Kyle E. Zobeck

KYLE E. ZOBECK, *Indiana Delta '12*, is a 2012 Tau Beta Pi Laureate for his achievements in athletics. He is a mechanical engineering senior at Valparaiso University and plans to minor in mathematics. Last season, he led the men's soccer team to their first Horizon League Conference championship, was selected as a NSCAA 3rd Team Academic All-American, and was chosen first team All Horizon as a goalkeeper. Kyle has amassed more than 200 hours of community service while in college, volunteering for organizations such as the St. Baldrick's Foundation, for which he helped organize events to raise money for children's cancer research. This involved gaining support from local residents, businesses and students. He has also volunteered at the Grant Wood Area Educational Agency since 2005, packing and delivering science kits for local elementary and junior high schools. He enjoys promoting the game of soccer among young children as a volunteer coach at numerous soccer camps and clinics. Kyle has been selected as the team captain for his final year of varsity men's soccer and plans to pursue a career in professional athletics after graduation. He passionately enjoys soccer and believes in the importance of service to his community and promoting healthy lifestyles. Kyle's coaching has led more children to enjoy and appreciate athletics. He has shown his peers that amidst a busy course schedule, there is still time to participate in athletics and volunteer for the community. He values and fosters global experiences, possessing German language skills, and spent a summer interning at Jili Machine Co. Ltd., in Hangzhou, China.

EXECUTIVE COUNCIL MEETINGS

The Executive Council met in Orlando, FL, on June 8-9, 2012.

The Council enthusiastically voted one ΤΒΠ Superior Service Award and four Resolutions of Appreciation to retiring District Directors and Engineering Futures Facilitators.

Neal T. Bussett, *CA Ξ '09*, was appointed as a District 16 Director to a term ending June 2015. The Council reappointed as District Directors for 2012-15: L.B. Farrington, S.J. Houghton, A.M. Olenik, G. Youssef, R.L. Werneth, D.A. Stirm, E.S. Styles, S.L. Forkner, D.A. Kamat, M.T. Pittard, and T.M. Edgar.

Engineering Futures Facilitators D.J. Colbry, K.L. Colbry, S.C. Dao, S.V. Eckersall, S.E. Fable, W.A. Hillard, D.L. Himes, A.J. Pinkus, J.A. Sawyer, and D.J. Tyner were reappointed for 2012-15, and Y.C. Chang and R. Singhal were reappointed for 2012-13. S.V. Eckersall and D.J. Tyner were reappointed to the Engineering Futures Planning Committee (EFPC) for 2012-15, and G. J. Morales was appointed to the EFPC for 2012-13.

S.E. Fable, C.G. Gorzkowski, D.A. Kamat, B.A. Kramer, A.J. Passman, and A.J. Pinkus were reappointed to the Interactive Chapter Exchange (ICE) Committee.

Executive Director Gomulinski presented the preliminary budget for the 2012-13 fiscal year. The budget was approved as presented, including funding for catalog card scanning and infrastructure improvements.

A new fund to support the District Program was established. The Council allocated a gift from the Charles O. Forge estate to the General Fund. The Kathleen A. and Robert D. Sickafoose Scholarship Fund was established from the proceeds of a bequest left to the Association.

Councillor J.F.K. Earle, Ph.D., P.E., reported on MindSET activities including a booth at the USA Science & Engineering Fair held in Washington, D.C. A MindSET presentation will be made at the ASEE meeting in San Antonio. MindSET grants were approved for the *NY Γ*, *CA Γ*, *PA B*, *FL E*, and *MD B* Chapters.

A new member benefit from Local Hospitality Inc. to provide hotel booking discounts was approved. The Council rejected a different proposed member benefit.

Lisa Gascoigne and Ellen Styles, members of the Laureate Selection Committee, reported that their group had selected five ΤΒΠ Laureates from 15 nominees. The selection of Derrick K. Rollins, Ph.D., *IA A '79*, as the 2012 McDonald Mentor Award was accepted.

The scholarship program application deadline was moved to June 1.

Final arrangements for the June 9 meeting of national officials were discussed. Possible locations for the 2013 meeting were presented and forwarded to the national officials for final selection.

Funding for projects to be conducted in 2012-13 for *CA Γ* were approved.

The Executive Council met via teleconference on July 18, 2012.

Christopher F. Benson, *UT A '08*, was appointed as a District 12 Director to a term ending June 2015. James P. Sandman, *TX Z '11*, and Ryan C. Morrison, *UT A '10*, were appointed as Engineering Futures Facilitators to terms ending June 2013. Susan L.R. Holl, *CA Λ '76*, was reappointed to the Fellowship Board to a term ending July 2016, and Charles W. Caldwell, *CA A '64*, was appointed to the Fellowship Board to a term ending July 2014.

The report from the Outstanding Advisor Selection Committee to name Abigail M. Richards, Ph.D., *WA B '99*, as the 2012 Outstanding Advisor was accepted.

The Council reviewed and approved a final budget for 2012-13. Funding allocations for fiscal year include naming of an Arline I. and Jack B. Hart Scholarship and a Charles W. Webster Scholarship; $130,000 to the Engineering Futures Fund, $236,000 to the District Program Fund, and $33,000 to the General Fund from additional proceeds of the Kathleen and Robert Sickafoose estate; and $250,000 to the General Fund from the Charles O. Forge estate.

Plans for the 2012 Convention were reviewed, and a permanent Convention chair and Parliamentarian were appointed.

The Executive Council met in Orlando, FL, on August 4, 2012.

S.E. Fable and B.A. Kramer were appointed to the District Program Planning Committee to terms ending June 2013 and June 2014, respectively.

Councillor Pih summarized the discussions and decisions of the Trust Advisory Committee (TAC) meeting on July 26 in New York City. Members of the TAC were invited to attend the 2012 Convention. President Simonson reported on plans for a meeting of the Vision Development Group to be held in September in New York City.

The Council approved a proposal to allow scholarship candidates to check a box on the application form to release their information to graduate schools interested in recruiting Tau Beta Pi Scholars. The Fellowship Board was invited to the 2012 Convention and was requested to meet with the Council to discuss the Fellowship and Scholarship Programs.

Two member benefits proposals were reviewed, but no action was taken pending input from the Member Benefits, Image, and Insignia Convention committee. The TBPConnect/InCircle contract with Affinity Circles contract was not extended due to declining interest and redundant service offerings.

Plans for the 2012 Convention in Lexington, KY, on September 27-29 were reviewed. Funding for activities

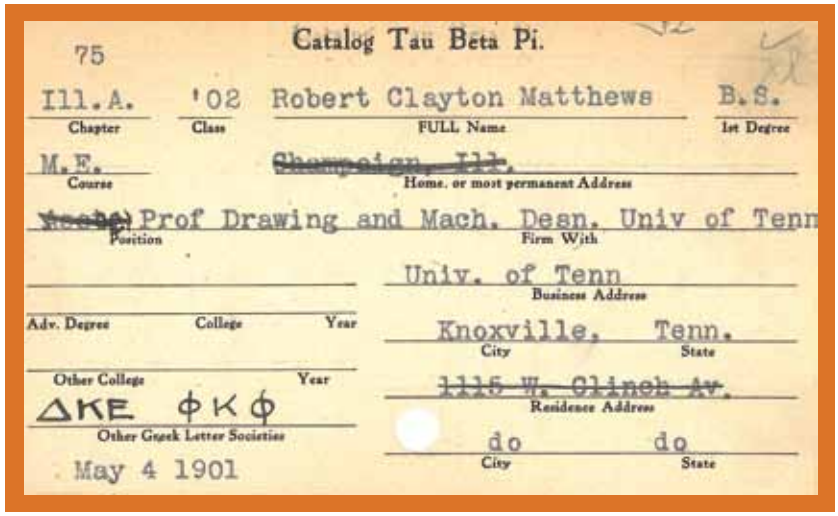
(Continued on page 45.)

Catalog Cards Go Digital

A look back at the hundred-year history of the catalog card and its newest incarnation

by **Raymond H. Thompson**

THE TAU BETA PI catalog card system was designed to provide a permanent record of every member. The cards have changed a little over the years as more information was collected on each new member. However, the size of the cards remained at 3"x5". How far back they go is difficult to accurately determine, but research has provided some clues as to how the catalog card system developed.

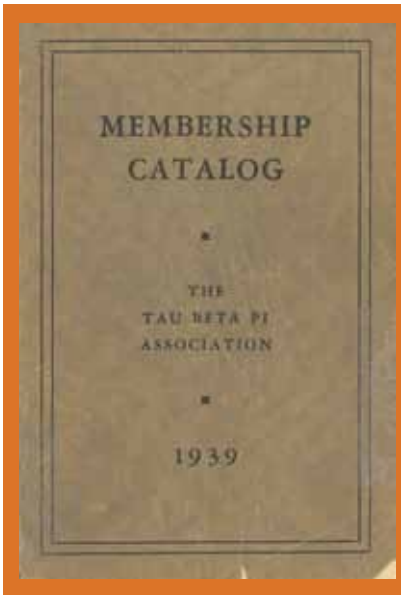

Catalog Tau Beta Pi.

75

Ill.A. — Chapter
'02 — Class
Robert Clayton Matthews — FULL Name
B.S. — 1st Degree
M.E. — Course
~~Champaign, Ill.~~ — Home, or most permanent Address
~~Teacher~~ Prof Drawing and Mach. Desn. Univ of Tenn — Position / Firm With
Univ. of Tenn — Business Address
Adv. Degree — College — Year
Knoxville, — City
Tenn. — State
Other College — Year
~~1115 W. Clinch Av.~~ — Residence Address
ΔΚΕ ΦΚΦ — Other Greek Letter Societies
do — City
do — State
May 4 1901

The earliest reference to the current ΤΒΠ catalog card system that can be located is the November 1906 issue of THE BENT where R.C. Matthews is credited as "editor of the catalog." The 1906 convention, in fact, had required that each chapter maintain card indexes of their membership. No mention is made of a master catalog card file maintained at Headquarters. The January 1907 issue of THE BENT includes a quote from the PA Alpha Chapter that "Our 'Card Index' is progressing satisfactorily."

The April 1909 issue of THE BENT includes a section entitled "The Catalog." Here is a significant excerpt: "The catalog cards which have been gathered by the Secretary (R.C. Matthews) for the last three to four years are now in the hands of the chapters, being brought up to date, and if this work is promptly done, we hope to issue the catalog during the month of June." This appears to indicate that the chapters were responsible for maintaining the cards and there was no central organizational maintenance of cards.


MEMBERSHIP
CATALOG

THE
TAU BETA PI
ASSOCIATION

1939

"No Inconsiderable Task"

In the 1911 issue of THE BENT, it is stated that the first catalog of the membership of ΤΒΠ was issued in 1898. The "Membership Catalog" was a pocket sized book that contained the names of current members. The membership was reported as 430 members. R.C.H. Heck, *PA A 1893*, who was Secretary of the Executive Council, produced the catalog and found it to be "no inconsiderable task."

The Membership Catalog was published several times after 1898. Additional issues were published in 1911, 1916, 1926, 1932, and 1939. The 1946 Convention discontinued publication, so the catalog of 1939 was the last one. The printing in 1911 was for 3,000 copies and even at the selling price of $0.25 the Association would still incur a loss of $200. THE BENT listed the catalog availability and pricing as "Cash sent well wrapped is preferred, though stamps will be taken. No objection will be raised if anyone sends us thirty-five cents for the book."

Costs were a consideration in discontinuing the printed catalog. In 1946, the price of the 1939 catalog was just $0.50, and it is doubtful that covered publication costs. Evidence indicates that the effort involved in producing this catalog over the years was significant. In 1911, it was apparent that maintaining an up-to-date printed catalog, including new members, was an impossible task. Updating the catalog was a moving target that kept getting further away.

There were no computers to keep track of records and record-keeping had to be done manually. The catalog referenced

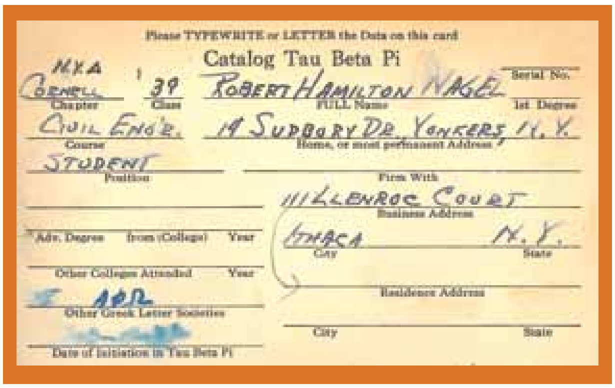
members in name, chapter, and geographical order. This had to be a daunting task as only lead-based typesetting existed then. Someone had to manually enter each name, more than once, into a machine. It is little wonder that the catalog was only published six times.

Typewritten Lists

In 1911, the efforts of an experienced stenographer were applied to the catalog with the creation of typewritten lists which were sent to each chapter. At the next convention, all the lists were found to be in order with the exception of one. The information from this chapter was considered "practically worthless," with only a few old cards available.

In 1911, an appeal was sent to the 3,450 members with good addresses requesting up-to-date information. About 1,725 members returned completed catalog cards. After a second mailing, a 51 percent response rate was achieved. These cards were compared with those on file and any changes were made. A typewritten list was created, compared with the list and compared with the cards from the chapters. This process was done by Secretary Matthews with "his general information regarding the society being of great aid in detecting errors and discrepancies."

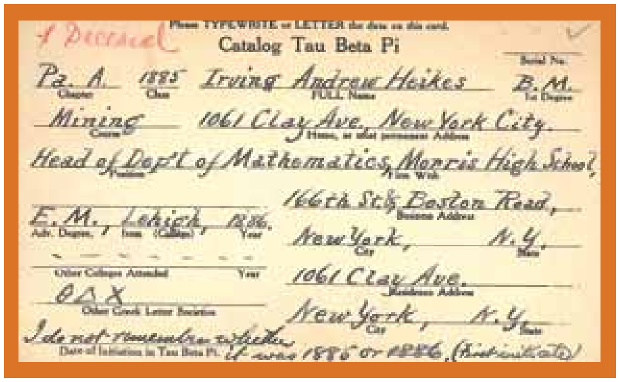
At that time, a member's record consisted of three cards,


Please TYPEWRITE or LETTER the Data on this card
Catalog Tau Beta Pi
N.Y.A. Cornell '39 Robert Hamilton Nagel
Chapter Class FULL Name Serial No. 1st Degree
Civil Eng'r. 14 Sudbury Dr. Yonkers, N.Y.
Course Home, or most permanent Address
Student
Position Firm With
11 Lenroc Court
Business Address
Adv. Degree from (College) Year
Ithaca N.Y.
City State
Other Colleges Attended Year
ΑΦΩ
Other Greek Letter Societies
Residence Address
Date of Initiation in Tau Beta Pi
City State

each of which required maintenance by the organization. The first card contained the member's full name, chapter, class, course, degrees, date of initiation, home or most permanent address, employment, business address, etc. The second card, known as the geographical card, contained name, class, chapter, position, firm, and business address. The third card, called the alphabetical card, contained the name with initials only, the chapter, and class.

From the research that was done and the documents that were located, initial record-keeping was inconsistent and primarily maintained by the chapter. Following the 1906 Convention mandate, R.C. Matthews developed the catalog card that was used for over 100 years. By 1911, the cards were finally stored at Headquarters where they remain today.

Over the years, little has changed except for formatting changes in the cards themselves. Early cards had no space for birth date which was added in the 1950s. The serial number was inconsistently used, renamed to chapter serial number in the 1960s, and removed completely in the 1980s.


Deceased
Please TYPEWRITE or LETTER the data on this card.
Catalog Tau Beta Pi
Pa. A. 1885 Irving Andrew Heikes B.M.
Chapter Class FULL Name Serial No. 1st Degree
Mining 1061 Clay Ave., New York City.
Course Home, or most permanent Address
Head of Dep't of Mathematics, Morris High School
Position Firm With
E.M., Lehigh, 1886. 166th St. & Boston Road,
Adv. Degree, from (College) Year Business Address
New York, N.Y.
City State
Other Colleges Attended Year
1061 Clay Ave.
ΘΔΧ
Residence Address
Other Greek Letter Societies
New York, N.Y.
City State
I do not remember whether it was 1885 or 1886.
Date of Initiation in Tau Beta Pi.

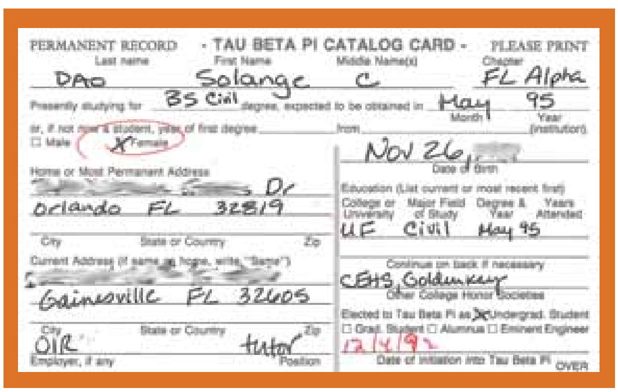
Space for gender was added as women were admitted into TBΠ. The addition of space for email addresses reflected the changing technology and method of communication. It is interesting to note that Irving Heikes, *PA A, 1885*, our first member, as evidenced by his catalog card, was unsure of the year of his initiation date. The year was later determined to be 1885.

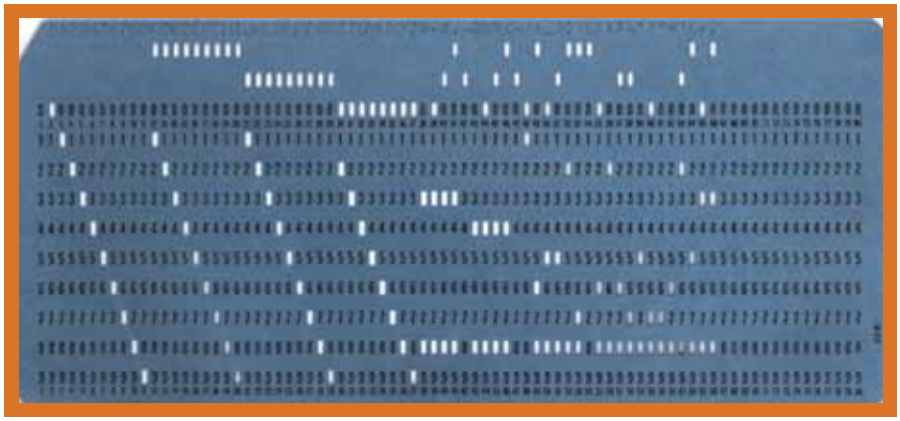
Long Overdue

The current catalog system was long overdue for a change as technology had advanced well beyond the manual typewriter and ink pen. In April 1967, Secretary-Treasurer Bob Nagel approached the computer center at the University of Tennessee about creating electronic copies. Sarah MacKenzie was hired to oversee the conversion. Information from the cards was manually entered on sheets that were arranged in two lines of 80 columns each. The information was keypunched onto computer cards by a firm in Corbin, KY, with two cards for each member. A computer program converted the information into the formatted member record.

The computer was an IBM S/360 system owned and maintained by the University of Tennessee with TBΠ renting time. Member information was limited to 132 characters which also happened to be the line length on a standard mainframe impact printer. Many coding tricks were used, such as a single field representing multiple values to enable as much information on each member to be captured electronically. At that time the number of membership records was 142,000 which all had to be manually copied from the catalog cards and entered into the computer system, a task that consumed slightly more than a year.

For two years after the cards were electronically encoded, little was done with the data. Nagel soon realized what could be done with the electronic information. Reports could be generated, lists of members produced, and members counted in various categories such as chapter,


PERMANENT RECORD - TAU BETA PI CATALOG CARD - PLEASE PRINT
Last name First Name Middle Name(s) Chapter
Dao Solange C FL Alpha
Presently studying for BS Civil degree, expected to be obtained in May 95
Month Year
or, if not now a student, year of first degree from (institution)
☐ Male ☒ Female
Nov 26,
Date of Birth
Home or Most Permanent Address
Dr
Education (List current or most recent first)
Orlando FL 32819
College or University Major Field of Study Degree & Year Years Attended
UF Civil May 95
City State or Country Zip
Current Address (if same as home, write "Same")
Continue on back if necessary
CEHS, Golden Key
Other College Honor Societies
Gainesville FL 32605
Elected to Tau Beta Pi as ☒ Undergrad. Student ☐ Grad. Student ☐ Alumnus ☐ Eminent Engineer
City State or Country Zip
OIR tutor
12/4/93
Employer, if any Position
Date of Initiation into Tau Beta Pi
OVER



gender, living, deceased, etc. A new age in record-keeping at ΤΒΠ had arrived.

Millennium Changes

In 2000, the electronic member records moved from the UT computer system to computer systems owned and operated by ΤΒΠ at Headquarters. The number of members had grown to 446,000. Green bar paper listings that were produced by the UT system of this final list of members from the IBM mainframe still exist today at HQ. Occasionally these listings need to be referenced to find information on members, generally for name changes.

In 2002, a new membership record system was developed by ΤΒΠ staff that relied on web applications and upgraded database technologies. This allowed for better online member information, immediate changes to member information, generation of member lists, and capture of more information on each member. The ability to track historical changes such as address changes, name changes, and gender changes allowed HQ staff to better serve the needs of the members. The 132 character limitation imposed on a member's record by the old system were now removed.

While the member information had been computerized, the paper catalog card system still remained. Each elected candidate was required to fill out the 3"x5" card which was mailed to HQ. This card was stored in large filing cabinets that survive to this day. There are currently over 535,000 catalog cards in the cabinets.

When the online eligibility system was installed in 2000, modules were added that allowed for member information to be entered into a web interface and captured electronically. However, this was still a manually intensive process; it was very time consuming for larger chapters to enter catalog card information for each person. Candidates were still faced with providing information on a small card with very limited space.

Stop Gap Measure

As a stop gap measure, a system was devised around July 2005, that would export candidate information to a spreadsheet. This removed the tedium of entering the name and class year information which had already been gathered. The address of the electee was still required to be entered, and the use of a spreadsheet helped to do this.

However, paper catalog cards were still required and filled out by each candidate. Unfortunately, requested information was not always provided. Chapters distributed the cards to candidates, gathered the cards, and mailed them to HQ. Large chapters often experienced problems which could result in initiation delays.

After each initiation was entered into the system, it was necessary for an individual at HQ to review each catalog card against information that had been entered online. Anything missing had to be added, and other information corrected. This was a tedious process as many of the paper catalog cards were difficult to read and required some guessing, especially for email addresses. As you can see from the sample card on page 30, the information was sometimes difficult to read. (Some information on the card was intentionally blurred.)

Headquarters also faced another challenge. Over the past several years, the office has been the victim of three floods from broken water pipes that left several inches of water on the floor. It is a shock to hear a loud bang and suddenly see water running down the walls because of a ruptured water chiller line. Because of the flooding, blocks were added under the cabinets to minimize any future water damage. The Dougherty Engineering Building, where HQ is located, has also experienced a fire that resulted in several millions of dollars in damage. Fortunately HQ was not in the area that burned and smoke damage was not an issue due to Headquarters' independent ventilation system. The events were a wake-up call that paper records are indeed vulnerable.

Last Difficulty

An additional problem is the cards are paper which deteriorates over time. The picture below illustrates the impact that aging has had on the cards. With roughly 9,000 cards added each year, storage of the cards also poses a problem. HQ is taking steps to resolve this issue for existing cards by having them scanned and stored electronically. Electronic catalog cards were the only viable long-term solution to these issues.

In Spring 2012, ΤΒΠ began to implement a fully electronic catalog card system. Beyond the goal of making the process easier and solving card storage problems, additional information is being gathered from the candidates in the process.

The process of converting to electronic catalog cards required some non-trivial changes to the chapter reporting system. Items being added included the birth date and email address. Email is of particular importance because ΤΒΠ is moving more toward online communications instead of paper mailings at the request of our chapters. More than one email address can be provided in the new system. Because all the information would be entered into the system by the electees, the ability to edit information was necessary to validate details and to prevent submission of cards with incomplete information.

The first change in the reporting process is the email address of the eligible candidate is now collected at the start of the eligibility process. The email is not mandatory at this point, but not having the email address puts the burden on the chapter officers to individually enter it. This can be done at the time of election, but is only necessary for those candidates that have been elected and accepted election (a Tau Beta Pi electee).


PERMANENT RECORD — TAU BETA PI CATALOG CARD — PRINT LEGIBLY

Other Changes

A much needed change included the separation of the first and middle names which was implemented in the membership system in November 2012. The current system had the first and middle name in the same field because of the legacy data systems limitations, in particular the 132 character limit. That design shortcoming was carried over into the new web-based system for backwards compatibility reasons. Along with this change, a preferred name was added as an optional field.

It should be pointed out that the membership records and the eligibility system are two separate systems with separate databases. This is done to protect member information as the membership system does not allow access outside the confines of HQ. Information from the eligibility system is transferred to the membership system when reporting is completed for a chapter's reporting period. Changes to the eligibility system will bring it in line with the membership system.

The ability to export and import a catalog card spreadsheet has been removed. It was a kludge and not an ideal method for capturing data. With implementation of the electronic catalog cards, this capability is no longer needed. Chapter officers now have access to a screen that will list all electees and card submission status. The officers control when emails are sent to electees, and reminders to complete the cards can also be sent. The ability to add a custom message to the outgoing email is also provided. As a result, all electees will receive an email with a unique personalized link to complete their own catalog card.

Added Benefit

This has an added benefit—the officers doing the chapter reporting does not have to enter catalog card information, it will now be completed by the candidates. Chapters no longer need to distribute paper cards, gather the cards from the candidates, and ship the cards to HQ. This should eliminate several days from the reporting cycle.

Send The Bent to Me

(Visit *www.tbp.org/pages* to pay by credit card, or detach and mail to: Tau Beta Pi, P.O. Box 2697, Knoxville, TN 37901-2697.)

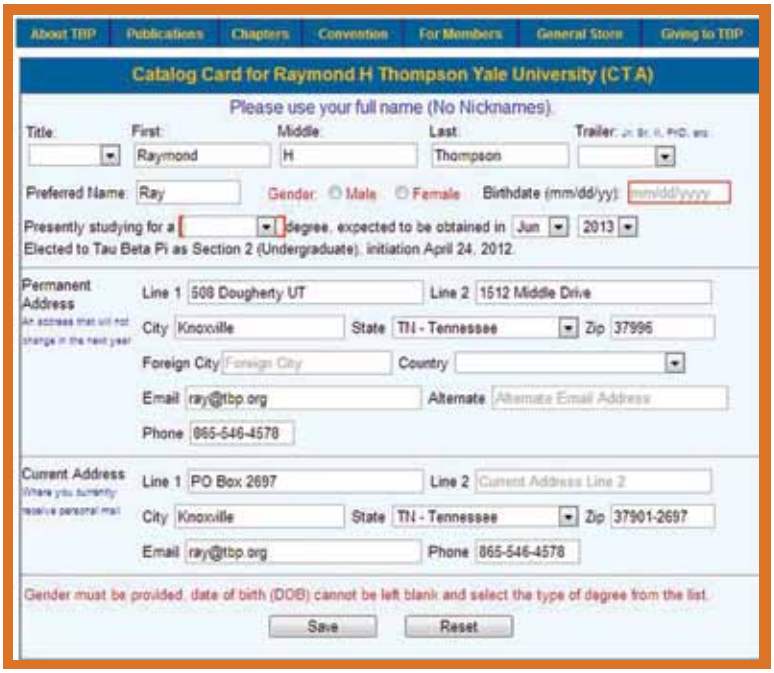
☐ I enclose $60, for which I shall expect to receive THE BENT for life. I will keep you informed of any change of address.

☐ I enclose $12.50 as the first payment for a BENT Life Subscription. Remind me to send $12.50 each year for the next four years.

☐ I enclose $10, which will keep me on the mailing list of THE BENT for one year. I should appreciate an expiration notice a year from now, so that I may renew without missing any issues. (Note that you may call 865/546-4578 to pay by credit card.)

Name _____ Chapter _____ Class _____

Address _____ Email _____



The resulting screen presented to the electee is obtained by clicking on the link in the email. It was necessary to include information embedded in the link that uniquely identified the individual. After careful testing, information was included to ensure that it is valid. Finally, the link had to provide information that would indicate if it had been corrupted or an attempt was made to gain access to another individual's information. A checksum was added to remedy the situation.

Information is filled in by the electees and the page submitted; if it is correct and complete, the electee will receive a confirmation page. Any errors on the page will have the field with a problem indicated by red lines or red text with an explanation at the bottom of the page. Once the catalog card information has been submitted, the link in the email will no longer function. Attempts to use it will produce a page indicating the catalog card has been completed. Once a card has been submitted, only HQ can make changes to the information.

HQ will no longer verify the information on the catalog cards as there is no longer a paper document to verify against. It will be the electee's responsibility to enter personal information correctly. The electee should understand that this is the permanent membership record.

Some safety nets are built into the process. The chapter officers have the ability to use links on the *Catalog Card* page to submit the information themselves rather than the candidate. This was necessary as the report of Final Action cannot be submitted until all catalog cards have been completed. Delaying the Final Action report and initiation because of one individual is undesirable. Chapters officers are reminded that the catalog cards should be completed by the electee except in extenuating circumstances. HQ also has the same capability to complete the catalog cards along with an added ability to force a catalog card to completion without the data being provided.

Implementation

The change to electronic catalog cards occurred with the start of the Fall 2012 chapter reporting period. This change was not taken lightly, and implementation was planned based on feedback from members and logistics at Headquarters. For a few hours on August 15, 2012, the chapter reporting system was shut down to install the new code on the server and make necessary modifications to the databases.

The use of electronic catalog cards represents a significant paradigm shift for a system that has been in place for over 100 years. Change is inevitable and the transition to fully electronic catalog cards is the beginning. For years, the paper catalog card has served as the primary membership record. As computers became commonplace, the transition to electronic records was only natural. The elimination of future physical cards will complete the transition to fully electronic member records. The change will benefit members, chapters, and the entire organization. Information on members will now be easier to capture, will certainly be more accurate, and will contain additional useful information.

•*I would like to express thanks to Dylan Lane for his research and efforts into finding archival information.*

Raymond (Ray) Thompson is the computer systems administrator at ΤΒΠ. Ray has been working with computer systems since the dark ages. During his tenure, which started in late 2001, he has done much of the work to improve the data systems and record keeping. In his free time he enjoys photography having earned a certificate in photography from the University of Tennessee. Ray also produces the photographs taken at the annual conventions.

SPOTLIGHT

South Korea Outpaces US
South Korea leads the United States in the percentage of young adults with college degrees—63 versus 41 percent, states a report in *The Washington Post.*

The Post adds that one in four college students in South Korea majors in engineering, compared to one in 20 in the US, and its K-12 students routinely outperform US children on international assessments.

While South Korean leaders have begun to fret that their young people—raised among skyscrapers and affluence—are pursuing higher-paying jobs outside technical fields, the workforce remains highly tech-savvy.

The article reports that "South Korea's school system—unlike the American system—is centralized and regulated according to economic demands" and the "national ministry of education and the ministry of science and technology are one and the same."

Digital Doors Thrown Open
From Harvard to Stanford, a growing number of elite universities are throwing open their digital doors, reports The Associated Press.

They are "offering their most popular courses online for no charge, allowing anyone with an Internet connection to learn from world-renowned scholars and scientists."

The AP adds: "Many colleges have offered Web-based courses for years, but the participation of top-tier research universities marks a major milestone in the expansion of digital learning."

The proliferation of massive open online courses "has the potential to transform higher education at a time when colleges and universities are grappling with shrinking budgets, rising costs, and protests over soaring tuition and student debt."

Master's Degrees Hit New Peak
Master's degrees reached another all-time high—of 46,940—in 2011 due to 19 percent growth over the previous three years, according to data from ASEE.

This trend will certainly continue, added ASEE, since enrollment grew for the seventh year in a row. Fall 2011 master's enrollment stood at 103,757, which is 25 percent higher than the 2005 mark.

Fighting Gender Gap
USA Today reported on efforts at some US colleges and universities to battle a "persistent gender gap" in the STEM disciplines.

For example, a number of schools "that specialize in these fields have recently taken steps to increase female enrollment and are seeing results," like Worcester Polytechnic Institute, which this spring "graduated 247 women, its largest number of women ever, representing 30 percent of its graduating class."

However, noted *USA Today*, "some critics of the focus on gender parity say the concern is overblown." It carried a quote from American Enterprise Institute scholar Christina Hoff Sommers, who said that some elements of math- and science-related fields may be intrinsically less interesting to most women.

Women Computer Grads Down
Although computer science is one of the fields poised for exponential job growth over the next several years, there is a glaring lack of women entering the field, according to the *Chicago Tribune*.

Since 1984, the number of computer science degrees awarded to women has steadily declined, the report added, and today only 13 percent of computer science graduates are female.

Accordingly, top jobs in the field are male-dominated. A recent study by technology staffing firm Harvey Nash Group found that out of 166 U.S.-based technology firms that replaced CEOs last year, only six appointed a woman.

PEOPLE

John Y. Walz Jr., Ph.D., *Louisiana Beta '82*, has been named the 10th dean of the University of Kentucky college of engineering. He has been professor and department head of chemical engineering at Virginia Polytechnic and State University since 2005. Walz takes over from **Thomas W. Lester,** Ph.D., *Indiana Alpha '70*, dean since 1990, who will remain a faculty member.

Sandra L. Woods, Ph.D., *Michigan Alpha '76*, is the new dean of the Oregon State University college of engineering. She is a former OSU environmental engineer who has led the engineering program at Colorado State University for the past seven years. Woods replaces **Ronald L. Adams,** Ph.D., *Oregon Alpha '70*, who stepped down as dean to lead a new initiative at OSU on industry relations as executive associate vice president for research.

Brett A. Peters, Ph.D., *Arkansas Alpha '87*, is now dean of the college of engineering and applied science at the University of Wisconsin-Milwaukee. Peters, had been a professor of industrial

and systems engineering at Texas A&M University since 1992. Peters' research interests include design, analysis, operation, and control of manufacturing systems. Former dean **Michael R. Lovell,** Ph.D., *Pennsylvania Lambda '89*, became UWM's chancellor last year.

David A. Wyrick, Ph.D., P.E., *Wyoming Alpha '79*, an engineering professor at Texas Tech University, has been appointed dean of the school of science and engineering at Al Akhawayn University in Morocco. He will be establishing general engineering curricula at the English language, coeducational public school. Wyrick also plans to work towards starting a ΤΒΠ chapter there.

Amy J. Moll, Ph.D., *Illinois Alpha '87*, has been named as dean of Boise State University's college of engineering. She had served as interim dean of the college since 2011. As a professor she co-founded the materials science and engineering program at Boise State and served as its first chair. Moll joined the school in 2000, after working in the private sector for Hewlett-Packard. She recently served as an adviser on the PBS documentary *Making Stuff*.

FACILITIES

Johns Hopkins University is receiving up to $90 million from the U.S. Army to help develop new lightweight armor. Toward this goal, Johns Hopkins is forming the Hopkins Extreme Materials Institute (HEMI). It will focus on what happens to protective materials at the moment of intense impact, when a large amount of energy enters a small space in a very short period of time. The institute will conduct basic research across the disciplines of mechanical engineering, materials science, civil engineering, aerospace engineering, and physics.

Massachusetts Institute of Technology's computer science and artificial intelligence laboratory (CSAIL) has announced a major new initiative called bigdata@CSAIL. It will tackle the challenges of the burgeoning field known as "big data"—data collections that are too big, growing too fast, or are too complex for existing information technology systems to handle. Additionally, Intel Corporation announced that it is establishing the new Intel Science and Technology Center (ISTC) for Big Data at CSAIL.

Columbia University will start an institute for data sciences and engineering in New York City. The program, which will be housed at the school's existing campuses in Morningside Heights and Washington Heights, is expected to employ 75 new faculty members over the next 15 years, according to a news release from the city. The agreement includes the creation of 44,000 square feet of applied-science and engineering space by 2016. New York will provide $15 million in financial assistance, including discounted-energy transmission costs and partial debt forgiveness.

University of North Carolina at Charlotte recently completed the $76 million engineering building, which will house its new energy production and infrastructure center (EPIC). The 200,000-square-foot building has four floors of classrooms, labs, and conference rooms. The *Charlotte Observer* reports that "EPIC combines the college's engineering programs, including electrical, civil and mechanical, with concentrations in energy and real-world industry practice." EPIC began four years ago when 11 Charlotte-area energy companies approached UNCC about creating a program to prepare students for the area's growing energy sector.

University of California, Santa Barbara is receiving a $50 million donation from alumnus Jeffrey O. Henley, chairman of the board of Oracle, which they will use to support their energy efficiency research and engineering programs. The *Los Angeles Times* reported that UCSB will use $25 million to help finance a new building, which will be named Henley Hall, and will house the three-year-old institute for energy efficiency.

The University of Kansas's plans to step up expansion of the school of engineering have been supported by the state board of regents. Last year, lawmakers approved a bill authorizing KU to issue $65 million in bonds to build a 100,000-square-foot engineering classroom building. The measure was part of a wider effort at KU, **Kansas State University** and **Wichita State University** to increase the number of engineering graduates in Kansas from approximately 875 a year currently to 1,365 a year by 2021.

University of Texas at Austin's center for electromechanics will receive $4.3 million to develop an affordable home natural gas refueling station, while **Texas A&M University** researchers will get $3 million to develop technology for natural gas storage tanks. These were among grants announced by the Department of Energy.

Cleveland State University is to receive $12.7 million from an Ohio state education commission to renovate Stillwell Hall for a new, hands-on engineering program. CSU's college of engineering will partner with technology systems giant Parker Hannifin Corporation, which is endowing a chair for the program.

Brain Ticklers

RESULTS FROM SPRING 2012

Perfect			
* Couillard, J. Gregory	IL	A	'89
* Kimsey, David B.	AL	A	'71
* Prince, Lawrence R.	CT	B	'91
* Riedesel, Jeremy M.	OH	B	'96
* Rowland, R. Wilson	MD	B	'51
* Schmidt, V. Hugo	WA	B	'51
* Slegel, Timothy J.	PA	A	'80
* Snelling, William E.	GA	A	'79
* Spong, Robert N.	UT	A	'58
* Strong, Michael D.	PA	A	'84
* Zapor, Richard A.	CA	E	'84
Other			
* Alexander, Jay A.	IL	Γ	'86
* Bernacki, Stephen E.	MA	A	'70
* Bohdan, Timothy E.	IN	Γ	'85
* Colello, Marc C.	NY	I	'97
* Doniger, Kenneth J.	CA	A	'77
Handley, Vernon K.	GA	A	'86
Johnson, Roger W.	MN	A	'79
Jones, Donlan F.	CA	Z	'52
* Jones, John F.	WI	A	'59
Lalinsky, Mark A.	MI	Γ	'77
* Lui, Huiliang	CA	A	'07
* Marks, Lawrence B.	NY	I	'81
Marks, Benjamin	Member's son		
Mercer, Robert	Non-member		
* Rasbold, J. Charles	OH	A	'83
Rentz, Peter E.	IN	A	'55
* Rubin, James D.	MI	Γ	'82
Sauer, Daniel M.	MI	B	'05
Sauer, Jon	Member's brother		
* Sentman, Mark H.	CA	E	'86
Sentman, Andrew	Member's son		
Sentman, Michale	Member's daughter		
* Stein, Gary M.	FL	Δ	'04
* Stribling, Jeffrey R.	CA	A	'92
* Summerfield, Steven L.	MO	Γ	'85
* Thaller, David B.	MA	B	'93
Vegeais, James A.	IL	A	'86
* Voellinger, Edward J.	Non-member		
von Laven, Kurt A.	CA	Γ	'12

* Denotes correct bonus solution

SPRING REVIEW

The most difficult regular problems were No. 2, about sequences, and No. 3, about the smallest solution to an equation. Only about half of the entries had correct solutions to these Ticklers. The Bonus problem, about arranging integers around a circle, was easier than usual with about 80% of the entries having correct solutions.

SUMMER SOLUTIONS

Readers' entries for the Summer problems will be acknowledged in the Winter '13 BENT. Meanwhile, here are the answers:

1 The problem asks for the exact movements of Paul, Quentin, Ron, Sam and Ted (P, Q, R, S and T), given their truthful statements, the train schedule, and the mileage and biking rate between the train stations (A, B, C, D, and E). From their exact movements, one deduces that S and T left their bikes at the Bingchester station (B) and T defaced the Moaning Lisa. The time table only allows each suspect to travel from their starting station, through B, to their destination station. Each suspect could travel to or from B by bike or train, so that there are four possibilities for their mode of transportation (TT, TB, BT, or BB). In P's case, he had to travel from A to B by train, then B to E by bike as no other means could put him at E by 9:52. Similarly, Quentin traveled from E to C by bike only, as no other means could put him in C by 9:58. Ron traveled from A to D by train as he left his bicycle at A. Sam traveled from C to B by bike, then B to D by train as no other means could put him in D at 10:03. Ted traveled from E to B by bike, then B to A by train as no other means could put him in E at 8:59. Therefore, their exact movements were:

- *Paul: (at A 9:14; dep. A 9:15 by T; arr. B 9:23; dep. B 9:24 by B, arr. E 9:52),*
- *Quentin: (at E 9:01; dep. E 9:01 by B; arr. B 9:29; dep. B 9:29 by B, arr. C 9:57),*
- *Ron: (at A 9:14; dep. A 9:15 by T; arr. B 9:23; dep. B 9:25 by T, arr. D 9:56),*
- *Sam: (at C 8:56; dep. C 8:56 by B; arr. B 9:24; dep. B 9:25 by T, arr. E 9:56),*
- *Ted: (at E 8:59; dep. E 8:59 by B; arr. B 9:27; dep. B 9:30 by T, arr. A 9:38).*

This means that Sam and Ted left their bikes at B and that Ted defaced the Moaning Lisa.

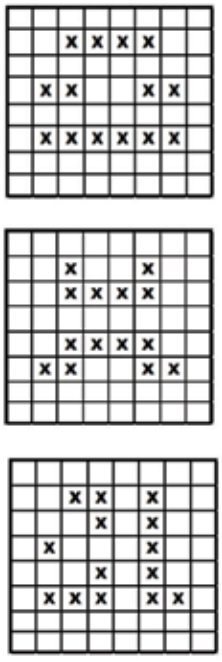
2 The cryptic multiplication ABCDEF = BCDEFA x M decodes as 923076 = 230769 x 4. Rewrite the original cryptic as 100,000 x A + BCDEF = (10 x BCDEF + A)M, which simplifies to (100,000 - M)A = BCDEF(10 x M - 1). Thus, (100,000 - M)A must be divisible by (10 x M - 1). Letting M = 2, 3, 4, etc., and trying 99,998A/19; 99,997A/29; 99,996A/39; etc., we find that only M = 4 and M = 5 are possibilities. For M = 5, 99,995A is divisible by 49 if A = 7, which gives 99,995/7 = 14285 for BCDEF, but this requires that both M and F be 5. For M = 4, we have 99,996/39 = 2564. A must be greater than 3 to give a 5-digit number and cannot be 4 (because M = 4). Trying A = 5, 6, ..., 9, we find that only 9 gives a solution without a duplicated value, so BCDEF = 9 x 2564 = 23076.

3 The precise time that the minute and hour hands of an analog watch coincide with the second hand within half a second of an hourly mark is 9:49:05.4545. The minute hand crosses over the hour hand 11 times in each 12 hour cycle or every 12/11 = 1.090909 hour = 1:05.454545=1:05:27.272727. The position of the second hand at the time the minute hand crosses the hour hand can be found by multiplying 27.272727 by 1, 2, 3, ..., 10 and subtracting multiples of 60 seconds. This gives 27.2727; 54.5454; 21.8181; 49.0909; 16.3636; 43.6363; 10.9090; 38.1818; 5.4545; 32.7272 for the position of the second hand when the hour and minute hands coincide. As can be seen, there is only one case in which the second hand is within half a second of an hourly mark. It occurs at 9(1:05.454545) = 9:49:05.4545… .

4 The minimum number of people in a group to have at least a 50% chance that three or more have a common birthday or two or more separate pairs share different common birthdays is 36. This probability is $1 - P_A(N) - P_B(N)$, where $P_A(N)$ is the probability that none of the N people in the group share a common birthday and $P_B(N)$ is the probability that exactly two people have the same birthday. $P_A(N) = (364/365)(363/365)(362/365)...((365-(N-1))/365)$. To see this, choose one person. The probability that a second person has a different birthday is 364/365, as there are 364 days that don't match. The probability that a third person's birthday matches neither of the first two birthdays is 363/365, and so forth for the rest of the group, so the probability of at least one common

birthday is the complement of $P_A(N)$, or $1 - P_A(N)$. $P_B(N)$ is calculated in a similar fashion and equals $C(N, 2)(1/365)(364/365)(363/365)\ldots((365-(N-2))/365)$. $C(N, 2)$ is the number of ways of selecting 2 people from a group of N, that is, the number of possible pairs; 1/365 is the probability that a pair have a common birthday; 364/365 is the probability that a third person in the group does not have that birthday, etc. The desired answer is $1 - P_A(N) - P_B(N)$. Trying successive values of N, at 36 people, $P_A(N) + P_B(N)$ drops below 0.5 for the first time. A spreadsheet finds the answer quickly.

5 The minimum number of knights that can be placed on a standard chess board such that every square is attacked is 14. There are three basic solutions, as shown. All other solutions are rotations or reflections of these three basic solutions. It is straightforward to find the symmetrical solutions by trial and error. We used a computer program to prove that a solution did not exist for 13 or fewer knights.



Bonus. When the pin constraining a 100 cm long uniform rod leaning against a frictionless wall with an initial horizontal angle of 30 degrees is removed, the horizontal velocity of the center of the rod as it passes the point where the rod initially touched the frictionless floor is 36.9 cm/s. Let y be the height of the upper end of the rod and x the horizontal position of the lower end of the rod. Conservation of energy equates the loss in gravitational potential energy to the gain in kinetic energy. The potential energy is $100mg(25 - y/2)$; where m is the mass/length and g is 980 cm/sec^2. Note that the vertical and horizontal velocities vary from point to point along the length of the rod. At a point b cm from the lower end of the rod, the vertical velocity is $(b/100)(dy/dt)$ and the horizontal velocity is $[(100-b)/100](dx/dt)$ when the rod is touching the wall. To find the total kinetic energy, you have to integrate over the rod's length. The increase in kinetic energy is $\Delta K.E. = \int_0^{100}(m/2)[(b/100)^2(dy/dt)^2 + ((100-b)/100)^2(dx/dt)^2]db = (100m/6)[(dy/dt)^2+(dx/dt)^2]$. Since $x^2+y^2 = 100^2$ and $2x(dx/dt) + 2y(dy/dt) = 0$, we get $(dy/dt)^2 = (x/y)^2(dx/dt)^2$ and $\Delta K.E. = (100m/6)(100^2/y^2)(dx/dt)^2$. Equating the potential energy loss to the kinetic energy gain yields $(dx/dt)^2 = 3g/100^2(50y^2 - y^3) = 0.294(50y^2-y^3)$. During the fall, the center of gravity of the rod accelerates horizontally in reaction to the normal force exerted by the wall. The horizontal acceleration decreases smoothly to zero at the moment that the rod leaves contact with the wall. The lower end of the rod, that is moving at twice the horizontal velocity of the center of the rod, stops accelerating at this time. The horizontal velocity of the center of the rod is constant after the rod leaves the wall. It equals (1/2) dx/dt when $d^2x/dt^2 = 0$. Taking the derivative of $(dx/dt)^2 = 0.294(50y^2-y^3)$ yields $2(dx/dt)d^2x/dt^2 = 0.294(100y-3y^2)(dy/dt)$. Thus, $d^2x/dt^2 = 0$ when $y = 100/3$. So, $dx/dt = 73.8$ cm/sec, and the center of the rod is moving at 36.9 cm/sec as it passes the point where the end of the rod initially touched the floor.

Computer Bonus. The number of ways that 14 married couples can be seated in chairs numbered consecutively from 1 to 28 (meaning rotations and reflections count as different arrangements) about a round table in such a manner that there is always one man between two women and no man is next to his own wife is 1,905,270,127,543,015,833,600. Break the problem into two parts. First place the 14 women; then place the men. There are 14! ways to place the women into the even-numbered chairs and 14! ways to place them into the odd numbered chairs. Pick one of those assignments. A recursive computer program counts 10,927,434,464 ways to place the men for each specific arrangement of women. So, the total number of ways to seat the 14 couples is to 2(14!)(10,927,434,464) = 1,905,270,127,543,015,833,600.

NEW FALL PROBLEMS

1 Two small rockets, one with a mass of 2 kg and the other with a mass of 26 kg, are traveling through space with no forces acting on them. The velocity of each is a positive integral number of meters per second such that the difference in their kinetic energies is 1 J. Each rocket then fires a short burst of its ion engine, after which each again has a velocity of an integral number of meters, and the difference in their kinetic energies is still 1 J. What are the smallest positive velocities which the two rockets can have before and after they fire their engines? Assume that the masses of the rockets do not change when firing the engines.

—Adapted from
Theodore J. Stadnik, *OH Λ '05*

2 Find a six-digit number with the following properties: a) the first (leftmost) digit is four more than the second digit, b) the third digit is one less than the second digit, c) the product of the first two digits equals the two-digit number formed by the third and fourth digits, d) the fifth digit equals the sum the first and third digits, and e) the sixth digit equals the sum of the fourth and fifth digits.

—**Mark A. Noblett,** P.E., *NY N '70*

3 A band of pirates has stolen a small chest containing nine identical bottles of gold dust that each weigh exactly the same. They decide to wait until the next day to divide the loot. During the night, one pirate surreptitiously opens one of the bottles and removes a small amount of gold. Later he starts to worry that, if he gets caught, he will have to walk the plank, so he sneaks back, grabs a bottle at random and replaces the gold he took. Using only a simple two-pan balance scale, what is the minimum number of weighings

(Continued on page 45.)

"Unfolding the true meaning of life and purpose of his creation."

AS THE WRIGHT BROTHERS circled Dayton, OH's, Huffman Prairie perfecting their flying machine, on a hill across town five Catholic brothers were looking into the future.

They saw innovation was moving society and industry forward. So they decided their school—which grew to become the University of Dayton—needed an engineering program to educate an innovative workforce and help move the world forward.

"The Society of Mary is known for being ever adaptable, embracing change," said school of engineering dean **Tony E. Saliba, Ph.D.,** *Ohio Theta '81,* of the Roman Catholic order that has sponsored the school since 1850. "It was like that from the beginning, and 100 years after envisioning an engineering school, we are pushing new envelopes of innovation."

In 2011, the University of Dayton School of Engineering began its celebration of 100 years of excellence in engineering education and research, featuring an awards ceremony for notable alumni including Nobel laureate Charles Pedersen '26. In 1911, the university offered its first engineering classes, as the course catalog stated, to "satisfy an oft-repeated desire and to fulfill a long-felt need." The departments of chemical and electrical engineering were the first to form, followed in 1916 by mechanical engineering and in 1919 by civil engineering.

Engineering and Catholicism? To some secular scientists, science gave no hope of life after death. "To them it was a paradox," wrote Brother Louis Rose, S.M., the second chair of electrical engineering. But the Marianist scientist and engineer, he said, was privy to a unique perspective of heaven and earth: "To the young religious, science was unfolding the true meaning of life and purpose of his creation."

As the century progressed, engineering education evolved to a blend of technical competency, entrepreneurial innovation, and social justice. In 2011, the school of engineering was named "best in class" in project-based engineering education by the Kern Entrepreneurial Education Network. It continues to send dozens of students throughout the world to work on sustainable, locally driven projects to improve life through the ETHOS (Engineers in Technical Humanitarian Opportunities of Service) program. Along with the University of Dayton Research Institute—faculty, staff and students have produced top-caliber work that has garnered UD the No.1 spot among all universities in the country in sponsored materials research, according to the National Science Foundation.

For the fourth time in five years, the school of engineering has attracted record enrollment in its undergraduate, master's, and doctoral programs; this year, for the first time, it will educate more than 2,000 undergraduates—a long way from the first five engineers the school graduated in 1915.

Work underway, above, in the school of engineering's Kettering Laboratories, top.
•This article was prepared by Michelle Tedford, director of communications, University of Dayton.

Executive Director's Report

by Curtis D. Gomulinski, *Michigan Epsilon '01*

SECRETARY'S REPORT

OVERALL, THE year 2011-12 exceeded expectations in nearly every respect, although the investments in the trust recorded a loss. Tau Beta Pi's first international Engineering Futures session was held in Doha, Qatar, on April 27-28, 2012. The second international initiation was held on the evening of April 28. *[see page 19.]* Excellent support by alumni through volunteer efforts, bequests, and annual contributions was impressive, while corporate and university financial support of the Convention and THE BENT remained high. Alumni interest in maintaining a relationship or reconnecting with the Association continued to increase. A new hotel-discount member benefit was established in June.

CHAPTERS

The 2011 Convention granted a charter to the University of San Diego, formally established as the California Alpha Epsilon Chapter on February 25, 2012. An account of the installation was published in the summer 2012 issue of THE BENT.

Inspection committees visited Penn State Erie, The College of New Jersey, and St. Louis University last fall and winter, and petitions from these schools will be considered by the 2012 Convention. No petitions for new chapters were received during the year.

Pennsylvania Beta and Washington Alpha celebrated their 100th anniversary. The Chicago Alumnus Chapter was reactivated, but the Southern Tier Alumnus Chapter went inactive; 18 of 60 alumnus chapters are active.

A total of 215 chapters (224 in 2011) completed annual surveys that listed approximately 1,100 projects. A report on the contents of the survey has been published in the September 2012 issue of THE BULLETIN, available online.

MEMBERSHIP

The chapters initiated 9,218 members in 2011-12, up 5.4% and the highest total in 16 years. This included 8,784 undergraduates, 323 graduate students, 59 alumni, and 52 eminent engineers.

Over 100 alumni met with Executive Director Curt Gomulinski in the past year at alumni gatherings held in eight cities. Pictured here are the 17 alumni who met in Longmont, CO, in February, 2012. Seated: **Michael Pierce,** *CO A '90*; **Tricia Gomulinski,** SD *A* '98; **James Morton**, CO *A* '09; and **Tina Pierce,** CO *A* '89. Standing: **Warren Wang,** *CO B'00,* **Catherine McCarrell,** *FL Z'10,* **Sandy Pitzak,** *CO B '00,* **Clyde (Mac) McLennan**, *AZ A '66,* **Keith Flaming,** *OK Γ '80,* **Curt Gomulinski,** *MI E '01,* **Chad Fox,** *CO B '91*, **George Miyata,** *WA Δ '10*, **Colin Graham,** *CO B'00*, **Rob Streeter,** *WY A'11*, **Rick Dauer,** *IN B'83*, **Scott Busch,** *CO B'09*, **Greg Newcomb,** *CO B '06*, and **Scott Rigg,** *WY A '12*.

Tau Beta Pi's initiated membership on July 31, 2012, was 535,627, and an estimated 58,000 are deceased.

During the year, about 35,800 engineering students in the 238 TBΠ chapter schools were scholastically eligible for membership in the top one-fifth of their senior or the top eighth of their junior classes. About 38.8% of these were members of TBΠ at the close of the year, down from the previous year's 40.6%. About 4.2% were not initiated, chiefly because of their chapters' failure to hold spring ceremonies. The remaining 57% indicated a lack of interest in membership, up from 56% last year.

Tau Beta Pi chapter schools graduate about 93% of all B.S. engineers at 390 schools with ABET EAC-accredited programs and the other five schools without EAC-accreditation.

Thirty-three chapters held only one election and initiation of new members, but all others held two or more. No chapters held initiations without approval. No members resigned during the year, and none was expelled.

CONVENTION

The 106th TBΠ Convention was held in October 2011 in Indianapolis with the Indiana Chapters as hosts. The meeting was fully reported in the Winter 2012 issue of THE BENT and the December 2011 issue of THE BULLETIN. The 2012 Convention will be hosted by the Kentucky Alpha Chapter in Lexington. The 2013 Convention will be hosted by Iowa Alpha in Ames.

The 2011 Convention: approved two amendments to the Constitution and Bylaws of the Association, which were ratified by the chapters, to update the retirement provisions for Headquarters staff to meet current practice, and to add a fourth alumnus member to the Fellowship Board and clarify the Board's duties; amended Bylaw VI and VII to clarify the terminology and process of postponement of initiation; updated the reimbursement schedule for the 2012 Convention to include $6 for breakfasts, $8 for lunches, and $10 for dinners; made recommendations regarding the Association's website and chapters section and suggested a competition to update the website; modified the Code of Conduct; recommended acceptance of the invitation from Washington Delta to host the 2014 Convention in Spokane; recommended the development of an "Implementa-

tion Process" for the K-12 MindSET Program; and conducted focus groups to gather information on member benefits and ways to improve the Association.

OFFICIALS

The TBΠ Executive Council, elected for the 2006-10 term and re-elected by the Convention for the 2010-14 term, comprises President L.A. Simonson, Ph.D., P.E., Vice President S.C. Dao, P.E., and Councillors J.F.K. Earle, Ph.D., P.E., J.A. Huggins, P.E., and N. Pih. Council meetings were held on Aug. 5, Oct. 26 & 29, Nov. 30, and Dec. 19, 2011, and Jan. 14, Feb. 16, Mar. 21, Apr. 18, May 16, June 8-9, and July 18, 2012.

Tau Beta Pi has three appointed Directors with responsibilities in major areas of its interest: D.S. Pierre Jr., P.E., serves as Director of Fellowships, E.J. D'Avignon as Director of Rituals, and R.W. Pierce as Director of Engineering Futures. Members of the Fellowship Board include: D.W. Donahue, Ph.D., S.L.R. Holl, Ph.D., and J.L.H. Jamieson. The Trust Advisory Committee, which directs investment activities of the corporate trustee, includes R.F. Smith (chair), H.W. Lange, and J.W. Johnson Jr.

District Directors on July 31 were:

District 1	Lynn B. Farrington
	Selden J. Houghton
	Matthew V. Paragano
	Lauren J. Swett
District 2	Anthony M. Olenik
	Thomas A. Pinkham IV
	Jason Rogan
	George Youssef
District 3	Edward P. Gorzkowski III
	Alexander J. Rovnan
District 4	Joseph P. Blackford
	Lisa C. Gascoigne
	Russell L. Werneth
District 5	Rebecca A. Holcomb
	Elizabeth A. Stephan
District 6	Kassy M. Lum
	Dee Anne Stirm
	Ellen S. Styles
District 7	Ellie R. Armstrong
	David E. Dale
	Andrew J. Flowerday
	Wesley R. Repke
District 8	Bruce A. DeVantier
	Stacey L. Forkner
	Ricardo K. Komai
District 9	Robert C. Huck
	Brenda A. Kramer
District 10	Brian R. Buisson
	Daniel A. Kamat
District 11	James C. Hill
	Sherry D. Jennings-King
District 12	Wade A. Hull
	George K. Miyata
	Gregory M. Newcomb
District 13	Jeffrey G. Dabling
	Matthew T. Pittard
District 14	Timothy M. Edgar
	Ian J. Frank
District 15	Joseph R. Burnett
	Scott E. Fable
	Kimberly Stillmaker
District 16	Neal T. Bussett
	Jason A. Corl
	Scott V. Eckersall
	Stacey H. Ross

The International Headquarters staff, which is located on the Knoxville campus of the University of Tennessee, includes Executive Director C.D. Gomulinski, Assistant Secretary-Treasurer R.E. Hawks, Director of Development P.B. McDaniel, and eight additional employees (see *tbp.org*). James D. Froula was given the title of Executive Director & Secretary-Treasurer Emeritus and retired on January 31, 2012.

AWARDS

Tau Beta Pi's top chapter prize, the R.C. Matthews Outstanding Chapter Award, was given to Michigan Epsilon for the excellence of its total program in 2010-11. An honorable mention went to California Alpha. The R.H. Nagel Most Improved Chapter Award went to California Tau; honorable mention was given to Tennessee Gamma. The inaugural J.D. Froula Most Improved Membership Award went to Missouri Gamma; honorable mentions were given to Georgia Alpha, Nevada Alpha, and Arizona Gamma.

The Council did not receive any Chapter Project proposals under the Greater Interest in Government Program. The Headquarters staff gave 34 Secretary's Commendations to chapters for the perfection of their reports to TBΠ in 2011-12, 30 Chapter Project Awards for ingenuity and creativity in activities, and 53 Membership Awards for in increasing the number of students initiated into TBΠ.

A selection committee of three District Directors chose no recipient for the Distinguished Alumnus Award from the two nominees, the first time that no selection was made.

The 2012 Outstanding Advisor was selected by a committee of engineering deans: R.J. Marley, Ph.D., (chair), M.S. Ingber Ph.D., and J.W Steadman, Ph.D. The recipient of a $1,000 cash award and an equal sum to be presented to her dean's discretionary fund is Abigail M. Richards, Ph.D., *WA B '99*, Montana Alpha Chief Advisor.

The 2012 TBΠ-McDonald Mentor was selected in June by a committee of three District Directors. The recipient of a $1,000 cash award with an equal sum to be presented to the Iowa Alpha Chapter is Derrick K. Rollins, Ph.D., *IA A '79*.

During the year, the Executive Council gave six Resolutions of Appreciation, one Superior Service Award, and two Distinguished Service Awards to collegiate chapter advisors and national officials for long and outstanding service.

DISTRICT PROGRAM

Sixteen Districts held at least one conference last year and conducted meetings during the 2011 Convention, and Directors visited many chapters during the year. The Directors and the Council met in Orlando, FL, in June 2012 and discussed means for improving regional activities and communications and planning for the upcoming year.

ENGINEERING FUTURES

The Engineering Futures Program presented a total of 263 training sessions by 40 volunteer facilitators to develop the leadership skills of student members during 2011-12. This award-winning program helps to prepare engineering students for their careers by enhancing their overall personal effectiveness through interpersonal-skills and teamwork-development seminars.

FELLOWSHIPS

The website contains reports by Tau Beta Pi's 78th fellowship group of 35 students, 17 with stipend, who were selected in the spring of 2011. The 79th group, comprising 40 students—21 with stipend, will do graduate work in 2012-13 and was announced in the Summer 2012 BENT. Fellows with stipends are paid cash grants of $10,000 each. Fifteen James Fife Fellowships, sponsored by an irrevocable trust bequeathed by William Fife, *CA A '21*, were given.

LAUREATES

A selection committee of three District Directors chose five Laureates from 15 nominees. *[See page 24.]*

MINDSET

The MindSET K-12 program continues to expand its reach across the country. Currently, 26 ΤΒΠ chapters are hosting or have hosted hands-on activity sessions with local schools. At the close of the fiscal year, more than 750 elementary, middle, and high school students had participated in MindSET activity sessions. In 2011-12, 16 grants totaling $2,618 were issued to nine chapters for MindSET projects.

SCHOLARSHIPS/GRANTS

The 14th group of 200 ΤΒΠ Scholars, who will complete their undergraduate engineering studies in 2012-13, was announced in the Summer BENT. All Scholars receive a cash grant of $1,000 or $2,000 for their senior academic year. Since the program began in 1999, Tau Beta Pi has given and committed $2,608,000 to 1,316 students. The one-time Richard G. Higgins Distinguished Alumnus Scholarship was awarded.

In the ΤΒΠ Chapter Performance Scholarship Program, $9,000 in scholarships were available to students selected by 18 chapters.

Six $1,000 grants for the first year of college study in 2012-13 for incoming freshman engineering students were provided by the Society (for a 14-year total of 89) through the national program conducted by the Society of Automotive Engineers. No Special Assistance Grant was made.

CONTRIBUTIONS FROM ALUMNI

Tau Beta Pi's 2011 Annual Giving Campaign brought gifts of $905,309 (down 2.7%) from 11,007 donors (down 5.7%), including 405 new donors (down 3.6%). Their names were published in the Winter and Spring 2012 issues of THE BENT. Included in the total is $37,430 allocated to the Fellowship and Scholarship Programs from 234 companies that match gifts from employees. The 2012 Giving Program began on February 1, and the response by July 31 reached $547,900 from 7,252 loyal members.

The Society was included as an eligible organization in the 2012 national Combined Federal Campaign.

The Society uses minimal professional assistance in the conduct of this extremely efficient program; the Association officials are deeply grateful to the generous alumni whose gifts fund important programs that help our chapters and student members.

OTHER ACTIVITIES

Tau Beta Pi has maintained its affiliations with the American Association for the Advancement of Science and the Association of College Honor Societies, and its association membership in the American Society for Engineering Education. The Executive Director is Tau Beta Pi's official representative to these organizations, although other officers of the Association occasionally attend their meetings.

Tau Beta Pi operates its own web-based job board—The Best People—and maintains other valuable benefits for members. Over 1,700 jobs were available through The Best People on July 31.

The Association was a contributing society to National Engineers Week 2012.

President Simonson, Executive Director Gomulinski, and others visited with alumni at receptions and gatherings in Longmont, CO; Manhattan Beach, CA; Northville, MI; Chicago, IL; Minneapolis, MN; Orlando, FL; San Antonio, TX; and Sioux Falls, SD. Alumni also attended several District conferences.

Tau Beta Pi has maintained its classification under Section 501(c)(3) of the U.S. Internal Revenue Code as a tax-exempt, charitable and educational, non-private organization and is exempt from sales tax in 16 states. Collegiate chapters are separately classified under Section 501(c)(7) of the code, except Michigan Gamma, which is classified under Section 501(c)(4).

TREASURER'S REPORT

THE FINANCIAL CONDITION of ΤΒΠ at the close of the fiscal year was weakened by substantial capital losses in the trust, but two large bequests and giving by alumni improved the situation. Excess of expense over revenue was $1,092,000. Assets declined in 2011-12 by $937,000 to a total of $21,909,000.

FINANCIAL POSITION STATEMENT

The several named trust funds are commingled and invested under the jurisdiction of the ΤΒΠ Trust Advisory Committee. The trustee is the trust department of the PNC Bank in Cleveland, OH. The trustee performed satisfactorily during the year.

Investment earnings of the funds, less trustee fees and including capital gains, are used for the purposes indicated by the fund titles: paying fellowship and scholarship stipends, paying for BENT magazines delivered to life subscribers, paying project grants to chapters in the MindSET and Greater Interest in Government Programs, helping to support the Convention, and financing many useful activities of the collegiate chapters. Overall net earnings of the investments, including security sales and market gains, were -6%; the previous year's figure is 19%. Paid investment earnings were $406,000; net investment market losses were $1,279,000.

Securities held by the trustee on July 31, 2012, are carried at market value of $19,123,000, a decrease of 6.3% from the previous year, and comprise holdings in 11 non-overlapping, no-load mutual funds. Equity securities constituted 90% of the total trust funds.

The current liability in fellowships and scholarships is for those stipends committed in 2011-12 for payment in 2012-13 to student recipients. The 2012 Convention liability includes the assessments paid by new initiates during the year and $30,300 in gifts from corporate and university sponsors. The deferred BENT subscription liability is for both annual subscriptions and the four-year subscriptions for new members included in the Association initiation fee. The liability for delivering future magazines under four-year subscriptions is entered on the books at the time of initiation.

The decrease in BENT life subscription liability was countered by the 337 new life subscribers. Life subscription fees are recorded as a liability because of the commitment against the annual earnings of those fees to pay for copies of THE BENT to be delivered. This liability represents the total value of all life subscriptions in force on July 31, 2012, at their enrollment-fee prices, less an actuarial proportion of $1,217,100 recognized as revenue since 2004. Upon the deaths of life subscribers, their paid fees are transferred on the books to the Fellowship Fund and are reported as revenue.

The net assets of the Association decreased by $937,000 because of trust investment losses of $1,092,000. A subsidiary report details the changes during the year in individual funds, most of which increased because of the gain in market value.

The L.E. Record Scholarship Fund fell by $403,000, Vincent A. Stabile Scholarship Fund by $239,000, the Fellowship Fund by $33,000, the Convention Fund by $232,000, and THE BENT Life Subscription Fund balance by $464,000, but the Engineering Futures and District Program Funds grew by $30,000 and $205,000, respectively. The new Kathleen and Robert Sickafoose Scholarship Fund and the new District Program Fund were established after a generous bequest was received.

THE TAU BETA PI ASSOCIATION

STATEMENT OF FINANCIAL POSITION

On July 31, 2011 and 2012

ASSETS

Current Assets	*2012*	*2011*
Cash and cash equivalents	$ 772,071	$ 471,119
Accounts receivable:		
Chapters	52,254	38,008
Student loans	17,092	19,000
BENT life subscription installments	6,130	7,574
Trust contributions	5,000	5,000
Other	16,077	7,816
Total Receivables	96,553	77,398
Inventory	20,130	20,130
Split-interest agreements, cur. portion	78,287	72,792
Prepaid expenses	22,121	14,499
Total Current Assets	989,162	655,796
Depreciable: Furniture and equipment	157,580	156,861
Less accumulated depreciation	-134,617	-134,148
Total Depreciable	22,963	22,713
Other Assets		
Investments	19,122,852	20,447,299
Split-interest agreement, net of cur. portion	774,803	720,416
	$19,897,655	$21,167,715
TOTAL ASSETS	$20,909,780	$21,864,224

Financial statements have been audited.

LIABILITIES AND NET ASSETS

Current Liabilities	*2012*	*2011*
Accounts payable		
Chapters	$ 6,131	$ 6,131
Laureate awards	12,500	12,500
Fellowships/Scholarships	609,000	471,000
Other	12,520	11,926
Accrued expenses	30,165	42,148
Annuities payable, current portion	19,037	19,037
Deferred Convention revenue	94,810	70,444
Deferred BENT revenue, current	63,783	60,262
Total Current Liabilities	847,946	693,448
Annuities payable, net of cur. portion	111,687	117,428
Deferred BENT subscription revenue	78,849	76,616
THE BENT life subscriptions	1,263,896	1,259,286
Total Long-term Liabilities	1,454,432	1,453,330
TOTAL LIABILITIES	2,302,378	2,146,778
Net Assets		
Unrestricted:		
Undesignated	998,747	925,783
Designated	6,776,125	7,372,842
Temporarily restricted	5,526,470	6,154,643
Permanently restricted	5,306,060	5,246,178
TOTAL NET ASSETS	18,607,402	19,699,446
TOTAL LIABILITIES & NET ASSETS	$20,909,780	$21,846,224

STATEMENT OF ACTIVITIES

Chapter and initiation fees (shown less THE BENT subscription portion) were unchanged.

Overall contributions and bequests rose by $580,000. Total gifts from alumni and matching corporations in the two annual giving programs in 2011-12 amounted to $881,896 (down 6% from 2010-11). The Association is deeply grateful to the 11,082 members who contributed during the year.

Convention revenue consists of assessments for the 2012 Convention, $59,650 in industrial gifts, and $54,797 from 106 alternate delegates and visitors.

BENT publication revenue rose by $13,000 aided by improved recruitment advertising; expenses rose by $14,000. Total investment earnings and market loss on the Life Subscription Fund fell by $130,000. In 2011-12, the invested fund lost $0.51 per life copy delivered, compared with the previous year's gain of $2.15. Losses per life copy exceeded cost by $1.83, versus last years' excess earnings of $0.85 per copy.

The total of interest and dividends in 2011-12 dropped by $5,000. The net loss on investments was $1,279,000, reflecting reported changes in market value.

The 10 major chapter programs (the first 10 under Expenses) usually show an operating loss. Convention expenses dropped by $17,000 and include the cost of attendance by one student delegate from each collegiate chapter, alternate delegates, alumnus delegates, chapter advisors, and visitors—but not by national officers.

Expenses for fellowships and scholarships rose by $135,000 because more scholarships and fellowships were given. (Revenue for these awards includes all matching gifts from corporations and alumnus contributions specifically earmarked by donors.) Since the Fellowship Program was inaugurated in 1929, ΤΒΠ has given and committed $5,500,000 in stipends to 964 Fellows and $2,608,000 to 1,316 Scholars. Fellowships and scholarships comprise the major philanthropic program of the Society—made possible by gifts from alumni, friends, and participating industrial firms.

INITIATION FEES

Tau Beta Pi's low Association initiation fee covers the cost of the official badge, membership certificate, copies of the *Constitution and Bylaws* and *Information Book*, and a four-year subscription to THE BENT. The initiation fee has been $32 since August 1, 2004. In addition, new members were charged an assessment of $7 for partial support of the annual Convention.

STUDENT LOANS

Only five new loans were made to members in 2011-12 for a total of $7,700. One was for the amount of TBΠ's initiation fee. One loan was repaid, two were written off during the year, leaving ten outstanding on July 31, 2012, with a principal balance of $17,100. Since inauguration in 1932 of the program, 1,784 loans have been made to student members for a total of $862,675.

EDITOR'S REPORT

THE BENT

During 2011-12, the four issues contained a total of 216 pages, and 390,279 copies of the magazine were available for paid subscribers. This is a 1% increase in paid copies above the previous year's circulation total. Engineering and graduate-school recruitment advertising for the year totaled 15.9 pages, a 9% decrease from the previous year. Total production cost of the magazine per paid copy was $1.32, up from $1.30 the preceding year.

New BENT life subscribers added during the year numbered 337 (down from 391), bringing total life subscriptions to 79,593. Of all the life subscribers enrolled since 1929 when the plan was instituted, 10,940 are deceased, and their

THE TAU BETA PI ASSOCIATION

STATEMENT OF ACTIVITIES

For the years ended July 31, 2011 and 2012

REVENUE	*Unrestricted*	*Temporarily Restricted*	*Permanently Restricted*	*2012*	*2011*
Initiation and chapter fees and fines	$ 219,930			219,930	209,710
Chapter and individual sales	129,094			129,094	122,063
Contributions and bequests	1,657,216	25,250	0	1,682,466	1,102,885
Convention	175,662			175,662	184,125
THE BENT publication	249,051			249,051	254,098
Net life subscription fee transfer	14,667			14,667	39,979
Student loan interest	1,639			1,639	705
Miscellaneous/ Net gain on equipment sales	30,816			30,816	22,848
Interest and dividends	195,514	392,333		588,847	593,859
Net gain (loss) on investments	(763,007)	(516,212)		(1,279,219)	2,919,762
Change in value of split-interest agreements			59,882	59,882	39,564
Net assets released from restrictions	529,544	(529,544)	-	0	0
TOTAL REVENUE	2,441,126	(628,173)	59,882	1,872,834	5,489,568
EXPENSE					
Program services:					
Chapter and initiate supplies	280,537			280,537	297,991
Cost of chapter and individual sales	104,873			104,873	106,015
Convention	458,745			458,745	453,037
Advisor Program	13,648			13,648	22,170
Alumni Programs	54,779			54,779	54,626
BENT publication	514,390			514,390	500,676
BULLETIN production	17,523			17,523	17,426
District Program	270,106			270,106	234,249
Engineering Futures Program	162,714			162,714	158,426
Fellowship & Scholarship Program	679,282			679,282	544,017
Greater Interest in Government Program	4,596			4,596	3,969
K-12 MindSET Program	44,154			44,154	44,480
Laureate Program	19,932			19,932	20,237
McDonald Mentor Program	5,674			5,674	5,618
Student Assistance Program	1,883			1,883	1,883
Student Loan Program	10,725			10,725	8,846
Total program services:	2,643,561			2,643,561	2,473,666
General and administrative	90,106			90,106	135,290
Alumnus Giving Program	231,212	0	0	231.212	238,605
TOTAL EXPENSE	2,964,879			2,964,879	2,847,561
CHANGE IN NET ASSETS	(523,753)	(628,173)	59,882	(1,092,044)	2,642,007
Net assets, beginning of year	8,298,625	6,154,643	5,246,178	19,699,446	17,057,439
Net assets, end of year	$7,774,872	5,526,470	5,306,060	18,607,402	19,699,446

Financial statements have been audited.

fees totaling $321,980 have been transferred to the Fellowship Fund in accord with the Constitutional requirement.

An average of 197 copies per issue in 2011-12 was delivered to annual renewal subscribers, 34,020 copies to original four-year subscribers, and 63,353 copies to life subscribers, for a total of 97,570 paid copies per issue. The total number of paid copies for the Summer 2012 magazine was 97,978.

THE BENT carries articles on general professional topics in engineering, news about TBΠ and its members and chapters, and regular departments. The Association is indebted to the alumni who serve as judges and writers of the Brain Ticklers column: H.G. McIlvried III (chair), D.A. Dechman, J.L. Bradshaw, and F.J. Tydeman.

THE BULLETIN

During 2011-12, the three issues contained a total of 28 pages, and no copies were printed. All issues are available on the website. Published chiefly for the information of the student members and the advisors of the collegiate chapters, the newsletter is a valuable means of exchanging project ideas and distributing information and instructions on chapter operations.

OTHER PUBLICATIONS, SOCIAL MEDIA, AND WEBSITE

New editions of the *Constitution and Bylaws and Eligibility Code* and the *Information Book* were prepared and will be printed in the fall when existing supplies are exhausted. Other brochures and materials were updated and reprinted throughout the year.

Tau Beta Pi's presence on social media continued to increase. Over 10,000 members are part of our LinkedIn group, 3,500 people "like" Tau Beta Pi on Facebook, and over 30,000 people have read our blog with daily news. A Twitter account was established and plans are underway for its use.

The website received improvements throughout the year and has received over 19.6 millions visits since its creation. Plans are underway for a complete redesign this fall. The website contains a wealth of operational and historical information about the Society. Visit *tbp.org* to find out the latest TBΠ news!

EDITOR'S NOTE

A flurry of activity is always occurring in and around Tau Beta Pi. You, our faithful readers, can glean a fair amount of what is going on through our Council's Corner and my Editorial. Reports such as Executive Council meetings, District Doings, Fellow & Scholar biographies, and award announcements provide additional details. However, there is much more going on that we hope to share with you as space permits. This section will provide information about member benefits, volunteer opportunities, alumni activities, and news from Headquarters. I hope you find it informative.

- C.D.G.

ASSOCIATION VOLUNTEERS

Tau Beta Pi is pleased to welcome the following new Association Officials:

- **Christopher F. Benson,** *UT A '08*—District 12 Director
- **Neal T. Bussett,** *CA Ξ '09*—District 16 Director
- **Charles W. Caldwell,** *CA A '64*—Fellowship Board
- **Stephan L. King-Monroe,** *MI* E *'08*—Futures Facilitator
- **George K. Miyata,** *WA Δ '10*—District 12 Director
- **Ryan C. Morrison,** *UT A '10*—Futures Facilitator
- **James P. Sandman,** *TX Z '11*—Futures Facilitator

Tau Beta Pi expresses its gratitude to the following retiring volunteers:

- **Hitesh R. Bhambhani,** *TX H '02*—Engineering Futures Facilitator for 9 years
- **Tricia E. Gomulinski,** *SD A '98*—District 12 Director for 12 years
- **Wade A. Hull,** *UT A '97*—District 12 Director for 13 years
- **Lindy M. Johnson,** *WY A '01*—District 12 Director for 6 years
- **Bradley E. Kabes,** *MN B '06*—Engineering Futures Facilitator for 5 years
- **Brandon M. Page,** *LA Δ '07*—District 10 Director for 3 years

VOLUNTEER RECOGNITION

Tau Beta Pi depends on many generous alumni to keep our programs and chapters running strong. We thank all of our volunteers for their time, energy, and commitment.

In particular, the Society recognizes four District Directors who have served the collegiate chapters for 18, 12, and 6 years as of July 31, 2012:

- **Sherry D. Jennings-King,** *TN A '93*—18 years
- **Lisa C. Gascoigne**, *NY N '97*—12 years
- **Tricia E. Gomulinski,** *SD A '98*—12 years
- **Lindy M. Johnson,** *WY A '01*—6 years

Seven Engineering Futures Facilitators have served the Society for 18, 12, and 6 years as of July 31, 2012:

- **Annette M. Brenner,** *OH K '93*—18 years
- **Michael D. Czebatul,** *OK A '92*—18 years
- **Yu Cathy Chang,** *PA Γ '00*—12 years
- **Mai D. Lauer,** *FL A '95*—12 years
- **Andrea J. Pinkus,** *NY Δ '97*—12 years
- **Joseph P. Blackford,** *DC Γ '95*—6 years
- **Katelyn T. Blazevic,** *IL Z '03*—6 years

ΤΒΠ would also like to recognize the following alumni who have volunteered their time for over 30 years!

James W. Johnson Jr., *NC A '77*, started volunteering in 1979. His over 30 years of service has included roles as

Assistant District 6 Director, Director of District Programs, Executive Councillor, and Association President. Most recently, he has served as a member of the Trust Advisory Committee for the last 16 years. He has also served as Convention Parliamentarian. Jim currently works at EGSC Beaumont, Inc., in Johnson City, TN.

John R. Luchini, *MI Γ '71*, began volunteering on the national level in 1980 as a District 7 Director. His 32 years of service have also included 4 years as Director

of District Programs. From 1987-1991 as the Assistant Director of District Programs, John helped establish the Engineering Futures Program and was one of the first E.F. Facilitators. He has served as an E.F. Facilitator since 1988, taking a 4-year break while serving as an Executive Councillor during 1994-1998. John retired from Cooper Tire & Rubber Company in 2011.

Russell L. Werneth, *MD B '64*, was one of the very first District Directors in 1976. His over 35 years of support

have included time as Vice President of the Association on the Maryland area Executive Council. He has spent 29 years as a District 4 Director based in Maryland. Russ is a retired NASA aerospace engineer who worked on the Hubble Space Telescope Project and is currently doing educational and public outreach for HST. This year's Convention will be Russ's 37th!

HEADQUARTERS OPERATIONS

Tau Beta Pi Headquarters has adjusted its operating hours effective August 1, 2012. Staff members are now available to take your calls from 7:30 a.m. to 5:00 p.m. ET Monday through Friday. Assistance by phone or email is available until 6:30 p.m. on Thursday and Friday beginning in October until the first week of December and again from the end of March through the end of May.

Headquarters will be closed in observance of the following holidays:

- New Year's Day
- President's Day
- Good Friday
- Memorial Day
- Independence Day
- Labor Day
- Thanksgiving
- Friday after Thanksgiving
- Christmas Eve
- Christmas
- New Year's Eve

HEADQUARTERS VISITORS

Nancy F. Gray, *MI Γ '69*, San Antonio, TX; September 2, 2011.
Norman Pih, *TN A '82*, Flagstaff, AZ; September 3, 2011.
Cheryl Cheng, *MI Γ '00*, Troy, MI; September 3, 2011.
Russell W. Pierce, *WA A '70*, Puyallup, WA; September 3, 2011.
Joseph P. Blackford, *DC Γ '95*, Washington, DC; September 3, 2011.
Dennis J. Tyner, *MA E '85*, Ottawa, KS; September 3, 2011.
Scott V. Eckersall, *CA I '96*, Chino Hills, CA; September 3, 2011.
Ronald W. Jenkins, *TNA '72*, Jonesborough, TN; October 7, 2011.
William P. Long, *TN A '69*, Loudon, TN; October 7, 2011.
Ellis P. Gardner, *GA A '83*, Signal Mountain, TN; November 7, 2011.
Nicholas J. Gomulinski, Shelby Township, MI; December 23, 2011.
Dennis R. Gomulinski, Warren, MI; December 23, 2011.
Nancy A. Gomulinski, Warren, MI; December 23, 2011.
Stephan L. King-Monroe, *MI E '08*, Livermore, CA; April 5, 2012.
Kassy M. Lum, *KY A '10*, Lexington, KY; June 20, 2012.
Rebecca A. Forbes, *TN Γ '12*, Cookeville, TN; July 6, 2012.

ALUMNI GATHERINGS

Alumni in the Lexington, KY, area are invited to a reception on Saturday, September 29, at 3:30 p.m. at the Hyatt Regency Lexington. Following the reception, **Harry W. Lange,** *MI Z '75*, will give a talk on Personal Finance and Investments. Harry serves on the Tau Beta Pi Trust Advisory Committee and is the former manager of Fidelity's Magellan Fund. If you are interested in attending, please RSVP to Pat McDaniel (pat@tbp.org) by September 25.

Additional gatherings are being planned for later in the year. An up-to-date list can be found on our website, www.tbp.org/alumni.

TBPCONNECT

Tau Beta Pi will be phasing out the TBPConnect/InCircle social network on September 30, 2012. While popular when launched, the growth and popularity of Facebook, LinkedIn, and Twitter has rendered much of its offerings redundant. We encourage you to join our LinkedIn Group "Tau Beta Pi The Engineering Honor Society," our Facebook Group "Tau Beta Pi: THE BENT" or follow us on Twitter @TauBetaPi. Groups for Fellowships and Scholarships, Districts, Conventions, and others can also be found on these social media services.

DISTRICT DIRECTORS NEEDED

Have you ever considered volunteering your time for Tau Beta Pi? We are looking for District Directors in the Pittsburgh, PA, and either Tampa, FL, or Orlando, FL areas. District Directors are asked to visit their local chapters (typically 4-6 per director) once per year and attend and assist with the annual District Conference, the 3-day annual Convention in the fall, and the Association Officials meeting in June. Directors serve as a resource for local chapters, collaborate with 1-3 other directors in the district, and assist in general administrative work.

Serving as a District Director is challenging but is a fun and educational avenue for giving back to the Association. If you are interested and live in either of the two aforementioned areas, send an email to tbp@tbp.org.

District Directors Ellen S. Styles, Dee Anne Stirm, Scott E. Fable, and Lindy M. Johnson relax after the 2008 Convention.

CHAPTER ETERNAL

The condensed style of these notices of death is made necessary by Tau Beta Pi's large membership and space limitations in The Bent. *You may email or write the Editor for further facts concerning the following deceased members. The assistance of all is earnestly sought in reporting the deaths of Association members, with appropriate details.*

AL A '48 **Davidson, William Reed;** May 31, 2012.
'65 **Clark, George R.;** no details.
AL B '50 **Hayley Sr., Benjamin Lee;** November 30, 2011.
AL Γ '83 **Lawless, Daniel F.;** May 3, 2012.
AR A '53 **Alls, Clarence Raymond;** May 8, 2011.
CA A '41 **Andresen, Robert C.;** June 26, 2012.
'43 **Fong, Arthur;** May 17, 2012.
'50 **MacKenzie Jr., R. Glen;** February 21, 2008.
CA B '44 **Smith, George F.;** November 8, 2003.
CA Θ '83 **Iba, Elaine M.;** August 20, 2011.
CA I '60 **Beltran, Richard D.;** May 26, 2010.
CA K '66 **Gunderson, Robert B.;** October 18, 2009.
CA O '64 **Kusters, John A.;** March 1, 2012.
CO B '49 **Watson, Donald E.;** September 13, 2011.
DC Γ '89 **Miller, John W.;** May 23, 2012.
IL A '43 **Mareneck, William A.;** July 7, 1997.
'52 **Schmidt, Elwood R.;** March 27, 2005.
'76 **Gilbert, Peter D.;** no details.
'84 **Burmeister, Richard A.;** 2010.
IL B '70 **Rustan Jr., Pedro L.;** June 28, 2012.
'73 **Kahn, Joel I.;** 2011.
IL Γ '50 **Stevens, Paul N.;** May 24, 2012.
IN A '38 **Lascoe, Orville D.;** February 11, 1988.
'47 **Tuttle Jr., Max A.;** June 26, 2012.
'48 **Lehman, Guy W.;** no details.
'49 **Davis, Henry E.;** July 16, 2011.
'52 **Burwell, Calvin C.;** June 1, 2012.
'53 **Schroeder, Morris E.;** November 5, 2011.
'56 **Canganelli, David O.;** September 20, 2011.
'92 **Hoenert, Shelly Ann;** no details.
IN Γ '63 **Kovac, Michael G.;** May 9, 2012.
IA A '48 **Doraiswamy, Laxmangudi K.;** June 2, 2012.
'51 **Kreer, John B.;** March 17, 2012.
'52 **O'Dell, Robert A.;** May 8, 2004.
IA B '57 **Judd Jr., Howard G.;** May 11, 2012.
KS A '34 **Edson, William A.;** April 13, 2012.
'46 **Douglas Jr., William H.;** May 18, 2012.
'53 **Murray, Warren A.;** April 11, 2003.
KS Γ '46 **Grosh, Doris L.;** no details.
'49 **Clarke, Richard L.;** no details.
KY A '60 **Linkner, Robert E.;** April 14, 2012.
KY B '48 **Clark III, John H.;** August 6, 2004.
'55 **Miller, Edmond T.;** May 2010.
ME A '40 **Bonney, Robert H.;** April 8, 2012.
MD A '50 **Mergenthaler, Ronald M.;** no details.
MD B '53 **Carter, Winfred O.;** July 28, 2010.
MA A '38 **Kullas Jr., Albert J.;** December 11, 2011.
MA Δ '49 **Bloom, Milton;** August 9, 2007.
'49 **Dunning, Robert F.;** July 15, 2005.
MA E '42 **Mroz, Edmund A.J.;** May 15, 2012.
'48 **McLeod, Benjamin C.;** April 24, 2011.
'49 **Ricketson Sr., Ralph S.;** October 25, 2011.
'50 **di Scipio Jr., Attilio Alfred;** January 6, 2011.
'52 **Hatch, Richard W.;** June 23, 2012.
'55 **Dispensa, Martin T.;** May 2, 2012.
MA Z '63 **Couture, Russell W.;** April 19, 2012.
MI B '38 **Peets, Robert G.;** July 3, 2012.
MI Γ '33 **Hesler, Harold P.;** January 11, 2012. *[Centennarian 84]*
'39 **Ipsen, Peter G.;** March 7, 2012.
'46 **Birdsall, Charles K.;** no details.
'46 **Gehring, Frederick W.;** May 29, 2012.
'49 **Akright, Harvey W.;** June 14, 2005.
MI H '40 **Kantrowitz, Adrian;** November 14, 2008.
MS A '39 **Hardy, Thomas W.;** May 9, 2012.
MN A '49 **Thoen, Richard L.;** May 3, 2011.
MO B '56 **Wofford, James J.;** May 5, 2012.
'60 **Rizer, Gene C.;** March 4, 2012.
MO Γ '58 **Hiscox, Harold C.;** June 10, 2010.
NE A '50 **Williams, Clifford W.;** January 2010.
NJ A '35 **Arnold Sr., Richard S.;** April 4, 2012.
'45 **Ritmeester, Henry J.;** no details.
'55 **Beckstein, Erick J.;** July 3, 2009.
NJ Γ '48 **Schneider, Lewis;** October 17, 2011.
NJ Δ '51 **Huber, Walter G.;** November 12, 2011.
NY A '44 **Gaden Jr., Elmer L.;** no details.
NY Γ '44 **Howe, Harlan L.;** April 12, 2012.
'48 **Lehman, Edgar B.;** no details.
NY E '48 **Losee Jr., Walter B.;** August 2004.
NY Z '49 **Galowin, Lawrence S.;** May 15, 2012.
NY Θ '47 **Conklin, George M.;** no details.
NY I '70 **Verter, Michael R.;** September 18, 2011.
NC A '40 **Gregg Jr., Percival Porcher;** June 16, 2012.
'49 **Overing, R. Edwin;** December 5, 2011.
NC Γ '42 **Beeson Jr., Donald Richard;** January 9, 2012.
OH A '45 **Wallach, Ivan A.;** June 10, 2012.
'50 **Fagley, William L.;** September 8, 2011.
OH B '42 **Kirsch Sr., Howard A.;** July 7, 2012.
'54 **Hoak, Donald E.;** February 2012.
'72 **Gahn, Bruce M.;** May 29, 2012.
OH Γ '42 **Berg, Morris;** October 13, 2004.
'49 **Hartman, Robert Ernst Conrad;** May 15, 2012.
'51 **Flannigan, James B.;** April 24, 2012.
'03 **May, Jamison Denard;** May 20, 2011.
OH Δ '84 **Quinet, David Arthur;** May 2, 2012.
OH K '50 **Thomas, Stan S.;** no details.
OR A '50 **Wildfong, Edgar F.;** no details.
PA A '42 **Ransom II, John T.;** June 12, 2012.
'63 **Wayson, R. Dennis;** September 9, 2010.
PA B '52 **Peterson, Robert S.;** May 10, 2012.
'79 **Davis III, Myron W.;** May 3, 2012.
PA H '59 **Kreider, John R.;** October, 2011.
SC Γ '49 **Graham Jr., Irwin Patton;** December 11, 2011.
TN A '43 **Wheeley, B. Otto;** May 21, 2012.
'55 **Reedy, Joe P.;** no details.
'83 **Cooper, Ronald D.;** August, 2006.
TN B '56 **Wilkerson, H. Joe;** May 26, 2012.
TN Γ '57 **Baker, Robert C.;** January 13, 2012.
TX A '48 **Ferguson, Charles W.;** May 3, 2012.
'60 **Krog Sr., John Armstrong;** May 23, 2012.
'73 **Trutna, William R.;** 2011.
TX B '69 **Raesz, Reuben Herman;** May 30, 2012.
TX Δ '47 **Worley, Willard P.;** March 29, 2012.
'48 **Phillips, Richard F.;** no details.
'53 **Birdwell, John R.;** April 4, 2012.
'53 **Park Sr., John Louis;** June 18, 2012.
TX I '63 **Ritchie, Ronald J.;** May 23, 2012.
UT Γ '90 **Olsen, Tanya Ann;** May 8, 2008.
VA B '52 **Frazier Jr., George C.;** June 1, 2012.
'62 **Zuidema Jr., George L.;** April 22, 2012.
WV A '41 **Zinn Jr., Taylor B.;** January 8, 2008.
WI A '43 **El-Wakil, Mohamed M.;** June 10, 2012.
'44 **Young, Warren C.;** March 2, 2012.
'45 **West, Robert P.;** February 2012.
'46 **Hlavka, George E.;** May 5, 2012.
'48 **Estrin, Gerald;** March 29, 2012.
'50 **Schopler, Harry A.;** May 8, 2012.
WI B '42 **Massopust, Carl Frank;** no details.
'43 **Schneider, E. Carl;** February 11, 2011.

BRAIN TICKLERS

(Continued from page 35)

required to assure either that the bottles all have the same weight or to determine the light and heavy bottles?

—*You'd Better Be Really Smart Brain Bafflers* by Tim Sole and Rod Marshall

4 Alice and Beth each toss n fair coins. What is the probability that they throw the same number of heads?

—adapted from *Problems in Probability Theory, Mathematical Statistics and Theory of Random Functions* by A.A. Sveshnikov

5 A Tau Bate is standing 5 meters away from a long, tall, vertical wall. She holds a garden hose in her hand. The nozzle is 1 meter above the ground and water emerges from the nozzle at a velocity of 10 m/s. Using only her wrist to vary the horizontal and vertical angles at which water leaves the nozzle, what is the maximum area of the wall that she can wet down? Use 9.81 m/s^2 for the acceleration due to gravity and report the answer to 3 significant digits.

—**John L. Bradshaw,** *PA A '82*

Bonus. A plane takes off from an airport on the equator and heads due northeast. If it always maintains a true northeast heading, what is the exact latitude at which it will cross its starting longitude for the first time? Assume that the earth is a perfect sphere and that the plane can be refueled while in flight.

—Technology Review

Computer Bonus. This cryptogram is in honor of Jim Froula and his many years of service to Tau Beta Pi; he was named Secretary-Treasurer in 1982 and served as Executive Director until his retirement in 2011.

J·FROULA = RETIRE·S

Of course, we want Jim to enjoy maximum REST. The symbol · stands for multiplication. The problem is in base 12, and all the usual rules apply.

—**Howard G. McIlvried, III,** *PA Γ '53*

Send your answers to any or all of the Brain Ticklers to: **Curt Gomulinski, Tau Beta Pi, P.O. Box 2697, Knoxville, TN 37901-2697** or email plain text only to: *BrainTicklers@tbp.org*. The cutoff date for entries to the Fall column is the appearance of the Winter Bent around mid-January. The method of solution is not necessary. We also welcome any interesting new problems that may be suitable for use in the column. The Computer Bonus is not graded. Curt will forward your entries to the judges, who are: **H.G. McIlvried III,** *PA Γ'53;* **F. J. Tydeman,** *CA Δ '73;* **D.A. Dechman,** *TX A '57,* and the columnist for this issue,

—**J.L. Bradshaw,** *PA A '82.*

EXECUTIVE COUNCIL

(Continued from page 26)

for Saturday night were approved, and an invitation to Ray A. Rothrock, *TX Δ '77,* to be the keynote speaker was extended. A proposal from the Advisor Recruitment and Development Committee to invite additional advisors to Convention was approved. A plan to offer professional development sessions on Thursday was accepted.

The Council approved a series of amendments to be reviewed by committees at the 2012 Convention. Amendments include clarifying the appointment and terms of Association officials, removing requirements for written documents in certain situations, changing a graduate student eligibility requirement to be "enrolled" instead of "in residence," clarifying the role of alumnus chapters in amendment ratification, removing paper catalog card stipulations, updating reporting requirements, clarifying chapter record-keeping, allowing THE BENT subscription price to be set by the Executive Council with Convention review, updating out-of-date language, and correcting incorrect internal references.

The Council reviewed the performance of Executive Director Gomulinski and established goals for the current fiscal year.

LETTERS TO THE EDITOR

(Continued from page 6)

have otherwise overlooked had I not had the honor of hearing Dr. Feisel present it in person. Thankfully Lyle's Laws will continue to be available at the Tau Beta Pi website or perhaps even in book form one day. Many thanks to Dr. Feisel for his extraordinary words of wisdom.

Gregory M. Wilkins, Ph.D., IL A '92

Scholars

•I am greatly honored to have received a Tau Beta Pi Scholarship! This not only aids in paying for college tuition, but is also an incredible recognition. Being a Tau Bate has been an outstanding experience! I devote my time to the Arizona Alpha Chapter as vice president and look forward to serving as president next year.

Ina A. Kundu, AZ A '13

•I would like to express my immense gratitude to Tau Beta Pi for this scholarship. It is a greatly appreciated financial relief. I am very proud to be a member of Tau Beta Pi and look forward to furthering my education in the field of computer engineering.

Ethan C. Grefe, WI A '13

• Thank you for honoring me with a ΤΒΠ scholarship. It is with deep and humble gratitude that I accept this award. The scholarship has brightened my future two semesters considerably, and has brought joy and relief to my parents.

Anjali K. Bains, NY A '13

•I would like to thank the Tau Beta Pi Association and Board for the honor of awarding me a ΤΒΠ Scholarship, and to all those who donate to make these scholarships possible. I am extremely grateful, and this will help me to continue my studies.

Breana K. Pabst, MT A '13

• My wife and I would like to express our gratitude for this generous scholarship. It will be such a blessing to us in the upcoming year.

Isaiah J. Davies, UT A '13

California Alpha

Timothy M. Edgar, '08, is a co-winner of the Department of Energy Apps for Energy competition for *Leafully*. This app helps utility customers visualize their energy usage in a variety of units, such as the amount of trees needed to offset an individual's consumption. Leafully encourages users to set savings goals. Edgar, a District 14 Director, is now working full-time on the app, after he and fellow Microsoft software engineer Nathan Jhaveri shared the $30,000 DoE award.

Colorado Alpha

Kent D. Peaslee, Ph.D., P.E., '78, has been appointed president of the Association for Iron & Steel Technology (AIST) for 2012-13. He is chair of steelmaking technology and professor of metallurgical engineering at the Missouri University of Science and Technology. Dr. Peaslee earlier worked for 13 years in the steel industry.

DC Beta

Mallory A. Vogel, '12, has been named by the Intercollegiate Women's Lacrosse Coaches Association as the IWLCA Division III scholar athlete of the year. A senior midfielder for the Catholic University Cardinals, she graduated in May with a B.S. in biomechanical engineering—and is expected to earn her master's this year. On the field, Vogel scored 42 goals and dished out 27 assists during the past season.

Florida Gamma

Peter E. Pisasale, P.E., '06, has been named the National Society of Professional Engineers (NSPE) young engineer of the year. He has been with Raytheon Company for 13 years and has worked in electrical design, test, and most recently manufacturing management.

Florida Delta

Steven C. Kellogg, '86, is a minister for Community of Christ and serves as the Africa/Haiti field financial officer. He is based in Independence, MO, and holds the priesthood office of bishop. Kellogg is a graduate of the U.S. Navy Nuclear Power School and served as a nuclear submarine officer.

Indiana Alpha

James A. Krozel, Ph.D., '85, has joined The Innovation Laboratory, Inc., Portland, OR, as chief scientist, to lead the research and development and innovation (R&D&I) division. He came from Metron Aviation where he was a senior engineer for 10 years.

Michigan Gamma

Lawrence J. Chickola, P.E., '86, is chief corporate engineer of Six Flags Entertainment Corp., presiding over one of the nation's largest collections of roller coasters (120) and other rides. He must ensure that the sudden twists and turns adhere to safety standards, which limit the strength and duration of gravitational forces to which riders can be exposed.

Massachusetts Alpha

Celena H. Dopart, '12, was chosen as winner of the Capital One NCAA Division III Academic All-America of the Year award for the Women's At-Large division, as selected by the College Sports Information Directors of America (CoSIDA). The WPI senior field hockey student-athlete graduated with a 4.00 GPA in aerospace engineering while earning a minor in English.

Massachusetts Beta

Daniel F. Dedrick, M.D. '66, has retired from his position as a faculty member at the Harvard Medical School. He was an assistant professor of anesthesia.

Mississippi Alpha

Thomas W. Hardy, '39, a 93-year-old Columbus, MS, native and mechanical engineering graduate, visited Mississippi State University recently to talk to ΤΒΠ members. Upon graduation, Hardy became an aircraft test engineer with Pratt and Whitney, before serving as a Marine fighter pilot in World War II, following which he ran the family plantation. Hardy is pictured with the concrete Tau Beta Pi Bent monument that he helped pour in the 1930s. Mississippi State

is one of few universities with a concrete Bent in that style. (We learned with sadness before going to press that Hardy passed away May 9.)

New York Gamma

James A. Horkovich, Ph.D., '69, has been honored as a 2012 fellow of The

American Institute of Aeronautics and Astronautics (AIAA). He is an engineering fellow at Raytheon Missile Systems in Tucson, Arizona. Dr. Horkovich retired from the U.S. Air Force in 1990 after directing all strategic defense initiative organization laser-technology programs at the Air Force Weapons Laboratory.

New York Eta

William Shapiro, P.E., '70, is retired, after 31 years at Volvo of North America, where he was director of safety, environment and government affairs. He is now a professor at Bergen Community College, teaching math and chemistry. Shapiro is also president of WS/MS Strategies.

New York Nu

Donald A. Coates, Ph.D., P.E., '64, has retired from Kent State Uni-

versity's College of Technology and is now a part-time professor. He teaches courses on innovation, energy power, and industrial controls. Industry positions before becoming a professor in 2004 included vice president of engineering at the Speed Queen division of Raytheon and director of dishwasher engineering at Frigidaire.

Pennsylvania Beta

Leticia Arrington, '83, is a senior staff aeronautical engineer at Lockheed Martin Space Systems. She works on air force strategic strategic and missile defense systems.

Pennsylvania Epsilon

Mark C. Stibitz, '87, has joined the board at Diablo Technologies, a provider of memory bridging solutions. He is president and co-founder of Adaptive Chips, Inc., an early-stage Silicon Valley start-up, and is also principal of Peak Value Solutions, LLC, a technology consulting firm.

South Dakota Beta

Sara J. Drake, '93, is an erosion control specialist at construction equipment and materials provider Carter Waters, LLC, in Kansas City, MO.

Tennessee Zeta

Warren D. Ladbrook, P.E., '93, is leading regional infrastructure

reconstruction following the 2011 earthquake that left some 185 people dead in Christchurch, New Zealand. He is now technical manager-infrastructure at the Canterbury Earthquake Recovery Authority after nearly seven years as an international projects manager at CH2M Hill.

Utah Alpha

John T. Kephart Jr., '48, lives in Wilmington, DE, after retiring in 1985 from the Du Pont Company where he was principal consultant in the engineering department. He was named a fellow of ASME in 1984 and served on several ASME national committees. Kephart also served as president of the Delaware Society of Professional Engineers. His grandson, **Steven Limpert,** *Arizona Beta '12*, is a 2012 TBP Laureate.

Virginia Alpha

R. Gordon Kirk, Ph.D., P.E., '67, is a professor of mechanical engineering

at Virginia Tech. He is also director of the rotordynamics industry affiliates group there. Dr. Kirk joined Virginia Tech in 1985 after some 10 years with the turbo products division of Ingersoll Rand, where he was supervisor of rotor dynamics analysis.

Virginia Beta

Stephen G. Lippy, P.E., '72, has

received the 2012 Stanley E. Kappe award from the American Academy of Environmental Engineers. He recently retired from the Baltimore County Bureau of Solid Waste Management after 40 years as the landfill engineer, and he is now part-time with the Maryland Environmental Service as a consultant.

Washington Gamma

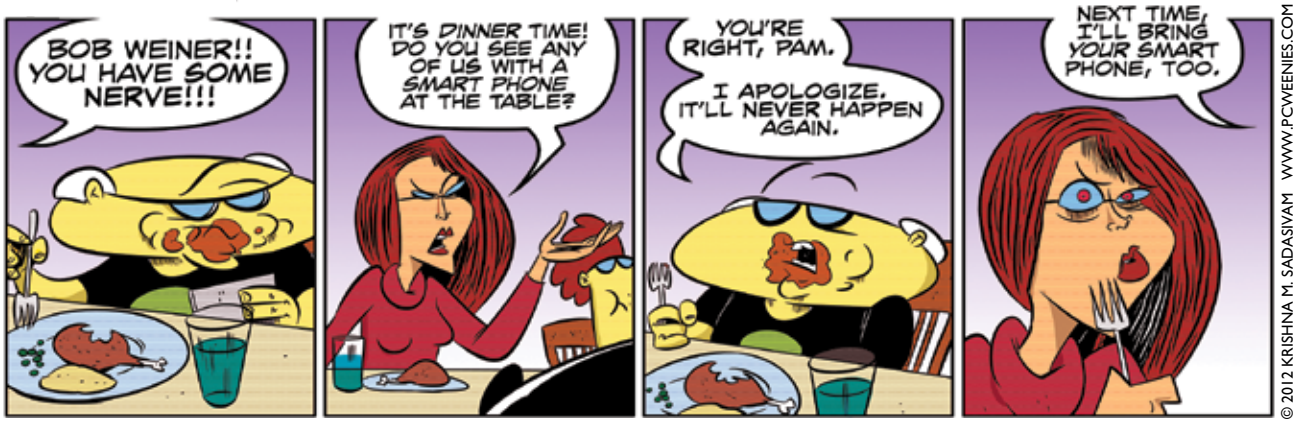
John A. McCarthy, '71, is a superior court judge in Tacoma, Pierce

County, WA. He is also an active member of a Hawaiian outrigger canoe club in the Pacific Northwest. At the age of 60 and after a winter of training, he recently took part in the golden master division of the world sprint races at the French Pacific territory of New Caledonia. It was his third world championship.

Write Your Own Note!

Your fellow Tau Bates are interested in news about you. Send items about civic activities, honors won, weddings, births, promotions, changes in address, etc. to Tau Beta Pi, P.O.Box 2697, Knoxville, TN 37901-2697 or to *alumnote@tbp.org*. Material for publication must be received for the **Spring** issue by February 1, **Summer** issue by May 1, **Fall** issue by August 1, and **Winter** issue by November 1. Include name, address, chapter, class year, and email address or phone number. Thank you!

The PC Weenies



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Member Benefits

SEE COMPLETE LIST at *tbp.org/pages/ForMembers*

- **GEICO**—additional discounts on automobile insurance.
- **Linked-In**—join 8,300 members in our official group for professional networking and career discussions. (Search: Tau Beta Pi Engineering Honor Society)
- **LTCFP**—long-term care outreach and education program with access to favorable rates on long-term care insurance.
- **My Home Benefits**—moving discounts & real-estate services.
- **PPI**—discounts on professional licensing exam review materials (FE/EIT, PE, LEED, & more).
- **TBP Job Board**—post a résumé online and browse through hundreds of engineering jobs at top companies.

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QTY.	DESCRIPTION & QUALITY	PRICE
	A. OFFICIAL BENT (FULL SIZE) FOR MEMBERS ENGRAVED AT NO CHARGE WITH NAME, CHAPTER, AND CLASS:	
___	•10K YELLOW GOLD	146.00
___	•10K WHITE GOLD	146.00
___	•GOLD FINISH, SATIN BACK	29.00
	B.1(p) OFFICIAL (FULL SIZE) BENT (PIN) FOR MEMBERS IS ENGRAVED WITH NAME, CHAPTER, & CLASS AT NO CHARGE, AND A PIVOTING PIN TO SECURE THE BENT TO A LAPEL IS SOLDERED ONLY ON NEW BENT:	
___	•10K YELLOW GOLD	148.00
___	•10K WHITE GOLD	148.00
___	•GOLD FINISH, SATIN BACK	28.00
___	***B.2(p)** SMALL BENT (PIN): •10K YELLOW GOLD	74.00
___	•GOLD FINISH, SATIN BACK	27.00
___	***B.2(c)** SMALL BENT (CHARM): •10K YELLOW GOLD	90.00
___	•GOLD FINISH, SATIN BACK	20.00
___	***B.3(p)** MINIATURE BENT (PIN): •10K YELLOW GOLD	70.00
___	•GOLD FINISH, SATIN BACK	26.00
___	***B.3(c)** MINIATURE BENT (CHARM): •10K YELLOW GOLD	69.00
___	•GOLD FINISH, SATIN BACK	25.00
	C. MINIATURE BENT, TO BE WORN AS A TIE TACK; CLUTCH AND CHAIN ASSEMBLY INCLUDED:	
___	•10K YELLOW GOLD	89.00
___	•GOLD FINISH, SATIN BACK	24.00
___	**D.** MINIATURE BENT, GOLD FINISH, TO BE WORN AS A RECOGNITION BUTTON (CLUTCH INCLUDED)	23.00
___	**E.** WOMAN'S 3mm BALL-LEVER BACK EARRINGS, 14K YELLOW GOLD WITH 10K MINIATURE BENTS	159.00
	F. OFFICIAL RING (SEAL TYPE):	
___	•10K YELLOW GOLD	515.00
___	•10K WHITE GOLD	515.00
___	**G.** OFFICIAL SIGNET RING (WITH MINIATURE BENT): •10K YELLOW GOLD	555.00

QTY.	DESCRIPTION & QUALITY	PRICE
	H. WOMAN'S OVAL INCISED LETTER RING:	
___	•10K YELLOW GOLD	295.00
	RING SIZE:	
___	**I.** TIE BAR, 50mm SOLID BAR WITH ALLIGATOR CLASP, GOLD FINISH (BENT NOT INCLUDED)	57.00
___	**J.** EXPANDABLE TIE BAR, WITH ALLIGATOR CLASP AND 140mm CURB CHAIN, GOLD FINISH	54.00
___	**K.** WOMAN'S SINGLE-LINK BRACELET, GOLD FINISH (BENT NOT INCLUDED)	48.00
___	**L.** CROSS PEN WITH BENT, GOLD FINISH	89.00
___	**M.** REPLACEMENT MEMBERSHIP CERTIFICATE	13.00
___	**N.** MAN'S NECKTIE, 100% SILK, 95mm WIDE; NAVY & WINE STRIPES, WITH GOLD BENT	35.00
___	**O.** STOLE: WHITE SATIN GRADUATION COLLAR EMBROIDERED WITH BENT	28.00
___	**P. CERAMIC MUG: WHITE, 125th LOGO (SEE WEB)**	**10.00**
___	**R1.** T-SHIRT: 100% PRESHRUNK COTTON, BLACK WITH RADIANT BENT, (XXL: 20.00) S-M-L-XL	18.00
___	**R2. NEW:** T-SHIRT: 100% PRESHRUNK COTTON, BLACK WITH GOLD BENT, (XXL: 17.00) S-M-L-XL	15.00
___	**R3. NEW:** HOODIE: 100% PRESHRUNK COTTON, MAROON OR GREY WITH BENT, (XXL: 30.00) S-M-L-XL	28.00
___	**S. T-SHIRT, 100% PRESHRUNK COTTON, WHITE WITH BLUE LOGO (SEE WEB) S, XL**	**8.00**
___	**U.1** UNSTRUCTURED, LOW-PROFILE, WHITE CAP WITH BLUE LOGO, TAU BETA PI ON SIDE	14.00
___	**U.2** UNSTRUCTURED, LOW-PROFILE, KHAKI CAP WITH BLACK LOGO, TAU BETA PI ON SIDE	14.00
___	**V.** TIE TACK, STERLING OVAL, w/ PIN & CLUTCH, NOT SHOWN (SEE WEB)	45.00
___	**X.** HONOR CORD: WHITE & ORANGE GRADUATION CORD, NOT SHOWN (SEE WEB)	15.00
___	**Z6. NEW:** BLUE PUSH-BUTTON PEN AVAILABLE IN QUANTITIES OF THREE	5.00

** FOR MEMBERS & RELATIVES*

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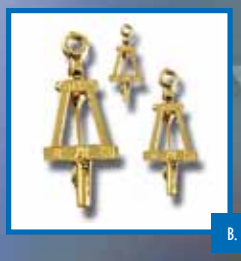
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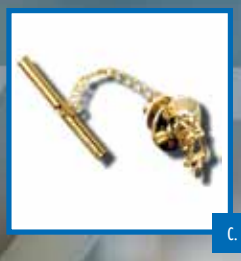
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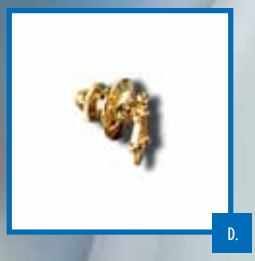
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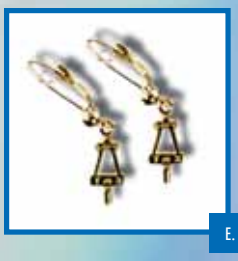
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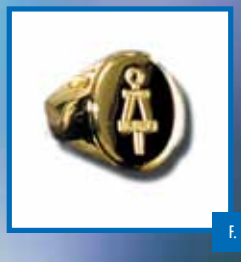
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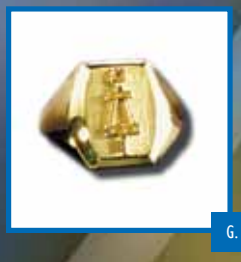
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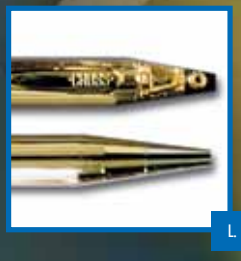
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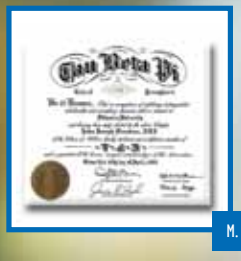

M.


N.


O.


R1.


R2.

R3.


U.


Z6.

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