

THE BENT

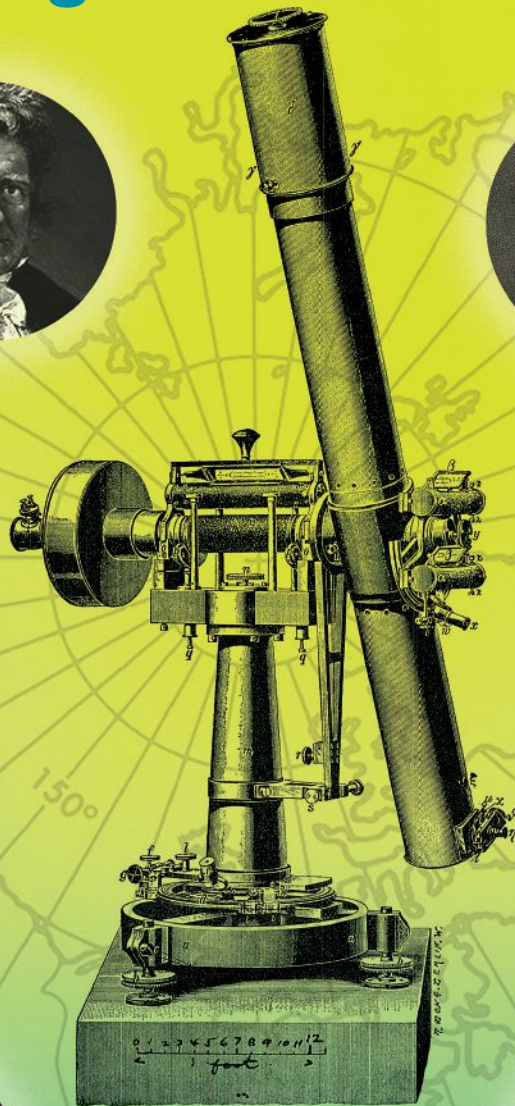
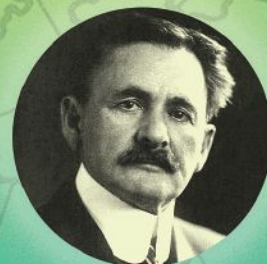
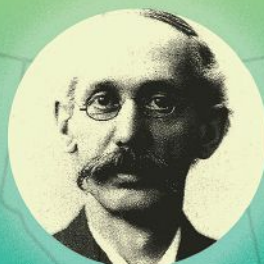
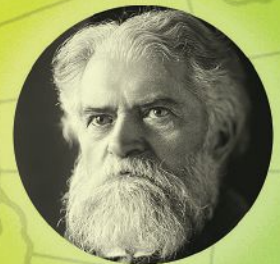
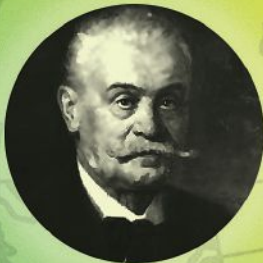
OF TAU BETA PI

The Engineering Honor Society

Spring 2016

Our Wobbling Planet

Leadership Profile



CHAPTERS

ALUMNI CHAPTERS (72)

District 1 • denotes active chapter

- Greater Boston Area, MA
- Central Connecticut, Hartford
- District 2**
- Buffalo, NY
- Central Jersey, NJ
- Long Island Suburban, NY
- Newark, NJ
- New York City, NY
- New York Capital District, NY
- Rochester, NY
- Southern Tier, Binghamton, NY
- District 3**
- Lehigh Valley, Bethlehem, PA
- Philadelphia, PA
- Pittsburgh, PA
- Wilmington, DE
- District 4**
- Baltimore, MD
- Hampton Roads, Newport News, VA
- Kanawha Valley, Charleston, WV
- Research Triangle, Durham-Chapel Hill-Raleigh, NC
- Richmond, VA
- Washington, DC
- District 5**
- Atlanta, GA
- Central Florida, Orlando
- Daytona Beach, FL
- Gainesville, FL
- Miami, FL
- Midlands, Columbia, SC
- Palm Beach/Broward, FL
- Piedmont, Clemson, SC
- Puerto Rico
- Tampa Bay, FL
- District 6**
- Bluegrass, Lexington-Frankfort, KY
- Central Alabama, Birmingham
- Great Smoky Mountains, Knoxville-Oak Ridge, TN
- Greater Gulf Coast, Mobile, AL
- Louisville, KY
- Mid-South, Memphis, TN
- Rocket City, Huntsville, AL
- District 7**
- Ann Arbor Area, MI
- Central Michigan, Lansing
- Cincinnati, OH
- Dayton, OH
- Southeastern Michigan, Detroit
- Flint, MI
- Ohio's North Coast, Cleveland
- Columbus, OH
- West Michigan, Grand Rapids
- District 8**
- Chicago Area, IL
- Central Illinois, Urbana-Champaign
- Milwaukee, WI
- District 9**
- Rolla, MO
- St. Louis, MO
- District 10**
- Greater New Orleans, LA
- Central Texas (Austin/San Antonio)
- Texas Gulf Coast, Houston
- District 11**
- Ames, IA
- Minnesota, Twin Cities, MN
- District 12**
- Pikes Peak, CO
- Front Range, CO/WY
- Salt Lake City, UT
- Treasure Valley, Boise, ID
- District 13**
- El Paso, TX
- Phoenix, AZ
- Sun City, AZ
- Tucson, AZ
- District 14**
- Columbia River Basin, Richland, WA
- Portland, OR
- Puget Sound, Seattle, WA
- District 15**
- Sacramento, CA
- San Francisco Bay Area, CA
- San Francisco Peninsula, Palo Alto, CA
- District 16**
- Greater San Diego, CA
- Southern California, Los Angeles

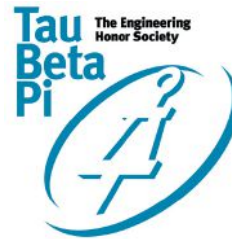
- CA A 15 Univ. of California, Davis
- CA M 15 Calif. Poly. St. Univ., San Luis Obispo
- CA N 16 California State Poly. Univ., Pomona
- CA E 16 San Diego State Univ.
- CA O 16 Loyola Marymount Univ.
- CA P 16 Northrop Univ. (inactive)
- CA P 15 California State Univ., Fresno
- CA S 16 Univ. of California, Santa Barbara
- CA T 16 Univ. of California, Irvine
- CA Y 15 California State Univ., Sacramento
- CA F 15 Univ. of the Pacific
- CA X 16 California State Univ., Fullerton
- CA Y 16 Univ. of California, San Diego
- CA Z 16 Harvey Mudd College
- CA AA 15 California State Univ., Chico
- CA AB 16 Univ. of California, Riverside
- CA AF 15 San Francisco State Univ.
- CA AA 15 Univ. of California, Santa Cruz
- CA AE 16 Univ. of San Diego
- CO A 12 Colorado School of Mines
- CO B 12 Univ. of Colorado at Boulder
- CO G 12 Univ. of Denver (inactive)
- CO D 12 Colorado State Univ.
- CO E 12 Univ. of Colorado at Denver
- CO Z 12 United States Air Force Academy
- CT A 1 Yale Univ.
- CT B 1 Univ. of Connecticut
- CT G 1 Univ. of Hartford
- DE A 3 Univ. of Delaware
- DC A 4 Howard Univ.
- DC B 4 Catholic Univ. of America
- DC G 4 George Washington Univ.
- FL A 5 Univ. of Florida
- FL B 5 Univ. of Miami
- FL G 5 Univ. of South Florida
- FL A 5 Univ. of Central Florida
- FL E 5 Florida Atlantic Univ.
- FL Z 5 Florida Inst. of Technology
- FL H 5 Florida A&M Univ.-Florida State Univ.
- FL O 5 Florida International Univ.
- FL I 5 Embry-Riddle Aeronautical Univ.
- GA A 5 Georgia Inst. of Technology
- GAB 5 Mercer Univ.
- ID A 14 Univ. of Idaho
- ID B 12 Idaho State Univ.
- ID G 12 Boise State Univ.
- IL A 8 Univ. of Illinois at Urbana-Champaign
- IL B 8 Illinois Inst. of Technology
- IL G 8 Northwestern Univ.
- IL A 8 Bradley Univ.
- IL E 8 Southern Illinois Univ. at Carbondale
- IL Z 8 Univ. of Illinois at Chicago
- IN A 8 Purdue Univ.
- IN B 8 Rose-Hulman Inst. of Technology
- IN G 8 Univ. of Notre Dame
- IN A 8 Valparaiso Univ.
- IN E 8 Trine Univ.
- IN Z 8 Indiana Univ.-Purdue Univ. Indianapolis
- IA A 11 Iowa State Univ.
- IA B 11 Univ. of Iowa
- KS A 9 Univ. of Kansas
- KS B 9 Wichita State Univ.
- KS G 9 Kansas State Univ.
- KY A 6 Univ. of Kentucky
- KY B 6 Univ. of Louisville
- KY G 6 Western Kentucky Univ.
- LA A 10 Louisiana State Univ.
- LA B 10 Tulane Univ.
- LA G 10 Louisiana Tech Univ.
- LA D 10 Univ. of Louisiana at Lafayette
- LA E 10 Univ. of New Orleans
- ME A 1 Univ. of Maine
- MD A 4 Johns Hopkins Univ.
- MD B 4 Univ. of Maryland
- MD G 4 United States Naval Academy
- MD A 4 Univ. of Maryland Baltimore County
- MD E 4 Morgan State Univ.
- MA A 1 Worcester Polytechnic Inst.
- MA B 1 Massachusetts Inst. of Technology
- MA G 1 Harvard Univ. (inactive)
- MA A 1 Tufts Univ.
- MA E 1 Northeastern Univ.
- MA Z 1 Univ. of Massachusetts at Amherst
- MA H 1 Boston Univ.
- MA O 1 Univ. of Massachusetts Lowell
- MA I 1 Western New England Univ.
- MI A 11 Michigan State Univ.
- MI B 11 Michigan Tech. Univ.
- MI G 7 Univ. of Michigan
- MI A 7 Univ. of Detroit Mercy
- MI E 7 Wayne State Univ.
- MI Z 7 Kettering Univ.
- MI H 7 Lawrence Technological Univ.
- MI O 7 Oakland Univ.
- MI I 7 Univ. of Michigan-Dearborn
- MI K 7 Western Michigan Univ.
- MI A 7 Grand Valley State Univ.
- MN A 11 Univ. of Minnesota-Twin Cities
- MN B 11 Univ. of Minnesota, Duluth
- MS A 6 Mississippi State Univ.
- MS B 6 Univ. of Mississippi
- MO A 9 Univ. of Missouri-Columbia
- MO B 9 Missouri Univ. of Science & Technology
- MO G 9 Washington Univ.
- MO A 9 Univ. of Missouri-Kansas City
- MO E 9 Saint Louis University
- MT A 12 Montana State Univ.
- MT B 12 Montana Tech of the Univ. of Montana
- NE A 9 Univ. of Nebraska-Lincoln
- NV A 15 Univ. of Nevada, Reno
- NV B 16 Univ. of Nevada, Las Vegas
- NH A 1 Univ. of New Hampshire
- NH B 1 Dartmouth College
- NJ A 2 Stevens Inst. of Technology
- NJ B 2 Rutgers Univ.
- NJ G 2 New Jersey Inst. of Technology

- NJ A 2 Princeton Univ.
- NJ E 2 Rowan Univ.
- NJ Z 2 The College of New Jersey
- NM A 13 New Mexico State Univ.
- NM B 13 Univ. of New Mexico
- NM G 13 New Mexico Inst. of Mining & Tech.
- NY A 2 Columbia Univ.
- NY B 2 Syracuse Univ.
- NY G 2 Rensselaer Polytechnic Inst.
- NY A 2 Cornell Univ.
- NY E 2 New York Univ. (inactive)
- NY Z 2 Polytechnic Inst. of Brooklyn (inactive)
- NY H 2 City College of CUNY
- NY O 2 Clarkson Univ.
- NY I 2 Cooper Union School of Engineering
- NY K 2 Univ. of Rochester
- NY A 2 Pratt Inst. (inactive)
- NY M 2 Union College
- NY N 2 SUNY at Buffalo
- NY E 2 Manhattan College
- NY O 2 SUNY at Stony Brook
- NY P 2 Rochester Inst. of Technology
- NY P 2 Polytechnic Institute of New York Univ.
- NY E 2 Alfred Univ.
- NY T 2 Binghamton University
- NY Y 2 United States Military Academy
- NC A 4 North Carolina State Univ.
- NC B 4 Univ. of N.C. at Chapel Hill (inactive)
- NC G 4 Duke Univ.
- NC A 4 Univ. of North Carolina at Charlotte
- NC E 4 North Carolina A&T State Univ.
- NC Z 4 East Carolina University
- ND A 11 North Dakota State Univ.
- ND B 11 Univ. of North Dakota
- OH A 7 Case Western Reserve Univ.
- OH B 7 Univ. of Cincinnati
- OH G 7 Ohio State Univ.
- OH A 7 Ohio Univ.
- OH E 7 Cleveland State Univ.
- OH Z 7 Univ. of Toledo
- OH H 7 Air Force Inst. of Technology
- OH O 7 Univ. of Dayton
- OH I 7 Ohio Northern Univ.
- OH K 7 Univ. of Akron
- OH A 7 Youngstown State Univ.
- OH M 7 Wright State Univ.
- OH N 7 Cedarville Univ.
- OH E 7 Miami Univ.
- OK A 9 Univ. of Oklahoma
- OK B 9 Univ. of Tulsa
- OK G 9 Oklahoma State Univ.
- OR A 14 Oregon State Univ.
- OR B 14 Portland State Univ.
- OR F 14 Univ. of Portland
- PA A 3 Lehigh Univ.
- PA B 3 Pennsylvania State Univ.
- PA G 3 Carnegie Mellon Univ.
- PA A 3 Univ. of Pennsylvania
- PA E 3 Lafayette College
- PA Z 3 Drexel Univ.
- PA H 3 Bucknell Univ.
- PA O 3 Villanova Univ.
- PA I 3 Widener Univ.
- PA K 3 Swarthmore College
- PA A 3 Univ. of Pittsburgh
- PA M 3 Penn State Erie, The Behrend College
- PR A 5 Univ. of Puerto Rico
- RI A 1 Brown Univ.
- RI B 1 Univ. of Rhode Island
- SC A 5 Clemson Univ.
- SC B 5 Univ. of South Carolina
- SC G 5 The Citadel
- SD A 12 South Dakota School of Mines & Tech.
- SD B 11 South Dakota State Univ.
- TN A 6 Univ. of Tennessee
- TN B 6 Vanderbilt Univ.
- TN G 6 Tennessee Tech. Univ.
- TN A 6 Christian Brothers Univ.
- TN E 6 Univ. of Memphis
- TN Z 6 Univ. of Tennessee at Chattanooga
- TX A 10 Univ. of Texas at Austin
- TX B 13 Texas Tech Univ.
- TX G 10 Rice Univ.
- TX A 10 Texas A & M Univ.
- TX E 10 Univ. of Houston
- TX Z 10 Lamar Univ.
- TX H 10 Univ. of Texas at Arlington
- TX O 13 Univ. of Texas at El Paso
- TX I 10 Southern Methodist Univ.
- TX K 10 Prairie View A & M Univ.
- TX A 10 Texas A & M Univ.-Kingsville
- TX M 10 Univ. of Texas at San Antonio
- TX N 10 Univ. of Texas-Rio Grand Valley
- UT A 12 Univ. of Utah
- UT B 12 Brigham Young Univ.
- UT G 12 Utah State Univ.
- VT A 1 Univ. of Vermont
- VT B 1 Norwich Univ.
- VA A 4 Univ. of Virginia
- VA B 4 Virginia Polytechnic Inst. & State Univ.
- VA G 4 Old Dominion Univ.
- VA A 4 Virginia Military Inst.
- VA E 4 Virginia Commonwealth Univ.
- WA A 14 Univ. of Washington
- WA B 14 Washington State Univ.
- WA G 14 Seattle Univ.
- WA A 14 Gonzaga Univ.
- WV A 4 West Virginia Univ.
- WV B 4 West Virginia Univ. Inst. of Technology
- WI A 8 Univ. of Wisconsin-Madison
- WI B 8 Marquette Univ.
- WI G 8 Univ. of Wisconsin-Milwaukee
- WI A 8 Milwaukee School of Engineering
- WI E 8 Univ. of Wisconsin-Platteville
- WY A 12 Univ. of Wyoming

COLLEGIATE CHAPTERS (252)

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|-------------|-------------------------------------|
| AL A 6 | Auburn Univ. |
| AL B 6 | Univ. of Alabama |
| AL G 6 | Univ. of Ala. at Birmingham |
| AL D 6 | Univ. of Ala. in Huntsville |
| AL E 6 | Univ. of South Alabama |
| AK A 14 | Univ. of Alaska Fairbanks |
| AZ A 13 | Univ. of Arizona |
| AZ B 13 | Arizona State Univ. |
| AZ G 13 | Northern Arizona Univ. |
| AZ A 13 | Embry-Riddle Aero. Univ., Prescott |
| AR A 9 | Univ. of Arkansas |
| CA A 15 | Univ. of California, Berkeley |
| CA B 16 | California Inst. of Technology |
| CA G 15 | Stanford Univ. |
| CA A 16 | Univ. of Southern California |
| CA E 16 | Univ. of California, Los Angeles |
| CA Z 15 | Santa Clara Univ. |
| CA H 15 | San Jose State Univ. |
| CA O 16 | California State Univ., Long Beach |
| CA I 16 | California State Univ., Los Angeles |
| CA K 16 | California State Univ., Northridge |

the Bent^{of}



Spring 2016
Vol. CVII / No. 2

*f*ounded 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

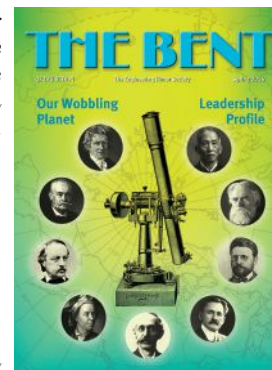
Wobbling Rotation Axis.....14

by Trudy E. Bell

Leadership: Tom Scholz.....20

by Alan S. Brown

ON THE COVER:
Trudy Bell chronicles the discovery of polar motion as the axis of earth's rotation wobbles into eternity.



Cover artist: Dali Polivka

Tau Beta Pi:
THE BENT



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The Bent of Tau Beta Pi® (ISSN 0005-884X) is published quarterly for \$10 per year by The Tau Beta Pi Association, Inc., Room 508, Dougherty Hall, The University of Tennessee, Knoxville, Tennessee 37996-2215; www.tbp.org; FAX: 865/546-4579; email: tbp@tbp.org. Life subscriptions are \$75. Printed in U.S.A. Periodicals postage paid at Knoxville, TN, and at additional mailing offices. SUBSCRIBERS and POSTMASTER: Send address change, request for online subs., & other correspondence to tbp@tbp.org or to: The Bent of Tau Beta Pi / P.O. Box 2697 / Knoxville, TN 37901-2697. Telephone: 865/546-4578

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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

Creating a Vision for the Future

SINCE WE WERE INSTALLED at the 2015 Convention, the Elevate Council has been looking at the programs and services we offer and seeing how they fit into the bigger picture of Tau Beta Pi. We aim to make our Association even more effective and of greater benefit to our members, and to the broader engineering community.

TBPI has been doing very well as an Association. However, it is important to step back and look at what we're doing now so we don't begin to stagnate. None of this is to say we're not doing a good job! Tau Beta Pi can do better and we want to see an increase in our visibility and relevance to today's world. We want to evolve beyond the "business as usual" scenario and transform our Association to an even better, stronger, and more relevant one.

So, we are in the process of reviewing and refining our vision and mission. We will always exist to recognize academic achievement and exemplary character as expressed in the preamble to our Constitution, but we want and aspire to be more than that. Founder Williams' values of integrity and excellence will always play a part—they are the values we cherish as an Association. Tau Bates are leaders on their college campuses and in their careers, and we exist to be more than just a society where you receive a key and certificate. The Council, with input from others, is developing mission statements which embody this goal. We will share these with you all in the coming months.

Reach Our Objective

A vision shared by everyone is critical. We need to look at activities, services, member benefits, etc., and assess their value to our members. In a time of limited resources, we need to get the most "bang for our buck" and be sure we reach our objective.

As an organization that has succeeded in honoring outstanding engineering students and alumni since our founding over 130 years ago, making changes isn't something we take lightly or plan without our members' input. We have brought in a consultant to guide us through strategic planning and have surveyed 2015 Convention attendees to help in this. Recently, the Council as well as other Association Officials completed an analysis of our Strengths, Weaknesses, Opportunities, and Threats (SWOT) and other exercises to identify our challenges and the context—history and values, for instance—that will be the basis of our planning.

Our membership is one of the strengths that was often

mentioned. Having members in all engineering disciplines and at all stages of their careers is the keystone we need to begin that transformation. Tau Beta Pi's focus has always been on our members. We need to continue to be relevant on campus so we can continue to honor in a fitting manner future outstanding engineering students.

For the Association, image or branding, is one of our chief weaknesses but it is also a significant opportunity. The first time I heard about Tau Beta Pi was, like many of you, when I received my letter to join. How many eli-



gible students never open that letter or don't pursue the invitation? We have tremendous opportunities to increase our membership through branding and recognition on campus. We can all contribute to improving our image, starting with something as simple as wearing your Bent or any TBPI merchandise, or participating in any Tau Beta Pi Day activities on March 14.

The groundwork for our strategic plan is being laid through the development of our mission and vision in parallel to better understanding our relevance and impact in the world while assessing outside influences that could impact the Association. This effort will ensure we offer programs of value to members and to the greater community. These services need to reflect and support core values which will help us reach our goal.

In closing, I am constantly reminded of the strength and dedication of our members. Visiting collegiate chapters, meeting alumni, advisors, and students at Convention, and hearing about the success of our Tau Beta Pi family is uplifting and inspiring. We are truly indebted to the over 10,600 members who contributed to the Association last year, especially to those who gave to the Chapter Endowment Initiative, and the dedicated Association volunteers, chapter officers, advisors, and all who help in the work of our Association. It is a pleasure to lead an organization with such a dedicated and generous membership!

I welcome your comments and suggestions throughout this process and look forward to continuing our work together to "elevate" Tau Beta Pi.

—Joseph P. (J.P.) Blackford,
District of Columbia Gamma '95, President

TELL US THE TALE... WIN A T-SHIRT!



Send us your clever captions for this photo from *The Bent* archives, and if it is judged one of the best, you will win a TBPI t-shirt.

The picture above, which appeared in the winter 1976 issue, was taken during the 1975 Convention hosted by Ohio Beta at the University of Cincinnati. Here, M.E. Forsman, Ph.D., *TX A '40*, delegate from the Gainesville Alumnus Chapter, compliments Mrs. Shapton on the table displays she had made for the Initiation and Awards Banquet. Mrs. Shapton, wife of Convention Treasurer W.R. Shapton, Ph.D., *MI A '62*, served as head of the "Wives Program" that year.

Email entries to pat@tbp.org, or mail them to HQ by Monday, May 2, 2016.

The photo for the winter contest, below, was taken during the 1974 Convention in Flint, MI, and hosted by the Michigan Zeta Chapter at the General Motors Institute, which is now Kettering University. Here delegates wait their turn to register for the Convention.

The judges were challenged by an all time high of 40 captions submitted by 21 readers. However, the clear winner was: "Here's the problem! You forgot to plug it in!" submitted by Cynthia F. Burham, Ph.D., *TX A '05*.

The second place entry sent by Arnold S. Grot, *IN A '71*, was:

"3.14159265..... 01989. Woo! Who chose pi to 1000 digits as the password to register?" Congratulations to both of you and enjoy your TBPI t-shirts.

Thanks again to all of our participants past, present, and future, for sharing your brand of engineering humor!



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Keys, Certificates, and Membership Cards

One hundred thirty-one years ago, Professor Williams was finalizing the details for the establishment of Tau Beta Pi. I recently stumbled across documents in our archives related to this early period of our history. In the early part of the 20th Century, Professor Williams prepared a letter outlining his early work.

Regarding the keys and certificates, he wrote, *“When the faults had been weeded out, the poster cuts were photographed and electrotyped, and the copy of the certificate and the electrotype of the bent were taken to the late Rev. Edwin G. Klose, manager of the Moravian Publication Concern. A special font of type, just designed, was purchased by Professor Williams for the sole use of himself; and the certificates were, after many rearrangements, pronounced correct, and the forms were ordered to be locked up ready for work. The working drawing of the key was sent to his friend John L. Newman of New York, the well-known maker of secret society badges, and the first one was filed out of the solid and accepted.”*

The key and certificate still received by each new member of TBPI are very similar to the originals conceived of by Professor Williams. Our current Constitution and Bylaws actually provides specifications for both the key and certificate. These specifications go back to the earliest versions recorded in the Constitution and Bylaws shortly after our founding. The certificates are now printed on standard 8.5” x 11” paper while R.C. Matthew’s certificate (which hangs at Headquarters) measures 17” x 14”. The badge is still shaped as a watch key, although current keys no longer are capable of winding a watch...sorry! For cost reasons, they are also not made of solid gold, although 10K keys are available for purchase. Each key is still engraved with a member’s last name, chapter, and class; something not every honor society does.

In my travels around the country meeting with students and alumni, several commented they wanted something more portable to identify themselves as Tau Bates. While our certificates are great, they just hang on an office wall (or sit in a box), and while the key is nice,

few members wear it. Rex Neal, president of our current certificate manufacturer, Printing Plus, had previously suggested TBPI might want to consider offering membership cards to our members. He provided samples used by other organizations which I presented to the members of our Student Advisory Board. The members of the board agreed that Tau Beta Pi should offer a membership card. The Executive Council approved the plan over the summer and the Headquarters staff worked with graphic designers to create a card. The initial samples were prepared in time for the Providence Convention and offered to donors this past fall.

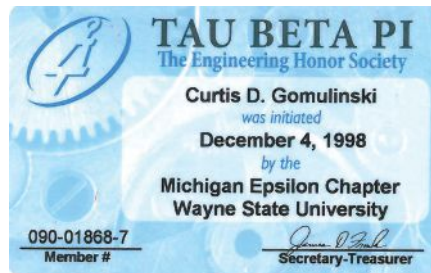
Delegates at the 2015 Convention considered a proposal to increase the initiation fee by \$10. After reviewing the financial data presented to the Financial Affairs Committee, the committee recommended, and the Convention adopted the proposal to increase the initiation fee from \$45 to \$55 effective August 1, 2016. A small portion of the increase will be used to provide a membership card to each new member.

The card is currently being offered to first-time donors making a gift of at least \$25 and to donors who increase their annual contribution by a certain amount. In just four months, over 1,200 members have stepped up their giving and received a card. When your appeal letter arrives this month, I hope you will respond with a gift to TBPI to obtain

your first edition membership card. Alumni giving provides over one million dollars to support the programs, chapters, and student members of the Association. We need to continue to build on our current giving to address the requirements of our growing organization.

The students realized the importance of ensuring the financial security of Tau Beta Pi. I know our generous alumni will continue to support our work so we can minimize future increases to the initiation fee.

Until later,





DISTRICT DOINGS



District 2 chapter members gather at Manhattan College in The Bronx, New York.

DISTRICT 2

The **New York City Alumni Chapter** held a joint event with ASCE where Board of Director member Fred E. Schuepfer, *PA Z '83*, gave a talk on “Cost Effective Management of Oil Spill Risk.” This presentation gave 1.5 PDH to Professional Engineers. Attendees enjoyed pizza while learning about the history, federal regulations, and case studies. Contact President Jennifer Lui at tbpnyalumni@gmail.com to join the chapter.

The **District 2 Conference**, hosted by the New York Xi Chapter, took place in The Bronx on February 20-21. Student leaders from 18 chapters in New Jersey and New York took part in a chapter operations workshop, a buffet dinner with students and alumni, and an Engineering Futures session to strengthen leadership effectiveness.

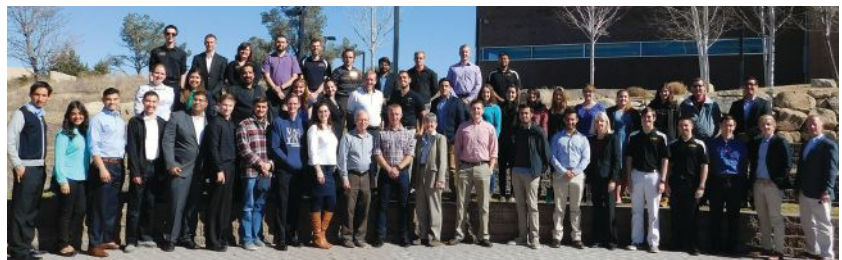
DISTRICT 10

The **Greater New Orleans Alumni Chapter** was installed on January 28 to become the 40th active alumni chapter of Tau Beta Pi. There are now a total of 72 chartered alumni chapters with 32 currently inactive.

The **Texas Gulf Coast Alumni Chapter** is getting together for an end-of-spring barbecue in Nassau Bay on June 18. Alumni, guests, pot luck sides, and donations are welcome. Email txgulf.tbpalumni@gmail.com to join them.

DISTRICT 13

The recently installed Arizona Delta Chapter hosted the **District 13 Conference** in Prescott, AZ. More than 60 attendees from Arizona, New Mexico, and West Texas, convened at the Embry-Riddle Learning Center for meetings geared towards making Tau Beta Pi a more enjoyable experience at their local schools. Attendees were also treated to a Q&A session with 13 local-area TBP alumni.



Attendees gather at the conclusion of the District 13 Conference in Prescott, AZ.



Greater New Orleans Alumni Chapter with their Charter (L-R): Director Pierre Champagne JR., LA E '76; Director Janet S. Elias, LA A '87; Secretary Samantha L. Montesdeoca, LA Γ '10; Vice President Andrew B. Hill II, TN B '08; President Ryan J. Schexnaydre, LA A '02; Treasurer Phillip W. Hebert, LA Δ '87; and Executive Director Curtis D. Gomulinski.

DISTRICT 16

The **California Nu Chapter** at the California State Polytechnic University, Pomona, welcomed engineers from both the past and present for its fall 2015 initiation. It consisted of 35 undergraduates and 14 eminent engineers from the Pomona College of Engineering Dean's Leadership Board (DLB), which were selected based on their extensive engineering careers. DLB members were seated with student initiates affording them the opportunity to take part in multi-generational exchanges, offerings of advice, and encouraging them to think beyond their academic careers. Three past California Nu Chapter presidents were in attendance, including Pomona College of Engineering Interim Dean Cordelia Ontiveros, Ph.D., P.E., *CA N '78*.



WHO'S WHO

HEY SIRI, WHO WON THE DRAPER ENGINEERING PRIZE?

Before you send another text or ask Siri for directions, thank **Andrew**



J. Viterbi, Ph.D., Massachusetts Beta '57. He developed an algorithm that facilitated today's digital wireless technology. The National Academy

of Engineering has honored Viterbi for his contributions to society with the Charles Stark Draper Prize for Engineering. The Viterbi algorithm, introduced in 1967, enhances error-correcting and helps to eliminate static. It is used in everything from digital cell phones, to subscriber line modems, to technology used for interplanetary communication during deep space missions. He is president of the Viterbi Group, co-founder of Linkabit and Qualcomm, and professor emeritus at the University of California, San Diego.

BENJAMIN FRANKLIN MEDALS

Two Tau Bates were recognized in the 2016 Benjamin Franklin Medal awards:

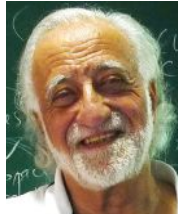
Robert S. Langer Jr., Sc.D., New York Delta '70, Medal in Life Science



for his design and implementation of multiple innovative drug delivery systems and for his founding work in the field of tissue engineering.

As a serial entrepreneur, Langer established a new paradigm for translating academic ideas into products.

Yale N. Patt, Ph.D., Massachusetts Epsilon '62, Medal in Computer and Cognitive Science for his pioneering contributions to the design of modern microprocessors. His work



provides higher performance by automatically identifying computer instructions that can be performed simultaneously. Patt is an engineering professor at the University of Texas at Austin.

BERNARD GORDON PRIZE

The National Academy of Engineering has announced the winners of the 2016 Bernard M. Gordon Prize for innovation in education. It went to four educators at Worcester Polytechnic Institute “for a project-based engineering curriculum developing leadership, innovative problem solving, interdisciplinary collaboration and global competencies.” They included



Diran Apelian, Ph.D., Pennsylvania Zeta '68, top, professor of engineering, and **Richard F. Vaz, Ph.D., Massachusetts Alpha '79,** dean of interdisciplinary and global studies.

Mary T. Barra, Michigan Zeta '85, has been elected chairman of the board at General Motors. This came two years after Barra took over as CEO, rising from intern to become the auto industry's first female chief executive. Soon



after, Barra navigated the company through a crisis over the recall of ignition switches.

Robert E. Fischell, North Carolina Gamma '51, has received the



National Medal of Technology and Innovation at a ceremony in the White House. The medal is the “nation's highest honor for technological achievement bestowed by the President.”

Currently, he is a professor of practice, physics at the University of Maryland and is known for inventing medical devices and pioneering modern space satellites.

Karl W. Reid, Ed.D., Massachusetts Beta '84, is executive director of the



National Society of Black Engineers. Previously, he was senior vice president of research, innovation, and member college engagement at the

United Negro College Fund. He had earlier served as executive director of engineering outreach programs for MIT's school of engineering.

General Ellen M. Pawlikowski, Ph.D., New Jersey Gamma '78, is



a United States Air Force officer and serves as commander of Air Force Materiel Command, Wright-Patterson Air Force Base, OH. She previously served as military deputy,

office of the assistant secretary of the Air Force for acquisition at the Pentagon, responsible for research and development, production, and modernization of programs worth more than \$32 billion annually.

National Academy of Engineering

The National Academy of Engineering has elected 80 new members and 22 foreign associates, announced NAE President C.D. (Dan) Mote Jr., Ph.D., CA A '59, in early February. Election to the academy is among the highest professional distinctions accorded to an engineer. It honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature," and to the "pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education." New Tau Beta Pi/NAE members are listed below.

Steven J. Battel, MI Γ '79, president, Battel Engineering Inc. For engineering design and implementation of space flight systems.

Neal S. Bergano, NY P '81, chief technology officer, TE SubCom. For innovation and leadership in undersea optical communications.

Charles "Chip" P. Blankenship Jr., VA B '88, president and chief executive officer, GE Appliances and Lighting Division, General Electric Co. For contributions to the incorporation of new technology in consumer products and aircraft engines.

Michael A. Celia, Ph.D., PA E '78, Theodora Shelton Pitney Professor of Environmental Studies and professor of civil and environmental engineering, Princeton University. For contributions to the development of subsurface flow and transport models in groundwater remediation and CO₂ sequestration.

Morton Collins, Ph.D., DE A '58, managing partner, Battelle Ventures LLC, Ewing, NJ. For accomplishments as a builder and manager of technology-based companies and as an adviser to government and universities.

Thomas M. Connelly Jr., Ph.D., NJ Δ '74, executive director and chief executive officer, American Chemical Society. For leadership of interdisciplinary innovations in chemical engineering including cellulosic ethanol, polymers, and related materials used worldwide.

Scott L. Delp, Ph.D., CO Δ '83, James H. Clark Professor of Bioengineering, Mechanical Engineering, and Orthopaedic Surgery, Stanford University. For computer simulations of human movement and their applications to treatment of clinical movement pathologies.

Albert G. Greenberg, Ph.D., WA A '82,

distinguished engineer and director, Azure Networking, Microsoft Corp. For contributions to the theory and practice of operating large carrier and data center networks.

Paul E. Jacobs, Ph.D., CA A '84, executive chairman, Qualcomm Inc. For leadership in the design, development, and commercialization of wireless products and services.

Kristina M. Johnson, Ph.D., NC Γ '81, co-founder and chief executive officer, Cube Hydro Partners LLC. For development and deployment of liquid crystal on silicon displays, the basis for high-speed optoelectronic 3D imaging.

Brian D. Kelley, WI A '86, vice president of bioprocess development, U.S. Biologics Pharma Technical Development, Genentech Inc. For leadership in the development of bioprocess technology and cost-effective manufacturing processes for clinically effective recombinant protein therapeutics.

Philip T. Krein, Ph.D., PA E '78, professor of electrical and computer engineering, and director, Grainger Center for Electric Machinery and Electromechanics, University of Illinois, Urbana-Champaign. For contributions to power electronics technology and education.

Jon D. Magnusson, P.E., WA A '75, senior principal, Magnusson Klemencic Associates, Seattle. For building designs that enable high-rise buildings in seismic sensitive regions and for innovations in modern structural engineering practice.

Michael J. Maloney, Ph.D., IL Z '83, manager of structural alloys, hot section materials, and coatings, Pratt and Whitney. For contributions to the development of low-conductivity thermal barrier coatings for advanced aircraft engines.

Warren C. Oliver, Ph.D., TN A '77, president, Nanomechanics Inc., Oak Ridge, TN. For contributions to the development and commercialization of nanomechanical testing technology.

Arati Prabhakar, Ph.D., TX B '79, director, U.S. Defense Advanced Research Projects Agency. For national leadership to advance semiconductor and information technologies.

Mohammad Shahidehpour, Ph.D., MO A '80, Bodine Chair Professor of Electrical and Computer Engineering, director, Robert W. Galvin Center for Electricity Innovation, and associate director, Wanger Institute for Sustainability and Energy Research, Illinois Institute of Technology. For contributions to scheduling of generation in a deregulated electricity market with variable renewable energy sources.

Adam D. Steltzner, Ph.D., CA A '89, manager, Planetary Entry, Descent, and Landing and Small Body Access Office, Jet Propulsion Laboratory. For development of the Mars Curiosity 2011 entry, descent, and landing system and for contributions to control of parachute dynamics.

Leonard K. Thomas, OK A '62, consultant, Bartlesville, OK. For contributions to the development of reservoir simulators to enhance production from complex reservoirs.

David F. Welch, Ph.D., DE A '81, co-founder and president, Infinera Corp. For contributions to high-power semiconductor lasers and photonic integrated circuits.

Michael I. Yarymovych, D.Eng.Sc., NY E '55, president, Sarasota Space Associates. For contributions to space programs and for leadership of national and international aerospace organizations.



LETTERS

California Drought

• Some 75 million gallons of water was reported for 2014 fracking water usage in California. Fracking water is polluted with undisclosed chemicals rendering it useless for drinking water and questionable for agriculture. Have the crops treated with these chemicals been independently tested for safe long term consumption?

There is an oversupply of oil in the USA. Fracked oil in California is absolutely not needed at all. Save the water.

Perhaps Trudy Bell mentioned fracking water in the California drought analysis. I didn't notice it.

Ref: www.reuters.com/article/us-california-drought-fracking-exclusive-idUSKBN0MU01M20150403

Jerry L. Amos, WV A '58

[Trudy Bell responds: Many citizens are concerned about recycling oil field wastewater for agriculture because of the contaminants for which water is not routinely tested; especially concerning is that some 3 billion gallons of recycled fracking wastewater was documented to be deliberately injected into a drinking water aquifer in violation of federal law.]

Jerry Amos raises a concern of both California and federal legislators (since California produce is shipped nationwide): if recycled oil field wastewater is to irrigate crops for human consumption, those crops—especially produce labeled “organic,” which people buy to avoid pesticides and other contaminants—should be independently tested for residues of benzene, acetone, heavy metals, radioactivity, and other toxins and carcinogens known to be in fracking brine.]

• I searched Ms. Trudy Bell's 9-page article on “California's Epic Drought” but could not find a reference to the 1992 Central Valley Project Improvement Act (CVPIA).

I believe that readers should

understand that this act and other similar actions by several U.S. and other state and local agencies have most likely significantly contributed to the shortfall of stored and/or other available water resources to assist the drought-stricken industries and populations. The act mandated changes in the Central Valley Project, requiring large instream “pulse” releases of storage water for the enhancement of fish and wildlife in the Bay Delta and other areas, most of which are far downstream of former users of the water.

The CVPIA required the dedication of 800,000 acre-feet of CVP water, formerly available primarily for agricultural and municipal uses, towards fisheries and supplies for wildlife. The “Epic Drought” article neither mentioned the act nor addressed the probable contributions to the serious shortfall in water supplies. Years of required releases of large amounts of stored water from the project's reservoirs for these purposes essentially gave priority to stored waters over long-standing, and long-dependent, former users and uses.

Studies of ways to offset this management change have failed to produce reasonable means of offsetting the CVPIA's impacts on others, but the greatest attempt was a shift from surface to groundwater uses, causing many of the problems noted in the article. The agricultural and other senior-right industries opposed this change in the project operations which they feel was unfairly “imposed” on them by environmentalists.

Some analysts (for example, mavensnotebook.com/glossary/central-valley-project-improvement-act/) conclude that, “Over 20 years later, despite millions of dollars spent and thousands of acre-feet of water, the benefits to the fish populations have yet to be realized, and the controversy remains.”

The article should have addressed the CVPIA contributions

to the current stress levels, particularly its impacts on groundwater pumping (which are very well documented in the article) that ensued as a means of attempting to offset what was considered to be a “taking” by the Federal Government.

Gary L. Lewis, Ph.D., P.E., MT A '66

[Trudy Bell responds: This issue gets to the heart of the matter. Much of California's “environmental” use of water is in rugged northern areas where streams don't even flow into watersheds used for human consumption.]

Where they do, without the pulsed releases, many native species of fish and wildlife would likely already be extinct rather than 83% being “just” faced with extinction; indeed, chronologically (from a seniority viewpoint), they are the most senior users. Other sectors reliant on the environment (including recreation and the related hospitality industry) would likely contest that agriculture should be entitled to every drop.]

The fundamental problems remain: far more water rights granted than water exists, weak regulation of groundwater, and planting choices that drive mammoth consumption.]

• I read, with great interest, the excellent article on California Drought Choices. That situation is dire and appears to be headed for the cliff. I find this at odds with how California often sets itself up as the environmental policy benchmark that the rest of us should strive for.

Beyond that, when it comes to formation of public policy on things like weather, water availability, climate impacts and such like, I cringe whenever I hear/see usage of the terms “norms” and “normal”. Regardless of whatever view you take on the origin of the universe, mankind has not been around long enough and accurately tracking such parameters for long enough to know what “normal” is!

We only know the average...and that is determinate over a miniscule period of time eternal. True, we can roughly/theoretically/model and extrapolate over a somewhat longer (still miniscule) period of time eternal, but there are many who have rushed to make variously reckless or equally draconian policy decisions based on an insignificant sample size. I believe the mercury thermometer was invented in 1774/France and digital measurements of any sort have only come about during my lifespan.

The point is, being carelessly blissful (i.e. pumping so much water, while assuming that ample rains are coming) or being ruthlessly draconian (i.e. banning fossil fuels and causing energy shortages) are examples of public policy that is being based on short-sighted convictions derived from an incredibly insignificant sample size. Moderation in all such policy is called for; else we risk making the truly bad situations even worse or imposing undue hardship by making innocuous circumstances out to be villainous.

Economics, emotions and politics are obscuring the limitations of what we really know about these situations and ultimately exacerbating the problems.

Stephen E. Elrod, AL A '80

- The Winter 2016 article by T. E. Bell on California Drought Choices contains an impressive quantity of data and research on past engineering accomplishments to move water throughout CA. Entire civilizations have disappeared when stresses have exceeded reserves. CA has essentially no reserves left. Unfortunately, CA has built no new water storage or distribution systems since 1970. CA policies and politics are the reasons. Urban sprawls, high income tax, and restrictions on freedoms are why I no longer live there. Water would have been a fourth reason.

Steven P. Sontag, NM A '74

- Another great piece from Trudy Bell, thank you.

I keep thinking about how many people think San Francisco is in the

Pacific Northwest...well, this is NOT Seattle. Coastal California is historically (and I am talking more than a few thousand years) a very dry place. We are not necessarily entitled to very much rainfall.

One other thing that occurred to me is people need to understand the overdraft of groundwater today is just same old problem in the Central Valley. Many readers have probably seen the famous sign showing how many feet of subsidence that was caused quite some time ago in the Tulare area.

I am struck by the series of lectures my historical geology professor gave when I was at Mines in the late 60s. He described what is thought to happen just before the Northern Hemisphere drops into a glacial period which includes the general weather becomes radically unstable, rainfall patterns become highly variable, climate shifts on a dime, and then the ice starts to build...rapidly. This may be thousands of years out...or not.

John F. Paxton, P.E., CO A '73

- I just read the "Peak Water?" article and really enjoyed it. I was also shocked by some of the statistics that were quoted. A good friend of mine and I have been discussing climate change and the California water situation and I will be forwarding an electronic copy of the article.

Gary S. Ketelsen, CA E '70

- I read the "Peak Water?" article and was particularly interested in the photograph and comment about the bridge over the Delta-Mendota canal. How do you explain the fact that the bridge sunk and the canal, which is made of concrete, did not sink?

Fount E. McKee, P.E., TX E '58

[Trudy Bell responds: The bridge is not sinking relative to the canal. Both the bridge and the canal are sinking at the same rate as part of subsidence in a wider area, which is effectively developing a local shallow bowl-like depression. As water is flowing into the canal, and this

part of the canal is now a lower level, the canal is beginning to act as a reservoir and its water level is rising—and it now almost reaches the bridge. This also means that any significant rainfall could cause the canal to overflow and cause local flooding—incidentally also wasting some of the water in the canal.]

"THE BEST PEOPLE" ENGINEERING JOB BOARD

Through a partnership with JobTarget, Tau Beta Pi is proud to offer a job board for students and alumni. Members can post resumes, browse over 4,500 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 www.tbp.org/memb/jobBoard.cfm.



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THE TAU BETA PI CHAPTER ENDOWMENT INITIATIVE WAS LAUNCHED LAST SPRING TO FUND ASSOCIATION ACTIVITIES THAT SUPPORT THE COLLEGIATE CHAPTERS. MAJOR GIFTS OFFICER SHERRY D. JENNINGS-KING, TENNESSEE ALPHA '93, SHARES PROGRESS AND DEVELOPMENTS.

Chapter Endowment Update

WE ARE TRULY DELIGHTED to report on the continuing success of our Chapter Endowment Initiative, by which alumni, companies, and foundations can permanently endow the Association's activities that support any of our 245 student chapters (and as we tend to add new chapters every year, this remains somewhat of a moving target!). Last year we reported 29 gifts/pledges to either fully or partially endow chapters, and this year we have 31 to add to the list as we strive to endow all of our chapters.

Any collegiate chapter can be endowed—you can designate your gift for your initiating chapter or another one that is important to you. In some cases, alumni have voiced a preference for allowing their gift for this effort to support “any” chapter. So we have established a designation specifically for this purpose.

While gifts of a minimum of \$5,000 are being accepted, a donation of \$100,000 is required to fully endow a chapter—see the following pages to learn more about the two \$100,000 gifts made this year. A naming opportunity is available for giving at the \$100,000 level and such gifts may be made over a period of 3-5 years. In cases where a group of individuals pool their funding to reach \$100,000 within a one-year timeframe, a naming opportunity can be created to honor or memorialize a trusted advisor, former professor, friend, etc.

Permanent Funding

As stated under the terms of the Chapter Endowment Initiative, investment income from the endowments will provide permanent funding for students of the endowed chapter to: attend the annual Tau Beta Pi Convention; receive officer leadership training through the District Program; obtain professional development through Engineering Futures sessions; participate and facilitate MindSET activities; support Headquarters operations; and conduct chapter-directed activities on the college campus and in the local community.

Over the past year, alumni have approached us about the opportunity of a challenge match regarding specific chapters. To date, we are in the process of beginning challenge matches on behalf of two chapters: California Gamma at Stanford University and Iowa Alpha at Iowa

State University. In each of these cases, an individual has stepped forward with a pledge of at least \$20,000 and will match gifts that come in from former classmates and alumni in amounts of \$5,000 minimum. Looking forward, we plan to conduct four to six of these challenge matches each year. In each case, we hope that donors will allow their name to be printed, but if anonymity is preferred, we would be happy to maintain your confidentiality.

There are a number of ways to support this initiative. Checks can be made out to “Tau Beta Pi – The Engineering Honor Society” and sent to Tau Beta Pi, Attention: Curtis Gomulinski, Secretary-Treasurer, P.O. Box 2697, Knoxville, TN 37901-2697. Other options include gifts of highly appreciated stock held for over one year as well as matching gifts and including Tau Beta Pi in your estate plans.

Tax-deductible

Gifts through this initiative will be reflected in an individual's total giving to TBP. As a non-profit organization, we are exempt from federal income taxes under Section 501(c)(3) of the Internal Revenue Code. Your gift is tax-deductible to the full extent allowed by law.

Thank you to everyone who has already stepped forward or is considering supporting your home chapter, another chapter, or any chapter. We look forward to adding more chapters to the list of those being supported in next year's spring issue of *The Bent*.

For more information on the Chapter Endowment Initiative, please check out our website at <http://www.tbp.org/give/chapterEndowment.cfm> or contact Sherry Jennings-King, Major Gifts Officer, by phone at (612) 226-2922 or by email to sherry.jenningsking@tbp.org.

Note: The minimum gift being accepted for this initiative is \$5,000. All checks received that are designated for this initiative in an amount less than \$5,000 will be paid into Tau Beta Pi's annual fund which supports the same programs as the Chapter Endowment Initiative.

New Gifts and Pledges Received

Harry W. Lange, MI Z '75, \$100,000
The Harry W. Lange Endowment for
MI Z Chapter at Kettering University

Barbara K. and **Ralph A. Rockow, OH Γ '58,** \$100,000
The Barbara K. and Ralph A. Rockow Endowment
for OH Γ Chapter at The Ohio State University

Anonymous, IA A '69, \$85,000
for IA A at Iowa State University

Robert W. Newcomb, Ph.D., IN A '55, \$25,000
for IN A at Purdue University

William R. Goodin, Ph.D., CA E '75, \$20,000
for CA E at Univ. of California, Los Angeles

Franklin P. "Pitch" Johnson Jr., CA Γ '50, \$20,000
for CA Γ at Stanford University

Renee M. Schoenborn, P.E., WY A '85, \$20,000
for WY A at University of Wyoming

Judith W. Vigar, RI A '83, \$20,000
for RI A at Brown University

Richard E. Kothmann, TX A '59, \$10,000
for TX A at University of Texas at Austin

Robert W. Peters, CA Z '61, \$10,000
for CA Z at Santa Clara University

Anonymous, MI B '72, \$10,000
for MI B at Michigan Technological University

Clinton R. Gilliland, GA A '59, \$5,886
for GA A at Georgia Institute of Technology

Bruce B. Barrow, Ph.D., PA Γ '50, \$5,000
for PA Γ at Carnegie Mellon University

Franklin T. Dodge, TN A '60, \$5,000
for TN A at University of Tennessee

Lawrence J. Hollander, P.E., NY E '51, \$5,000
for NY M at Union College

Richard W. Karn, CA A '50, \$5,000
for CA A at University of California, Berkeley

Sandi and **Kevin S. Kayse, P.E., CO B '78,** \$5,000
for TX I at Southern Methodist University

Stanley C. Lynch, OR A '73, \$5,000
for OR A at Oregon State University

Otto T. Muller-Girard, NY K '52, \$5,000
for NY K at University of Rochester

Thomas F. Parrish, Jr., TN B '75, \$5,000
for TN B at Vanderbilt University

Michael C. Romer, TN A '04, \$5,000
for TN A at University of Tennessee

Bobby S. Shackouls, MS A '72, \$5,000
for MS A at Mississippi State University

John G. Smith, WI B '87, \$5,000
for WI B at Marquette University

Carl M. Stahle, Ph.D., MD B '81, \$5,000
for MD B at University of Maryland

TECO Energy \$5,000
for FL Γ at University of South Florida

Mark A. Tracy, Ph.D., IL A '86, \$5,000
for IL A at Univ. of Illinois at Urbana-Champaign

R. Dudley White, VA A '76, \$5,000
for VA A at University of Virginia

Anonymous, TN B '71, for Any Chapter \$5,000

Anonymous, FL A '78, \$5,000
for FL A at University of Florida

ESTATE PLANNING/DEFERRED GIFTS

Robert H. Tolson, VA B '58, for VA B at Virginia
Polytechnic Institute & State University

CA Γ (STANFORD) MATCH CHALLENGE

Tau Beta Pi has received a challenge match of \$20,000 from alumnus, **Franklin "Pitch" Johnson, Jr., CA Γ '50,** founder of Asset Management Company in Palo Alto, CA. This gift is in support of our Chapter Endowment Initiative, by which alumni, companies, and foundations can permanently endow the Association's activities that support any of our 245 student chapters. While gifts of a minimum of \$5,000 are being accepted for this effort, a gift of \$100,000 is required to fully endow a chapter—and we are trying to reach this amount for CA Γ!



Pitch has generously stepped forward as the first person to support our chapter at Stanford University. While the first \$5,000 of Pitch's \$20,000 constitutes his gift toward this effort, the remaining \$15,000 is a pledge that will be paid out in increments of \$5,000 to match the next three gifts made by others who come forward with gifts of this minimum amount designated for CA Γ.

For more information on this opportunity or to learn more about the Chapter Endowment Initiative, please see our website at www.tbp.org/give/chapterEndowment.cfm or contact Sherry Jennings-King, Major Gifts Officer, by phone at (612) 226-2922 or by email to sherry.jenningsking@tbp.org.

Harry W. Lange, MI Z '75

Endowment for the Michigan Zeta Chapter at Kettering University

hARRY LANGE'S INVOLVEMENT with Tau Beta Pi has spanned a good portion of his life, and he notes that his parents were an important part of his support network from the start. "My parents drove 180 miles from Gaylord, MI, to attend the initiation banquet—they had to spend a night in a hotel, and they never did that, so this was a big deal for all of us." Harry became an active member in his chapter attending the 1973 Convention in Gainesville, FL, and then was the Co-Arrangements Chair in 1974 when his chapter hosted the Convention in Flint, MI.

While Harry initially followed the career path of a General Motors engineer, his true passion lay with the world of investments. As an eight-year-old, he accompanied his father to meetings of an investment club where members would pay \$10 each month, meet to discuss investments, and then vote on which stocks to buy. Even when his father dropped out, Harry stayed a member seeing the possibilities for increasing one's wealth with no manual labor by investing in stocks, as he experienced with an early investment in AT&T.

Upon graduation with a degree in mechanical engineering, Harry worked as a senior structural engineer on the 1984 Corvette program noting that driving them was a lot of fun. General Motors paid for Harry to attend Harvard Business School. While completing Harvard's loan application, he noted that they asked not about his income (considerable) but about his parents' employment income which was small as they had retired by this time. Able to receive sizeable loans, he invested much of this in the stock market in 1981-82. Following graduation with his MBA, Harry worked for four years at two investment firms. His first day at Fidelity was on Monday, October 19, 1987, now known as Black Monday, the first day of the stock market crash. Harry enjoyed his time at Fidelity noting that in 1988-92 he lived in Tokyo and was their director of research and that in 1992-96, three of his technology funds were included in a listing of all-time greatest funds. Harry wound up his career at Fidelity as manager of the Magellan Fund, one of the best-known funds in America, from 2005-11.

He is currently owner and chairman of an all-inclusive resort in Negril, Jamaica, spending much of his time on the island and also at his home in Miami Beach, FL. Harry notes that the improvements he is making at his resort are inspired by business leaders and innovators including Steve Jobs/Steve Wozniak from Apple, Inc., and Jack Welch, former Chairman/CEO of General Electric. Harry notes that Steve Jobs came up with products that people

did not know they wanted and that Jack Welch's introduction and application of Six Sigma for quality improvement changed GE's culture and ability to focus on process improvement. Harry applies those lessons to his business, asking himself, "What can you provide that your customers aren't aware they want?" and "How can we provide consistent quality when delivering a service or product making sure nothing slips through the cracks?"

Harry has continued his involvement with Tau Beta Pi attending Conventions since 2009 and in the past several years talking to students about investments and personal financial management as one of our professional development speakers. In 2010, Harry spoke at a TBPi alumni gathering in Naples, FL, on the topic of investing and his work at Fidelity. With several others, Harry participated in the Vision Development Group which met from 2011-12 and has also been a member of the Trust Advisory Council (TAC) since 2007.



Raise Awareness

Harry made his commitment of \$100,000 to endow Michigan Zeta at Kettering University to raise awareness and the importance of Tau Beta Pi at his alma mater. He also wanted the chapter to have one member of each section at Convention to help unite them as Michigan Zeta has two student chapters being a work co-op program (half the students are working when the other half are in

school). He also wanted to support chapter projects and encourage alumni to be more involved.

Harry's advice to the engineering students of today is to dream big. Growing up in a small community of 1,500 gave limited perspective on career options other than those that were obvious, such as being a fireman. Harry wanted to be President of the United States because at the time he was not aware that other positions existed. As he grew older and became more experienced he saw the possibilities and noted that he consistently stayed on the fast-track. "It's important when young to never do anything that will rule out something possible in your future. As you embark on your education and career, keep your options open. Don't drop out of science classes or important liberal arts courses such as English. Keep your options and avenues open because you don't know what the future is going to bring."

Harry and his wife, Hiroko, are avid ballroom dancers and also enjoy trips to Napa Valley for annual winetasting events. He has three children: Sarah, 32, a lawyer, Josh, 29, a software engineer for Microsoft, and Julia, 27, who is attending Washington University Medical School.

Barbara K. and Ralph A. Rockow,

Endowment for the Ohio Gamma Chapter at The Ohio State University

OH Γ '58

Ralph and Barbara Rockow have shared a long history with The Ohio State University beginning with their graduation in 1958. Ralph earned B.S. and M.S. degrees in mechanical engineering and Barbara earned a B.S. in education. Ralph and Barbara have enabled opportunities and enriched experiences for numerous students through their association with the university. In 2015, they were awarded the Reese Medal by Ohio State. This is its highest honor in recognition of private philanthropy.

Ralph has served on the Foundation Board and the Alumni Advisory Council and has remained dedicated to the engineering college through service on the advisory board and campaign committees. He received the Ohio State Alumni Association's Citizenship Award in 1991, the John B. Gerlach Sr. Development Volunteer Award in 1999, and the university's Distinguished Service Award in 2003. Ralph is an enthusiastic supporter of the electric racecar student design team and has contributed to curriculum reform in mechanical and aerospace engineering.

Ralph and Barbara have been actively involved with the Ohio State Alumni Club of Phoenix, hosting engagements, raising funds to name "The Arizona Room" in Longaberger Alumni House, and made a leadership gift to name the facility's boardroom. Early in his career, Ralph worked at Atomics International, a division of Rockwell International, where he was responsible for the test and evaluation of the SNAP 2, 4, and 10 nuclear reactors. SNAP 10 was the first nuclear reactor launched into earth orbit by the U.S. Space Program.

Ralph then served as a Manager for Space Technology Laboratories/TRW, Inc., where he performed theoretical heat transfer analyses on the Titan, Atlas, and Minuteman Intercontinental Ballistic Missile (ICBM) Programs, as well as being responsible for a portion of the design of aft heat shields on the ICBMs. He provided overall systems engineering and technical direction to the Minuteman program and served as program engineer for development of a major portion of the LEMDE Descent Engine (this is the rocket engine that provided the retro-braking that safely returned the *Apollo 13* crew to earth at the end of their aborted mission).

Ralph was General Manager and Vice President of Dynamic Science, Inc. (DSI) under Marshall Industries and Ultrasystems, Inc. Under his guidance, DSI was selected by the U.S. Department of Transportation to take a major role in advancing the state-of-the-art of safety in auto-

motive vehicles. DSI has been involved with the design, development, test, and performance of air bag restraint systems since 1971. At DSI, under contract for the U.S. Army, Ralph was responsible for designing a crashworthy fuel system for combat helicopters that significantly mitigated post-crash fire fatalities in the Vietnam War.

From 1976 to 1982, Ralph worked at Talley Industries, Inc. and as Group President was involved in acquisitions, creating new starts, and divestitures. He also re-staffed subsidiaries to change losses into profits.

As Founder and President of Exodyne, Inc., Ralph now oversees three wholly owned subsidiaries (Exodyne Properties, Inc., Dynamic Science, Inc., and Dynamic Educational Systems, Inc.) with diverse products and some 500 employees.



"Basic Tools"

Ralph shares his advice for the students of today noting, "I have found in my career path that the engineering degree provides one with the basic tools for solving problems regardless of the discipline being reviewed. In other words, it gives us the ability to diagnose a given problem by studying the key issues involved. For example, the solution process, whether it be a new engineering design, talking to a banker, an attorney, medical doctor, or

salesman, the solution boils down to solving a significant situation one small element at a time."

Over the years, Ralph has re-engaged with TBPI through serving on the Vision Development Group which met from 2011-12 and through his and Barbara's attendance at alumni gatherings in Phoenix, AZ. He gave the keynote address at the final banquet of the 2013 Convention in Ames, IA.

Ralph and Barbara support the entire Tau Beta Pi organization by providing monetary reserves to help engineering students achieve their educational goals. He remembers the important scholarship he received from Standard Oil of Ohio for \$2,000 to complete the combined bachelor and master's degrees in mechanical engineering at The Ohio State University. With the Chapter Endowment Initiative, they are providing funds for Ohio Gamma students to attend the annual Convention, receive officer leadership training through the District Program, obtain professional development through Engineering Futures, participate and facilitate MindSET activities, and conduct chapter activities on campus and in their local community.

Wandering Pole, Wobbling Grid

Earth's rotation axis wobbles irregularly, changing the direction of true north, and varying latitudes and longitudes by 30 to 70 feet every year. The discovery of polar motion is a tale of instrumentation and serendipity.

By **Trudy E. Bell** (Text Copyright 2016 Trudy E. Bell)

tHE DISCOVERY of polar motion and its resultant variation of latitude is not only a tale of interdisciplinary and international cooperation enduring more than a century even through two world wars, but is also a classic example of serendipity.

It was all Leonhard Euler's fault. In the 1750s, the Swiss mathematician became fascinated by the physics of spinning bodies. By the 1760s, he was wondering about the rotating Earth, recognizing that the planet is not a sphere and that its mass is lumpy with mountains and valleys. What would happen if its axis of figure (axis of its three-dimensional shape, passing through its center of mass) might not exactly coincide with its axis of rotation?

In 1765, he published a startling prediction: Earth's axis of rotation might migrate in a small circle around its axis of figure: that is, the direction of astronomical north might vary, causing an equivalent periodic variation in latitude of every place on the planet. Assuming a rigid Earth and calculating from the flattening of the poles, Euler predicted the latitude of every place might oscillate with a period of 10 months (305 or 306 days).¹



Euler



Bessel

With astronomical instruments precise enough to determine a location's true zenith, such variation in latitude might even be detectable. Therein lay a catch: the angular amplitude of Earth's wobbling is minuscule—less than a second of arc, smaller than the angle of parallax of the closest stars when viewed from opposite sides of Earth's orbit around the Sun. Parallax itself posed such a monumental instrumental challenge that it was not detected until 1838, and even then was found only by precision visual observer Friedrich Wilhelm Bessel after he had devised his fundamental theory of instrumental errors and commissioned a special-purpose instrument (the heliometer) up to the task.^{3,9}

Still, as instrumental precision

NEWS FLASH: Earth's axis of rotation—whose orientation in space has determined astronomical true north since time immemorial—irregularly wanders each year in a veritable drunkard's-walk counter-clockwise spiral that varies from 30 to 70 feet across. Thus, the worldwide grid of latitude and longitude defined by astronomical north is also wobbling, with a magnitude about the size of an average residential house lot.

improved over the 19th Century, half a dozen astronomers came close to stumbling across observational evidence for variation of latitude. Bessel himself suspected he might have detected some evidence for it in 1843 when he was testing a new merid-



Peters

ian circle installed in the Königsberg Observatory, and noticed that his observations indicated the observatory's latitude might have changed since 1820. He also suspected something similar in a series of observations by his former student, positional astronomer C.H.F. Peters at Pulkovo Observatory in Russia. But he died before he could tell for sure.

In the 1870s, Swedish astronomer Magnus Nyrén analyzed 375 observations of various circumpolar stars over two decades by different astronomers. He strongly suspected they showed evidence of polar motion but was puzzled why not at Euler's predicted period of 10 months. What was needed, he declared, was a continuous observing program to monitor latitudes to detect the true period and amplitude of any polar motion.¹

Then, two simultaneous sets of observations (1884–85) on opposite sides of the Atlantic burst wide the entire research field through pure happenstance.

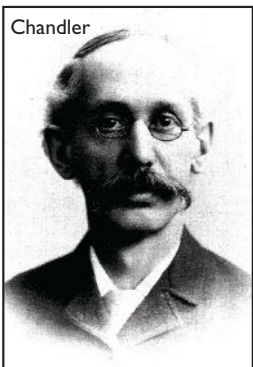
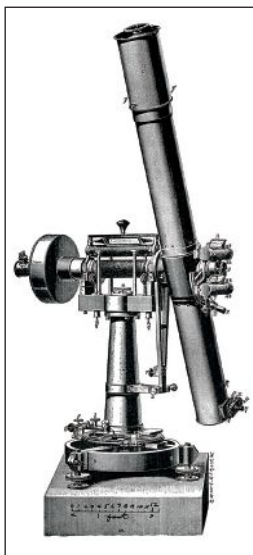
Seeking Worms, Striking Gold

First, in Cambridge, MA, Seth Carlo Chandler Jr., had just invented a brand new astronomical instrument he called an almucantar. From his early days with the U.S. Coast Survey in the 1860s (before the service added the word Geodetic to its name) using a visual zenith telescope to determine latitude, he had been annoyed that nearly half his time was spent squinting in dim light at finicky bubbles in precision spirit levels rather than observing stars in the night heavens. His almucantar was a self-leveling instrument floating on



Nyrén

BELOW: Instruments at the four main latitude observatories were identical Wanschaff visual zenith telescopes, having a lens diameter of 4.25 inches (108 mm) and a focal length of 51 inches (130 cm). An observer measured the angular distance of a star down from the zenith at the moment it crossed the meridian using spirit levels (two cylinders at far right); stars were observed in pairs, one crossing north of the zenith and the other south, and the telescope was rotated around the vertical axis between stars. *Credit: Report...U.S. Coast and Geodetic Survey [for 1899-1900], Appendix 5.*

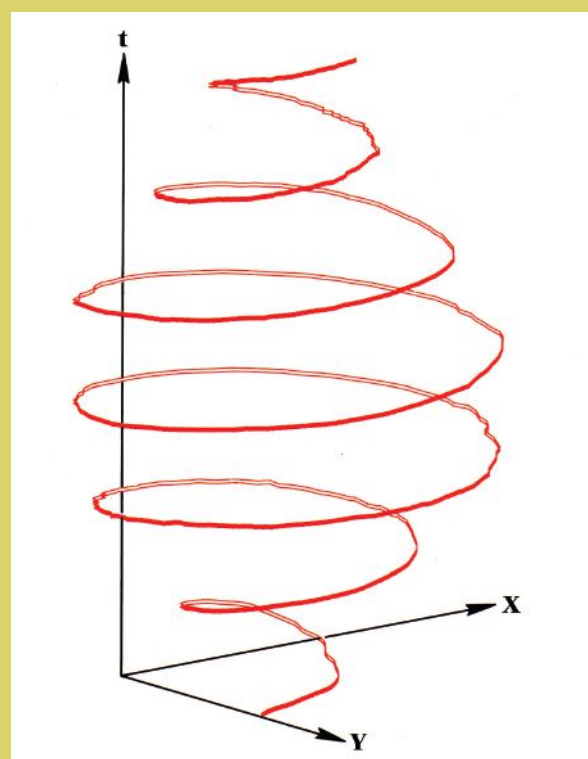


a bearing of liquid mercury, designed to be both easier and more time-efficient. From April 1884 to May 1885, Chandler rigorously tested his prototype by repeatedly determining the latitude of Harvard College Observatory, a well-known location. Although he kept finding discrepancies that could be explained only by a variation in the observatory's latitude, he thought it "too bold an inference to place upon record" when he published his analysis in 1887.^{4,6}

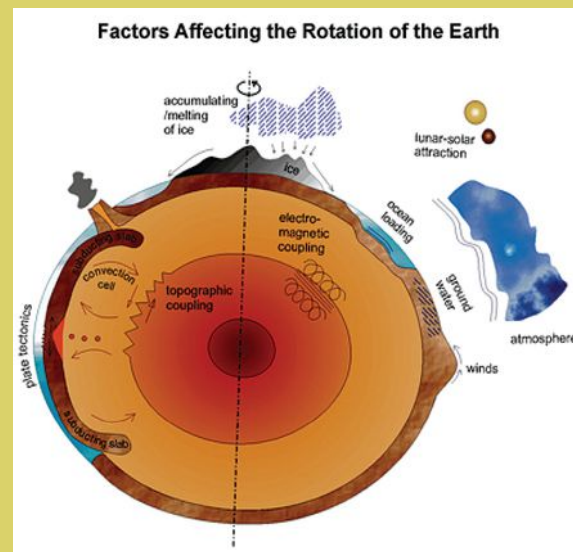
Meantime, recent measurements of the speed of light by U.S. physicist A.A. Michelson gave Karl Friedrich Küstner at the Berlin Observatory a realization: astronomers could more accurately determine the size of the solar system and other key cosmic distances if they could more precisely measure the aberration of starlight (the apparent angular displacement of stars in the heavens as the result of the Earth's orbiting the Sun³). So in 1884-85, Küstner began measuring that small angle with the observatory's new Bamberg universal transit instrument. But like Chandler, he found weird patterns in his data that could not be explained without allowing for periodic variations in the observatory's latitude—a conclusion he published in 1888.

Astronomers jumped on the announcement because variation of latitude (and for that matter, its concomitant variation of longitude¹⁸) would affect absolutely every fundamental measurement in celestial mechanics and positional astronomy, including star catalogs and precision timekeeping. Geodesists were equally electrified, because variation of latitude would affect every fundamental measurement in topographic mapping of Earth worldwide.

So in 1889, the International Geodetic Association (IGA) set up a special committee with funding to send observers to Hawaii, about 180 degrees of longitude



THIS THREE-DIMENSIONAL PLOT of the irregular spiral motion of Earth's rotation axis shows how our planet's north pole wandered from September 1980 (bottom) through March 1988 (top). Horizontal axes x and y represent displacement in feet from Earth's axis of figure (in the spiral's center, not shown); time proceeds upward. Diameter of spiral ranges from about 30 to 70 feet; each spiral loop is about 14 months (the Chandler wobble). The time series spans rather longer than one cycle of the 6- to 7-year beat period of the Chandler wobble and a 12-month annual motion driven by meteorological effects. Small irregular variations in the polar motion are real disturbances, but not all physical causes are currently understood. *Credit: International Earth Rotation and Reference Systems Service*



WOBBLES ORIGINATE from numerous sources, including motions of matter within Earth's inner and outer core and mantle, earthquakes, volcanic eruptions, ocean currents and tides, winds, and freezing and melting of polar ice, as well as gravitational (land) tides from the Moon and Sun. Such forces also cause the Earth's spin to speed up or slow down by microseconds per day. For example, the 2004 magnitude 9.1 Sumatran earthquake is estimated to have shortened the length of day by 6.8 microseconds and shifted Earth's axis of figure by about 2.75 inches (7 cm). *Credit: U.S. Naval Observatory*



LEFT: The empty Gaithersburg latitude observatory, now a National Historic Site; the walkway commemorates all six observatories. The edge of the circular brickwork approximates the largest diameter of the pole's wandering. Credit: Trudy E. Bell. BELOW: Cincinnati Observatory director Jermain G. Porter beside one of the six observatories set up in 1899, with the zenith telescope visible. All were similar with a split roof (shown open). Credit: Cincinnati Observatory Center



latitude. However, they all showed “a revolution of the earth’s pole in a period of 427 days, from west to east, with a radius of thirty feet, measured at the earth’s surface”⁷—demonstrating a period 40% longer than Euler’s prediction. Today, this primary period of about 14 months is called the Chandler wobble or the Chandler component.

That huge discrepancy nonplused astronomers and geodesists alike until Simon Newcomb—superintendent of the U.S. Nautical Almanac Office and a towering figure in 19th Century astronomy—reminded everyone that Euler had been assuming an “absolutely rigid” Earth. But fluid oceans cover part of the planet. Moreover, in a compelling thought experiment, Newcomb calculated that Earth likely was about as elastic as steel. He also cited geologists’ observations that suggested Earth consisted of “a thin crust floating upon a liquid interior, and must therefore be a viscous solid.”¹⁶ Such sources of internal friction would lengthen the period.

The following November (1892), Chandler published another blockbuster paper, announcing, “The observed variation of latitude is the resultant curve arising from two periodic fluctuations superimposed upon each other.” The first (and larger) was the 14-month wobble. The second had a 12-month (annual) period. The two beat against each other, their constructive and destructive interference causing both the amplitude and period of latitude variation to increase and decrease over about seven years^{8,14}—part of the reason why polar motion had been so difficult to detect.

away from the Berlin Observatory. The concept: set up a pilot latitude observatory for a year on the opposite side of the planet to compare its observations with another year of measurements at Berlin. The IGA also solicited the collaboration of the U.S. Coast and Geodetic Survey (USC&GS). It too deployed an astronomer to Hawaii; the Berlin and USC&GS astronomers built temporary latitude observatories about 30 feet apart at Waikiki (near Honolulu). As a further check on results, the USC&GS also set up temporary latitude stations in San Francisco, CA, and Rockville, MD, at longitudes and latitudes intermediate between Hawaii and Berlin.¹⁹

By mid-1891, all five observers were in position and training their visual zenith telescopes and other instruments at the heavens, accurately and repeatedly measuring their observing sites’ latitudes.

The Chandler Wobble

Meanwhile, as soon as Chandler saw Küstner’s 1888 paper, he knew what he had measured at Harvard was real. After several years of intense mathematical analysis, Chandler published two seminal papers in November 1891. They showed that his almucantar results and Küstner’s measurements were fully consistent with each other as well as with observations from Pulkovo, the U.S. Naval Observatory, and elsewhere, verifying the physical existence of the variation of

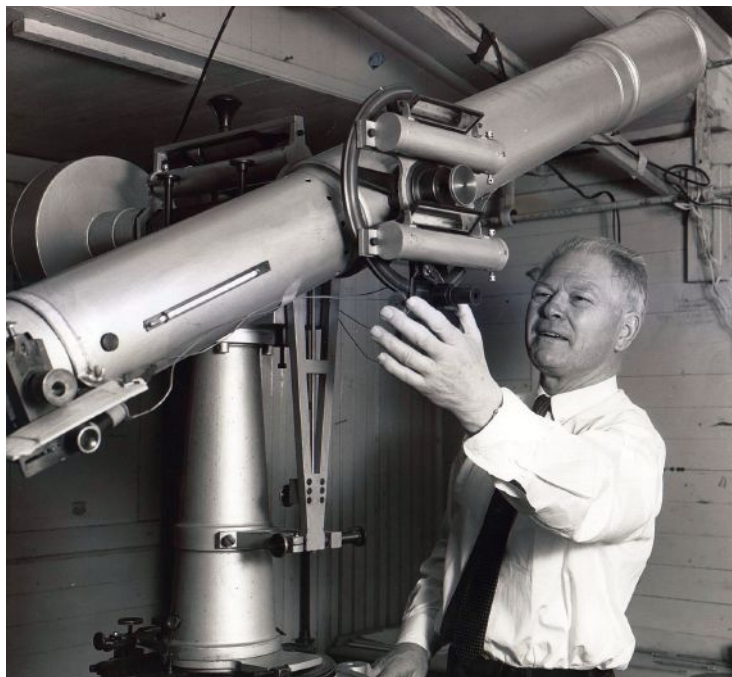
That same fall (1892), when the observers returned from Hawaii and compared their measurements with those in Berlin and the United States, the preliminary results were clear. Latitude varied with a period significantly longer than Euler predicted, in counterphase on opposite sides of the planet: when the position of the Berlin observatory headed north, the observatories in Hawaii headed south, and vice versa; intermediate variations were recorded at San Francisco and Rockville.¹⁹ (Visualize this by nodding your head: when your forehead tilts up, the back of your head tilts down, and your ears move less in between.)

International Latitude Observatories

The idea for a concerted worldwide observing program to monitor and quantify polar motion was a proposal whose time had come. The ambitious goal: stand up four observing stations on the same parallel of latitude around the planet, and operate them for an initial campaign of five years.

The geodesists of the IGA knew that monitoring polar motion demanded skilled astronomers. So it opened negotiations with the *Astronomische Gesellschaft*, an international astronomical society founded in 1863, in part specifically to help orchestrate large worldwide research projects (the International Astronomical Union was not founded until 1919). Like all major multinational collaborative programs today, negotiations involved balancing competing national interests.

Alfred W. Helm adjusts the visual zenith telescope at the International Latitude Observatory in Gaithersburg, MD, where he was observer 1957–75, in this photo taken around 1960. The parallel horizontal cylinders above his hand are the spirit levels; mirrors helped the observer to read their precise graduations. The two eyepieces on the silver index ring read altitude to 0.2 second of arc. Credit: Gaithersburg Community Museum



One major influence was Japan, rocked in 1891 by the devastating magnitude 8.4 Nobi earthquake that killed 7,000. To minimize human cost of future earthquakes, the Japanese government immediately inaugurated major programs in geophysical research. As a nation just entering industrial development in the 1890s, Japan deeply wanted the prestige of one of the proposed latitude observing stations within its borders—manned by a native Japanese observer. Although the IGA agreed to that last condition reluctantly, true worldwide coverage demanded observations from Japan’s longitude.

By 1898, after much international lobbying and wrangling, the parallel chosen was latitude $39^{\circ} 8'$. Four main International Latitude Observatories received full IGA funding for observatory construction, identical visual zenith telescopes, and support of an observer for five years: Mizusawa (then a rural town 300 miles north of Tokyo); Ukiah, CA, (115 miles north of San Francisco); Gaithersburg, MD, (just north of Washington, DC); and Carloforte, Italy, (on the island of San Pietro off Sardinia). Although not originally planned, Russian and U.S. astronomers enthusiastically volunteered two more locations: Tschardjui in Uzbekistan (to fill in a gap in longitude) and the Cincinnati Observatory (coincidentally already on the chosen latitude). Those fifth and sixth stations received partial funding and somewhat smaller zenith telescopes.

In 1899, the International Latitude Service (ILS) was officially born. All six latitude observatories were quickly built and instruments installed; by year end, all six observers had begun repeatedly and meticulously measuring their latitudes, using the same several dozen pairs of stars and the same observing protocols. The goal once their observations were combined: to monitor the x and y offsets of Earth’s rotation axis as it spiraled around the axis of figure.

X, Y, Z

Within a year, something was clearly amiss. The measurements in Japan, made by 30-year-old Hisashi Kimura, seemed to have large errors compared with observations from the other five stations. The ILS Central Bureau assigned only half weight to the Mizusawa observations, called on Kimura to explain his methods, and requested an inspection of the instrument. A technical expert overhauled the zenith telescope. Still the discrepancies remained, seeming to follow an annual oscillation, as if each year Earth’s center of gravity were slowly moving six feet up and down its axis of rotation.²

By 1903, it was clear that Kimura’s observations were *more* exact than everyone else’s, and that he had discovered a new non-polar phenomenon he dubbed the z term (in analogy to x and y) affecting all the stations. To study it further, both Chandler and Kimura independently called for additional latitude observatories in the southern hemisphere. In 1906, two were established in Bayswater, Australia, and Oncativo, Argentina, about 180 degrees apart at the latitude of $-31^{\circ} 55'$ and operated to 1908.^{5,10}

By the 1960s, the z term was believed to be a response of Earth’s fluid outer core to the tidal torque of the Sun—

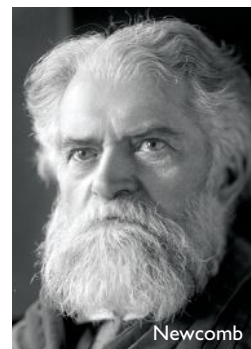
discovered by Kimura a decade before geologists observing seismic waves had even confirmed the existence of Earth’s viscous core. Kimura received international acclaim and the z term came to be celebrated in Japan as the nation’s first scientific discovery of world significance, even appearing in popular culture: Mizusawa was nicknamed “the city of z term,” and Z was incorporated into the names of a school, a large city theater, and even a type of small pastry.¹⁷

Value Was Clear

When the initial five years were up, the outstanding value of the latitude observatories was clear to both geodesists and astronomers. The IGA renewed the worldwide observing program time and again, supplemented by independent measurements from scores of other observatories worldwide. Over the 20th Century, with multiple name changes, the International Latitude Service morphed into the International Polar Motion Service, and finally (2003) into today’s International Earth rotation and Reference systems Service (IERS)—becoming what former NASA chief historian Steven J. Dick calls “the longest-running series of focused observations in the history of astronomy.”¹

For the entire program, the International Latitude Observatories used visual observers and relatively small zenith telescopes, even after the advent of electronic technologies such as photographic zenith tubes, photoelectric astrolabes, and photoelectric transit instruments. But several game-changing technologies spelled the end of the visual program, shuttering the remaining five observatories in 1982.

One was Very Long Baseline Interferometry (VLBI), in which radio telescopes hundreds or thousands of miles



apart observing quasars at the edge of the universe could monitor variation in latitude precisely enough even to track ongoing continental drift of Earth's tectonic plates. Others were lunar laser ranging and satellite laser ranging for more exact monitoring of earth dynamics. Still others were several satellite-based position-finding programs, notably the first constellation of ten satellites of the U.S. Air Force's Global Positioning System (GPS).

Today, with GPS and similar satellite constellations launched by other nations (collectively known as Global Navigation Satellite Systems), latitude and longitude are not referred to Earth's rotation axis. Instead, knowing the speed of the satellites' transmitted microwave signals in space and the atmosphere, a GPS/GNSS receiver instantaneously triangulates and calculates its 3D position from the arrival times of signals broadcast by whatever GNSS satellites are then above the local horizon. A minimum of four satellites within view of a handheld receiver is enough to determine geographical position to a precision of about 5 meters (16 feet); better receivers along with augmented measurements, procedures, and techniques can pinpoint locations to within centimeters.

Moreover, to account for variation of latitude and other variable characteristics, they specify position to a reference normalized to a standardized instantaneous moment in time and space; the most recent epoch, released in January, is called ITRF2014. (Specifying a positional grid according to a moment in time is the way astronomers map the ever-moving positions of stars on celestial charts, currently referred to epoch J2000, meaning January 1, 2000, in the astronomical convention of Julian years.)

Jolting the Planet

Quantifying polar motion has become precision science. Some 120,000 star positions were refined to 0.001 second of arc by the European Space Agency's Hipparcos satellite operating 1989 to 1993. Since the 1990s, a Doppler-based satellite tracking system called DORIS, for which satellite receivers monitor signals transmitted by ground stations, has proven its worth also in monitoring temporal changes in Earth's orientation, including polar motion. Yet for all the high tech, the original visual measurements remain the only long time record of Earth's polar motion we have, extending back to 1840. So they have been reanalyzed using sophisticated mathematical and computational techniques.¹⁵

Although the geophysical interpretation of Kimura's z term seems less certain today than it did in 1970, there is now no doubt that polar motion reveals information about the deep interior of planet Earth as well as changes in the oceans and air masses in the atmosphere. Indeed, other wobbles have been discovered having periods ranging from years or even decades down to under a day.

And finally getting more respect is Earth's comparatively overlooked axis of figure, around which spirals the rotation axis. Thanks to satellite techniques, the position of Earth's center of mass is now known to within a centimeter—the size of a dime—in three directions.¹³ So now we can see that powerful earthquakes literally rock the planet: the 2011 magnitude 8.9 Fukushima quake jolted Earth's axis

of figure 6.5 inches (17 cm) toward 133° E longitude.¹¹ “The change in the inner state of the Earth first brings about a variation in the figure axis, which then affects the polar motion,” concluded geodesist Yoshio Kubo in 2012. “Therefore it is the variation of the figure axis on the Earth's surface but not the polar motion that geophysical events should be linked to.”¹²

Acknowledgments

Gratitude is expressed to the following sources for information, photographs, and time: J. Bryan Blundell, Dell Corp.; Martin Bradley, Park Interpreter, City of Ukiah; Steven J. Dick, former NASA Chief Historian; David Doyle, Base 9 Geodetic Consulting Services; Kendall Fancher and Dana J. Caccamise II, National Geodetic Survey; Karen Lottes and Nansie Wilde, Gaithersburg Community Museum; John E. Ventre and Craig Niemi, Cincinnati Observatory.

References

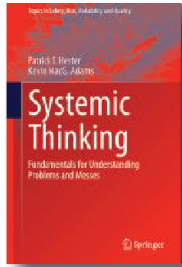
1. *Polar Motion: Historical and Scientific Problems* (edited by Steven Dick, Dennis McCarthy, and Brian Luzum, Astronomical Society of the Pacific, 2000), the proceedings of International Astronomical Union Colloquium 178 in 1999 on the centennial of establishing the International Latitude Observatories. Although not individually cited here to conserve space, half the papers in this volume were key references for this article.
2. Abbott, C. G., “Variation of Latitude and the Wandering of the Pole,” *Annual Report of...the Smithsonian Institution...for the Year Ending June 30, 1906*. Government Printing Office, 1907. pp 166–171.
3. Bell, Trudy E., “Engineering the Heavens,” 2012 *The Bent* 103(3): 21–25.
4. Carter, Bill, and Merri Sue Carter, *Latitude: How American Astronomers Solved the Mystery of Variation*, Annapolis: Naval Institute Press, 2002 is a popular account of Chandler's discovery of the 14-month wobble.
5. Chandler, Seth Carlo, “Letter...Proposing the Establishment of a Southern Belt of Latitude Stations,” 1903 *Monthly Notices of the Royal Astronomical Society* 63: 293–296. Also
6. Chandler, “On the Variation of Latitude I,” 1891 *Astronomical Journal* 11 (No. 248): 59.
7. Chandler, “On the Variation of Latitude II,” 1891 *Astronomical Journal* 11 (No. 249): 65.
8. Chandler, “On the Variation of Latitude VII,” 1892 *Astronomical Journal* 12 (No. 277): 97.
9. Hirshfeld, Alan W., *Parallax: The Race to Measure the Cosmos* (NY: W.H. Freeman & Co., 2001) is a riveting account of Bessel's achievement in observationally detecting stellar parallax an atmosphere of fierce international competition.
10. ———, *A History of 75 Years at the International Latitude Observatory of Mizusawa*. October 1974. p. 12.
11. “Japan Earthquake May Have Shortened Earth Days, Moved Axis,” NASA, March 14, 2011. <http://www.nasa.gov/topics/earth/features/japanquake/earth20110314.html>
12. Kubo, Yoshio, “The Earth's figure axis determined from the polar motion data,” arXiv June 2012. <http://arxiv.org/abs/1206.5044>
13. Malys, Stephen, et al. “Prime Meridian on the Move,” *GPS World*, January 13, 2016. <http://gpsworld.com/prime-meridian-on-the-move/>
14. Markowitz, W., “Polar Motion: History and Recent Results,” 1976 *Sky & Telescope* 52: 99–103, 108.
15. Miller, N.O., “Chandler Wobble in Variations of the Pulkovo Latitude for 170 Years,” 2011 *Solar System Research* 45(4): 342–353.
16. Newcomb, Simon, “On the Dynamics of the Earth's Rotation, with respect to the Periodic Variations of Latitude,” 1892 *Monthly Notices of the Royal Astronomical Society* 52: 336–341.
17. Sasao, Tetsuo, “Kimura's z -Term and Study of the Earth's Deep Interior,” 1993 *Journal of Geomagnetism and Geoelectricity* 45:1217–1220.
18. Tucker, Richard H., “The Variation of Longitude,” 1921 *Publications of the Astronomical Society of the Pacific* 33: 194–197.
19. “The Variation of Latitude at Waikiki...” Appendix No. 2, *Report of the Superintendent of the U.S. Coast and Geodetic Survey for the Fiscal Year Ending June 30, 1892*. Part II. 1894. pp 53–160. Also “On the Variation of Latitude at Rockville, MD...” Appendix No. 1, *ibid.*, pp 1–52. Also “The Variation of Latitude at San Francisco...” Appendix No. 11, *Report... Ending June 30, 1893*. Part II. 1895. pp 445–508.

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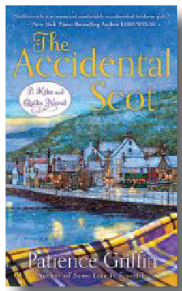
AUTHORS

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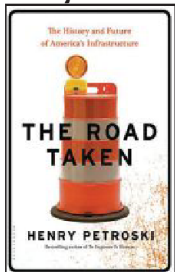
Fundamentals for Understanding Problems and Messes with Patrick Hester of Old Dominion University, which presents a novel way to think about different kinds of problems (and messes). It draws from disciplines as diverse as mathematics, biology, and psychology to provide a holistic method. It is published by Springer.

Patience Griffin is the pen name of **Patience A. Jackson, *Missouri Alpha '93***, who has released *The Accidental Scot*, the fourth book in her *Kilts and Quilts* romantic novel series. It tells of Scottish engineer Pippa who returns home to save her ailing father's engineering company and enlists the aid of American Max. Griffin is an award-winning author, has a master's degree in nuclear engineering, and is known for her quilting of the September 11th Story Quilt. Publisher is Signet Eclipse.



author, has a master's degree in nuclear engineering, and is known for her quilting of the September 11th Story Quilt. Publisher is Signet Eclipse.

Henry Petroski, Ph.D., P.E., *New York Xi '63*, has released his latest title, *The Road Taken*. The Duke University civil engineering professor and writer reports on the state of America's infrastructure,



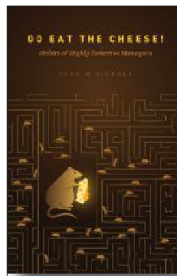
from its historical origins to its present crumbling state. The book is also a call to citizens, politicians, and anyone with a vested interest in our economic well-being on the road we take in rebuilding our aging infrastructure. It is published by Bloomsbury.

Chuck G. McConnell, *Oklahoma Beta '65*, has written his first fictional novel *Fire with Fire*, a Jack Tallon Novel, published by CreateSpace. It tells of a U.S. government scheme to destroy the Mexican drug cartels using a paramilitary team covertly based in Mexico. McConnell is a retired chemical engineer and energy service industry chief executive.



McConnell is a retired chemical engineer and energy service industry chief executive.

John W. Nichols, P.E., *West Virginia Beta '80*, is retired from engineering after 32 years in telecommunications. He has written *Go Eat the Cheese: Habits of Highly Defective Managers*, a humorous look at certain practices engineers witness in the workplace. The book is published through CreateSpace.



the workplace. The book is published through CreateSpace.

Albert Z. Schwartz, *New Jersey Alpha '67*, retired after 29 years with the U.S. Navy, commanding the nuclear submarines, USS Haddock (SSN 621) and USS Michigan (SSBN 727). He has written *Secret War*, a submarine novel set on USS Haddock as she embarks

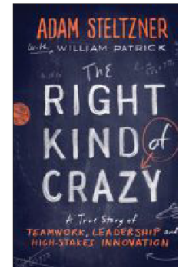


on her final mission in August of 1991. The book is a realistic slice of submarine life and operations for those who served in submarines and know the reality, and a look into that world for those that wish to learn about it. Publisher is CreateSpace.

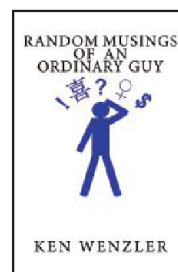
Heather R. Smith, *Virginia Beta '16*, is an engineering science and mechanics senior who has written *A Song in the Rain*. This is a fantasy tale of a song sparrow who wakes up with no hearing and no memory. A search for his past becomes a quest to fulfill a prophecy and win the war against evil. The book is produced by Tate Publishing.



Adam D. Steltzner, Ph.D., *California Lambda '89*, has authored, with William Patrick, *The Right Kind of Crazy, A True Story of Teamwork, Leadership, and High-Stakes Innovation*. He is an engineer at the Jet Propulsion Laboratory and was lead for the entry, descent, and landing team of the Curiosity rover on the surface of Mars. Publisher Penguin Random House says the book "is a first-person account of innovation that is relevant to anyone working in science, art, or technology."



Kenneth G. Wenzler, *Indiana Delta '90*, is currently an office manager with many years of corporate experience too often paralleling
(Continued on page 45)



Profiles in Leadership #8

Tom Scholz: Engineering a Unique Rock Sound

Donald Thomas Scholz, Massachusetts Beta '69, entrepreneur of modern music

by Alan S. Brown

dON'T EVEN THINK about calling Tom Scholz an overnight sensation. "When people say I'm a Cinderella story, it's because they don't know about the six years of drudgery and lost savings I put into preparing myself for that very remote possibility of success," he replied.

Scholz's story sounds like so many other engineering entrepreneurs: He graduated MIT and joined a major corporation. Instead of buying a house, he poured his savings into equipment and prototypes. He faced rejection after rejection before lining up backers, who later tried to assert control.

The only difference between Scholz and most other engineers is that Scholz is a musician and his product is the band, Boston. When Boston's first album broke in 1976, it shot Scholz, who had not played live shows in years, straight to the top. The album went on to sell 17 million copies, making it the best-selling debut album by any artist up until that time.

With wave after wave of lavishly textured guitar solos, surprising harmonies, and unusual sounds, Boston rang out fresh and new. It was a triumph of Scholz's musicianship—and his inventive engineering.

"There wasn't a single note on those recordings that wasn't played through gear that intentionally altered the sound in new and unique ways," he recalled.

Born in 1947, Scholz grew up in a blue collar neighborhood in Toledo, OH, and later moved to the city's ritziest suburb. He describes his parents

What does it mean to be a leader? In this series "Profiles in Leadership," Tau Beta Pi is exploring that essential question through the lives of member engineers who attained leadership positions in their fields.

as "brilliant." His father left engineering school after two years to design modular homes. His mother graduated valedictorian of her high school at 16.

Like many engineers, Scholz was always taking things apart or building them. He was hooked on engineering the first time he saw someone flying a radio-controlled airplane.

"I didn't have a chance of getting anything like it, but I took all my money and bought balsa wood so I could make models of those airplanes. I was interested in anything that could fly, float, or move," he recalled.

This showed up in his choice of sports. At 6' 5½", Scholz played varsity basketball because he liked getting airborne and dunking. When college athletics eliminated the dunk, he left the MIT team.

Although he was a basketball player, Scholz never aspired to popularity.

Liked Working by Himself

"Like all high school kids, I wanted to be part of the group. I also really liked working on stuff by myself. I enjoyed working with people who shared a specific

interest. But I was always trying to do something to reach some goal," he remembered.

At MIT, that goal was survival. The competition was ferocious. Scholz remembers viewing everyone's SAT scores during freshman orientation.

"The English scores formed a Bell curve skewed to the right. The math scores rose asymptotically to 800," he said.

Scholz struggled, received little feedback,



Tom Scholz, who studied classical piano as a child, in concert. Photo: Kamal Asar

and felt he was near the bottom of his class. He applied to Case Institute of Technology so he could transfer if he flunked out. He was shocked to end his first semester with a GPA of 4.8 out of 5.0.

As he fell into MIT's rhythms, he began exploring an emerging interest, rock and roll. Scholz's parents were both musical, and he grew up listening to classical records, attending orchestral concerts, and studying classical piano.

Popular music left him flat until his senior year of high school, when he heard the Kinks, Yardbirds, Animals, and other British Invasion bands.

"I liked the high energy and distorted guitars. It reminded me of live symphonies, because they had that same power. I like that sort of animalistic, brute force. That's what got me playing in bands. We would play for anyone who would put up with us," Scholz said.

Music and engineering came together at Scholz's first job. He graduated MIT with a master's degree in mechanical engineering in 1970 and joined nearby Polaroid, a company best known for cameras that developed photographs instantly.

Scholz loved the work: "I couldn't believe anybody would pay me to do this, and I was working only 40 hours per week after doing 80 to 100 hours at MIT. It was exciting to build things, especially the way Polaroid did it. There was not a lot of calculation, because it was faster to make a part, see if it broke, figure out why, and then make another."

Polaroid assigned him to help develop the sound component of an instant movie film system.

"That was a stroke of luck because it taught me how to put together an inexpensive multitrack studio in my basement," Scholz recalled.

Increasingly Frustrated

It came at a time when Scholz was increasingly frustrated as a musician.

"I tried to put music on stage with other musicians and it didn't work. Everyone does the best they can, but when it's your music and you have a vision, it's difficult to get others to see or understand what you are looking for. As I became more fluent at multitrack recording, I realized this was holding me up," he explained.

This was in 1974. Scholz, a senior product design engineer, still didn't own a home. Instead, he rented and plowed all his money into his basement studio, where he was inventing new electronics to make the sounds he could hear only in his head.

His doubler, for example, delayed a sound by 10 to 20 milliseconds and changed its pitch slightly. Today, such devices are common. Then, companies were struggling with how to vary the clock on their digital devices. Scholz took a different approach: he started with an analog chip and drew upon his experience with simple physics to alter the clock rate in a way that sounded natural.

"This was my attempt to create a second performance of my original performance in stereo in a different speaker," he said.



DONALD THOMAS SCHOLZ

Basketball 1, 2, 3, 4; Class President 4; Council on World Affairs 3; National Honor Society 3, 4; Varsity Club 3, 4.

This Leader In Brief

Full professional name: Tom Scholz.

Current position: Founder, Boston.

Birthplace: Toledo, OH, 1947.

Highest degree: M.S., Mechanical Engineering, Massachusetts Institute of Technology, 1970.

Major career highlights: Engineer, Polaroid, 1970; senior product design engineer, Polaroid, 1974; founder, Boston, 1976; founder and president, Scholz Research & Development, developer of Rockman guitar amplifiers, 1980-1995; founder, DTS Charitable Foundation, 1987.

Honors: USO's 2011 *Boston*, Multiplatinum, 1976; Grammy nomination, Best New Artist, 1977; *Don't Look Back*, Multiplatinum, 1978; *Third Stage*, Multiplatinum, 1986; *Walk On*, Platinum, 1994; Charitable awards from People for the Ethical Treatment of Animals, Friends of Animals, The National Hospice Organization, Action for Life Conference (Mahatma Gandhi Award), The Ark Trust, and the Animal Rights National Conference.

Greatest accomplishment: Being a father to my son.

Leader most admired: Albert Einstein, not for his work in physics, but for his vegetarian belief that eating animals is an unnecessary cruelty.

Hobbies: Freestyle skating, designing and flying radio control airplanes, flying real airplanes, studying Spanish, and recording rock n' roll music.

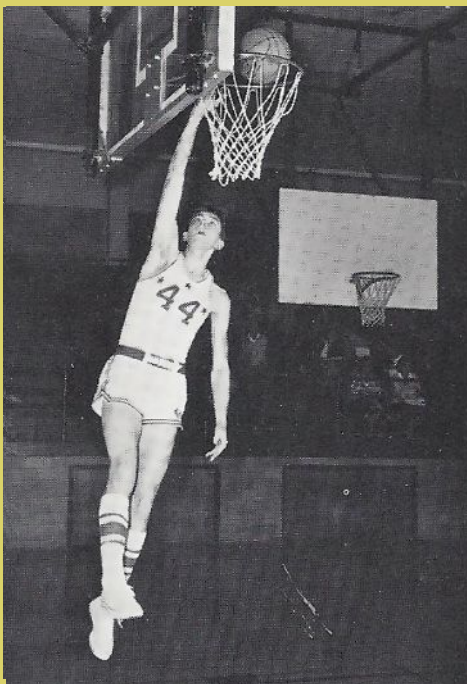
Favorite book: *Brain Droppings* by George Carlin.

If you could do one thing over: I make a lot of mistakes... wouldn't know where to start.

Tom Scholz



Above: A pastel of a young Tom Scholz. **Center:** Getting airborne as a varsity basketball player in his senior year of high school. **Below:** With Boston vocalist Brad Delp in his studio, which he rebuilt after the success of Boston's first album. **Bottom Photo:** Ron Pownall



Another device made the guitars sound like violins. A third changed tape echo speed and pitch. Using foot pedals, he added these sound effects as he played.

Working with two friends, drummer Jim Masdea and singer Brad Delp, he would lay down rough tracks, then spend weeks or months experimenting with the sound.

By late 1975, Epic Records was interested in his music, but John Boylan, a leading producer, wanted Scholz to re-record his songs in a top studio in Los Angeles.

Scholz said he could not reproduce his sound there and took Boylan down to his basement. The studio combined rudimentary technology with customized electronics in a space the size of a large closet. Boylan was skeptical but promised to fly in an engineer to look at it

"He took one look and said, 'Quite frankly, there is absolutely no way anyone could make an album in this basement,' and went back to the hotel," Scholz said.

Boylan returned on a bitter cold day in February 1976 to insist that Scholz re-record the album in Los Angeles. Scholz refused. Boylan put on his hat and coat to leave, opened the door, then turned around and said, "You make the master tape here, we'll mix it in Los Angeles, and we'll split the engineering royalties."

The rest was history. Scholz had modest dreams. He knew that people wanted to listen to music they had heard on the radio and thought an album might give him a modest local following.

Epic signed Scholz and Delp and recruited three more musicians. Boston played its first gig at a high school. Not one kid applauded, Scholz recalled. One week later, after the album's release, they played a large club. The crowd went wild and demanded an encore (they had none, so they replayed "More Than a Feeling," their first single). Their third concert was outdoors. Police arrested the promoter after the crowd broke through the fence.

He Quit His Day Job

Boston was flying. Scholz took a leave of absence from Polaroid to open on a Black Sabbath tour. Afterwards, he went back to work at Polaroid. Only after the album, *Boston*, surpassed sales of one million and promoters offered him a headline tour did he quit his day job.

Boston went on to sell 17 million copies, establishing Boston as a star in the rock and roll firmament. Success, however, brought pressures similar to those faced by successful entrepreneurs.

For example, Scholz saw Boston as an instrument to achieve his musical vision. Management chose to market the band Boston as a five-member group. This empowered some of the backing musicians who wanted to control Scholz's musical creations.

Noted film director Cameron Crowe later wrote in *Rolling Stone* that there was a deliberate effort to downplay Scholz's contributions. Scholz believes management did this because he resisted being manipulated.

They were right. Scholz clashed with Boston's managers about control of his music. He argued with Epic about the timing of a second album (Epic wanted a quick follow-up and released "Don't Look Back" before Scholz

was fully satisfied. It sold millions of copies, but was not as successful as *Boston*. Epic sued and withheld royalties when Scholz refused to rush a third album.

It took years before Scholz re-established control over his music, his recordings, and his band. His third album, *Third Stage*, took eight years to produce. It went multiplatinum, but left Scholz with a reputation as a perfectionist.

He thinks it is undeserved: “There is no such thing as perfection when it comes to art, but doing second rate work just to collect a paycheck is not something I would be happy with. My goal is the same as that of the best engineers, to come up with the best solution within my constraints.”

He also began manufacturing some of the guitar effects he had invented. His Rockman was the first portable headphone amplifier to produce the distortion heard on giant stadium speakers. It earned him fan letters from top rock musicians and a warranty card from famed guitarist Jeff Beck that is still tacked on Scholz’s bulletin board.

Raised Millions of Dollars

Today, Scholz continues to make music both in his studio and on tour. He has raised millions of dollars for his DTS Charitable Foundation, which supports a variety of animal and human rights causes. He received major awards from People for the Ethical Treatment of Animals (PETA) in 2013 and the Animal Rights National Conference in 2015.

Over the years, he has learned a lot about leadership.

“Doing something on a stage brings a lot of things to the surface that help you become a leader,” he explained. “When you get any group in a room, everyone has his or her own ideas, vision, and agenda. You need to get them to cooperate and do things to help you. You either figure it out or you won’t succeed.”

Leaders must understand critical technologies. “It gives you a leg up,” he said. “You’re not blind and counting on someone else to explain or interpret things.”

Before Scholz became an “overnight sensation,” he battled long odds and rejection. What enabled him to persevere?

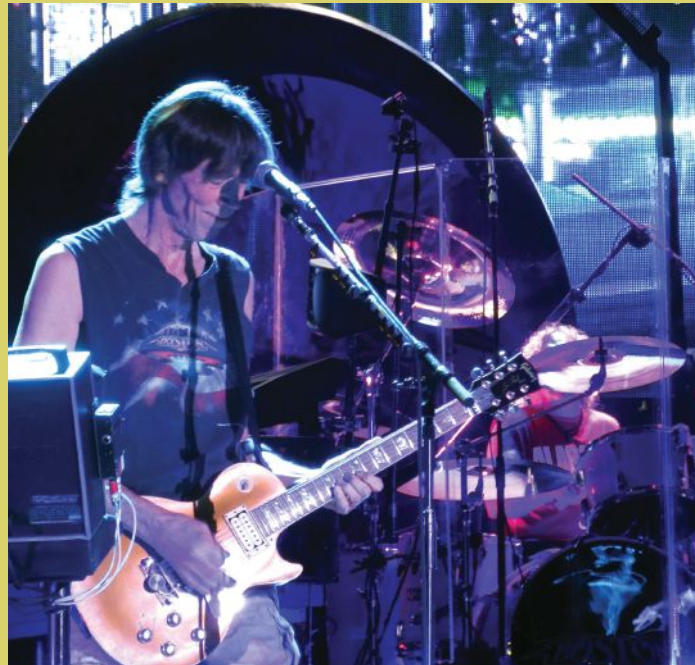
“You don’t have to have confidence that you are going to be successful. Instead, you must believe that what you’re doing is rational and makes sense, and that it’s a good approach to solving a problem or making a discovery.”

That approach has enabled him to combine music and engineering for 40 years, and keeps him rocking today.

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.



Scholz’s Rockman, the first amplifier capable of reproducing the distortion of stage speakers in the musicians’ headphones.



Scholz on stage during a concert in Tuscaloosa, AL, playing his Les Paul guitar.



A wedding day image after Scholz married Kim Hart in the Florida Keys in 2007. Photo: Bob Summers

2015 Alumni Giving Program November-January Contributors

The names of an additional 3,452 Tau Beta Pi alumni who made donations to the Association in the 2015 Alumni Giving Program appear in two separate sections on the following pages. Their gifts totaling \$333,120 arrived between November 1, 2015, and January 31, 2016. Gifts received after January 31st do not appear here but will be published in the Summer 2016 issue of The Bent.

The generous support of each member is deeply appreciated by the Executive Council and other Association Officials. The financial resources have permitted strengthening our programs in several areas that emphasize the importance of Tau Beta Pi's basic objectives and that help all collegiate chapters and student members.

Recognition Club Donors are listed alphabetically within their chapters and appear in the first section below. Member-contributors appear in the last section. Names marked with a † symbol are of deceased members in whose memory donations were made either by relatives and friends or through bequests. In addition to gifts acknowledged here, several were made anonymously through the Combined Federal Campaign and Network for Good and are also deeply appreciated.

Donor Recognition Clubs

The names of 2,483 Tau Bates appear in this first section. They made donations to the 2015 Alumni Giving Program between November 1, 2015, and January 31, 2016, AND they have also made CUMULATIVE contributions (in some cases including matching gifts) and bequests to Tau Beta Pi through the years totaling from \$250 to more than \$1,000,000.

The Donor Recognition Clubs are part of our effort to recognize a donor's total lifetime cumulative giving to Tau Beta Pi. Such continuous support significantly contributes to the overall strength of the Association and allows our Society, with confidence in our financial resources, to plan for modest growth in our services to the engineering profession. These clubs were chartered by the Executive Council in 1986 and have been set at the following levels:

Matthews Club	500,000	Alpha Club	25,000	Chi Club	1,000
Nagel Club	250,000	Beta Club	10,000	Second Century Club	500
Williams Club	100,000	Delta Club	5,000	Founder's Club	250
Heikes Club	50,000	Zeta Club	2,500		

WILLIAMS CLUB

MI Z Lange, Harry W. '75
NY E Lynworth, Lawrence C. '58
SD A Simonson, Larry A. '69
VA A White, Robert Dudley '76

HEIKES CLUB

CT A Soderberg, Peter Holton '68
RI A Anonymous '72

ALPHA CLUB

CA B Myers, Gerald Elwyn '70
CA E Pappone, Daniel Charles '77
IA A Faidley, LeVern William '67
MI E Anderson, James Anton '66

BETA CLUB

CA B Schlinger, Warren Gleason '44
CA Z Peters, Robert William '61
CO A Armentrout, Michael Lee '94
CO B Anonymous '78
FL B Crews, Renard Calvin '70
IN A Spitzer, Robert Edward '61
IL A Ford, Steven R. '80
Griffin, Abbie J. '74
Sarkisian, Nancy Louise '77
IN G Rice Jr., Donald Blessing '61
IA A Moyer, James Hardy '51
Anonymous '69
LA G Kitchens, Philip Hudgins '67
MD B Stahle, Carl Michael '81
MA B †Bose, Amar Gopal '52
MI Z Thebert, Alan Wilbert '57
NH A Sherman, John Lincoln '54
NJ A Bezos, Jeffrey Preston '86
NY E Hollander, Lawrence Jay '51
Marniscalo, Thomas Louis '67
NY K Knox, Keith Thomas '70
NC A Johnson Jr., James William '77
PA G Barrow, Bruce Barton '50
SD A Gomulinski, Tricia Elizabeth '98
TN G Hall, Kristofer Brian '98
TX A Kothmann, Richard Edward '59
Yates Jr., Saint Clair Peyton '65
TX H Trich, John Albert '70
WI A Smith, Robert Field '64
WI B †Hurlbert, Gordon Charles '46
Anonymous '45
WI G Cronce, Richard Gordon '77

DELTA CLUB

AZ A Milan, John M. '67
AZ B Story, Franklyn H. '81
CA B Marshall III, J. Howard '57
Shombert, Lee A. '79
CA A Davis, John Leo '60

CA E Goodin, William Rex '75
Tozaki, Ronald Yuji '74
CA Z Grigsby, David A. '84
CA H Crotchett, Denton Robert '71
CA I Pickett, Stephen Euan '75
CA N Caddock Jr., Richard E. '72
CA O Turhollow, Charles B. '81
CA H †Lyons, Eddie Lee '76
CO B Harris, James Robert '68
Harris, Karen L.W. '74
CO A Laughlin II, George Thomas '75
FL A Bolton, Charles H. '62
Kalter, Howard L. '66
GA A Brown III, Emil W. '82
IL A Fue, Harold '57
Luzbetak, Paul Daniel '96
IN A Buchholz, Richard Fred '47
Sedlacek, Warren Richard '45
IN A Stechholz, Jonathan M. '72
IA A Ask, Andrew C. '64
Carlson, Mary Terese '78
KS A Kleist, Robert A. '51
LA A Comeaux, Keith A. '89
Olivier, Donald Andrew '51
MD B Crane, Thomas Clemson '62
MA A Duris, Robert A. '74
Keogh, Brian James '84
MA D Fenton, Harvey Albert '58
MA H Garriques, Ronald Gene C. '86
MI G Crouch, Dennis Eugene '62
Fay, John Edward '56
†Simmons, Charles David '50
MI E Frye, James Henry '51
Gomulinski, Curtis Dennis '01
MS A Shaekruls, Bobby Stone '72
MT A Melnick, Charles Howard '41
MT B Samuels, Blake Robert '84
NJ A Forslund, Donald Charles '60
NJ B Mudie, Samuel Hunter '62
NJ A Mendelsohn, Andrew J. '77
NY I Judd, Robert Paul '78
NY N Weber, Thomas William '53
OH B Throckmorton, Dean W. '82
OH G Ross, Elliot Bennett '69
OH D Robe, Thurlow Richard '55
OH E Korzep, Stanley '66
OK A Hall, Ralph Roy '64
Morris, Jay Kevin '81
OR A Lynch, Stanley Clark '73
PA A Harker, Patrick Timothy '81
PA H Hetteche, Leroy Raymond '61
SC B Daley, Leslie N. '71
Gibbons, Joseph Harrison '56
SC G Davis Jr., Emmett Irwin '50
Good, Mary Lowe '50
TN A Pih, Norman P. '82
TN B Layne, Margaret Edith '80

TX A Adamo, Paul Magness '85
Knight, Graham B. '48
TX A Plank, Michael J. '83
UT A Morrison, Michael George '88
VA A Brown, Lee Merry '88
Pitzer, William Groh '75
VA B Breeser, Jeffrey W. '83
Carpenter, Joseph Andrew '63
WAA Gunter, Robert A. '62
Okita, Richard Y. '56
WAB Moors, Donald E. '55
WI A Bolender, John William '51

ZETA CLUB

AL A Rowell, William Johnston '69
AL A Koelbl, Terry Gene '84
AZ A Koupal, Jerome Robert '56
AZ B Stout, Roger Paul '77
AR A Biggadike, Robert Holden '58
Edgar, Timothy Matthew '08
Kuo, Meng-Han '08
McCune Jr., Earl William '79
Meyers, William Raymond '80
CA B Jessen, Howard Ellsworth '46
Lippey, Gerald Zee '55
CA G Hardison, Robert Logan '57
Kwoks, Munson Arthur '62
Marks, Stuart Warren '84
Tyson Jr., James Jordan '58
CA A Cozens, Eric Trevor '48
Sekimura, Gerald Takashi '73
CA E Gliksmann, Jerome A. '62
Miller, Jeffrey Clark '83
CA G Koblitz, Gordon Frank '66
Smith, Gregory W. '75
CA A Downing, Edward Ernest '84
Pickles, William Raymond '80
CA N Lytle, Scott K. '86
CA O Treinen, James Patrick '85
CA T Fable, Scott Edward '96
CA A Abell, Joseph Markwell '56
Davidson, Jeffrey D. '79
Knight, William James '79
CO B Kern, Robert Edward '43
Wilson, Paul L. '59
CT B Chatfield, Larry Allen '71
Killingbeck, David R. '77
Klopfenstein, Rex Carter '59
DE A Hyer, Frank Sidney '58
Kimpel III, Paul H. '70
DC A Belcher, Wade D. '70
Griffin, Earl H. '57
DC B Yousser Mir, Paul '78
DC G Altamore, Annette '79
Cooper, Reid Franklin '77
FL A Newlands, David Michael '62
Plumb, Russell A. '76

FL B Tilles, Arno William '84
FL A Palm, William Howard '55
GA A Fawcett, Clinton Douglas '92
Rogers, Don E. '63
Snare, Daniel M. '80
IL A Dittman, Jason Blair '91
Pfefer, Bernard Lee '47
Tracy, Mark A. '86
IL B Jaras, Anthony Algrid '67
Lewis, Ted Howard '68
IL Z Woyna, Mark Anthony '87
IN A Barker, Kenneth Dale '64
Carlson, Richard Alan '70
Hooks, Collis C. '64
Mason Jr., Lowell B. '48
Murdoch, Jay Homer '51
Taylor, Harold LeRoy '51
IN B Badger, Jerry Delon '62
IN F Buran Jr., Joseph E. '75
Jones, Walter T. '64
IA A Feisel, Lyle Dean '61
IA B Small, Warren Lindsey '57
KS A Parrish, Joseph Victor '72
KY A Dunning, William E. '61
Feather, Gary Alan '80
LA A Williams, Colleen D. '82
LA B Ibele, Warren E. '44
Legendre III, Emile Joseph '60
LA G Cornish, Merrill A. '67
Samuels, Anne Kathleen '86
ME A Brigham, Ernest Bennett '53
Johnson, Christine E. '82
MDB Bryner, Nelson Prentice '83
Rowland, Ralph Wilson '51
NY I Trumble, Alan R. '71
MA A Snively, Fred S. '60
MA B Gilkes, Alan M. '68
Goldstein, Andrew C. '69
MA A Birger, Jordan '43
Carter Jr., Arthur Alfred '51
Coutts, Robert Bruce '72
Patkin, Murray S. '64
MA E Sladek, John R. '77
Stevens, Janet M. '72
MA Z Cetti, Richard P. '70
Grzeslak, Kazimierz T. '88
Harrison, Charles Brett '64
Poulin, James Edward '66
Walker Jr., William E. '57
MA H Maneval, Daniel C. '82
MI A Colby, Dirk Joel '66
Colby, Kathleen Luchini '99
Spindler, Jeffrey David '79
MI B Jenekhe, Samsa A. '77
MI G Allaben, Elizabeth Ann '79
Bell, Lawrence David '68

Padzieski, Robert Joseph '70
Seidel, David Allen '81
Trankle, Thomas Lynn '71
MI A Cook, Clifford C. '69
MI E Thompson, George W. '55
Timmins, William D. '62
MI I Allen, Michael Peter '85
MI A Berke, Wesley Ryan '09
MN A Peters, Timothy Gene '78
MS A Faries Jr., Charles E. '57
MO B Davis, Jon Timothy '85
MO F Gibbs, Kenneth Paul '76
Hruswiz, Dan N. '50
Russetti, David Joseph '74
MT A Collins, Douglas M. '71
NJ A Post, Edwin Lewis '62
Skowronski, Victor J. '71
NJ B Carey, Mark '77
Dougherty, Steven P. '64
Fletcher, Leroy S. '58
NJ F Krumins, Aivars Edgars '75
NM B Serwie, James M. '96
NY B Carr, Donald Joseph '77
Phillips, Glen E. '71
NY F Cole, Marie Sayre '84
Luckett, Larry W. '83
Uber, Charles Bertram '55
NY A Kemp, Thomas Ward '59
NY E Hellman, Martin Edward '66
NY H Varon, Michael '73
NY I Dumjich, Louis Charles '78
NY A Abrardo, Joseph M. '71
Schmitt, Robert E. '72
NY E Runowich, Carl Joseph '84
NY I Dermmel, Johann George '83
Stalzer, Jeffrey '74
NY P Calfa Jr., Frank Salvatore '81
NC A Vercaemert, Carol Starnes '76
Walker, Gary Kenneth '70
NC F Anapol, Edward '76
Linker, Edward Markham '47
NC E Allen, James A. '88
ND A Quanbeck, Gordon C. '51
OH B Pollock, Flavil Martin '77
OH G Albery, James O. '59
Howland, Smith Eugene '69
Monter, George C. '60
OH Z Zelms, Charles Michael '73
OH H Senyk, Joseph Michael '67
OH M Bowers, Keith Allen '91
OK A Vercaemert, Paul Armand '87
Honker, William Kutz '75
OK B Royce, Robert Michael '73
OR A Carlson, Burton Carter '53
Eden, James D. '79
Milton, Stuart W. '84
Paynter III, Walker Burton '74

The Heritage Society

The Heritage Society was established in 2001 to recognize and honor those who continue the tradition of outstanding support by remembering TBPI in their plans. Heritage Society members, listed below, have included a provision in their estate plans to benefit the Association and have informed TBPI of this commitment. Their support is gratefully acknowledged, and their names will appear each spring.

- Aggaard, Ph.D., James S., *IL* Γ '53
 † Alford, Henry M., *MS* A '27
 † Althouse, Ernest E., *PA* A '26
 † Anderson, Marshall, *MI* Γ '32
 Anonymous, *IL* A '55
 Anonymous, *MA* B '66
 † Arm, David L., *PA* E '30
 † Banner, Charles E., *OH* Γ '47
 † Barnes, Raymond H., *MI* Γ '40
 Basta, Edward D., *OH* E '82
 Bateman, Terry S., *CA* Γ '58
 Beans, Ph.D., E. William, *OH* Γ '53
 † Bossert Jr., Warren H., *PA* B '45
 † Brems, Jr. John H., *MI* Γ '46
 Brill, Arno W., *TX* A '71
 Budd Jr., Col. Roger, *IL* A '62
 Burg, Stoddard S., *PA* B '51
 Burns, Carlisle V., *NY* A '50
 Campbell, P.E., Cleveland L., *IA* A '47
 Cancilla, Charles E., *CA* Z '59
 Chamberlain, Ph.D., P.E., Adrian R., *MI* A '51
 Chute, Richard, *MI* H '49
 Colbry, Ph.D., Dirk J., *MI* A '06
 Colbry, Ph.D., Kathleen Luchini, *MI* A '99
 Cook, Norman L., *WY* A '79
 † Curtis, Ph.D., Richard A., *OH* A '64
 D'Avignon, Edward J., *NY* B '88
 † Donoghue, Leonard W., *MA* Δ '37
 Dooley, George H., *NH* A '53
 † Duenweg, Col. Louis, *IN* B '36
 † Dulles, John W.F., *AZ* A '43
 Fellner, Kenneth M., *AZ* A '34
 Fisher, James E., *CO* Δ '78
 Fleming, John R., *IA* B '50
 † Forge, Charles O., *CA* Γ '56
 Forslund, Donald C., *NJ* A '60
 Froula, P.E., James D., *TN* A '67
 Fue, Harold, *IL* A '57
 Gendron, Roger J., *IL* B '55
 Gomulinski, Curtis D., *MI* E '01
 Gomulinski, Tricia E., *SD* A '98
 † Hanley, Edward P., *IL* B '42
 † Hart, Jack B. & Arline I. (ΣT)
 Haynes, Ph.D., P.E., Charles D., *AL* B '62
 Herke Jr., Frederick P., *OH* A '54
 † Heymann Sr., Andrew P., *FL* A '39
 Hord, William E., *MO* B '59
 Jackel Jr., Henry E., *IN* B '57
 Jackewicz Jr., Joseph I., *IN* Γ '75
 Jennings-King, Sherry D., *TN* A '93
 † Johnsen, Roy L., *MI* B '57
 Johnson Jr., James W., *NC* A '77
 † Jones, David S., *KS* A '49
 Kern, Jack C., *CA* K '71
 Kirschman, Ph.D., Randall K., *CA* A '66
 Kitchens, Philip H., *LA* Γ '67
 Kogut, Ph.D., P.E., Kenneth J. *MI* Δ '71
 † Kolff Van Oosterwijk, H.L.J., *CA* A '50
 † Liggett, John A., *MI* A '43
 Luce, John W., *FL* Γ '50
 † Luchini, Ph.D., P.E., John R., *MI* Γ '71
 † Lucken, Ernest G., *NY* I '42
 McDonald, Capers W., *NC* Γ '74
 Maniscalco, Thomas L., *NY* E '67
 † Marks, Edwin M., *TX* A '49
 † Nelson, Thomas A., *CA* Δ '49
 Orkins, James E., *OH* Γ '66
 Peterson, Charles C., *UT* A '68
 Pierce, Russell W., *WA* A '70
 † Ray, Frederick H., *OH* E '49
 † Reed, Ph.D., Charles E., *OH* A '34
 Regula, Ph.D., Donald W., *MI* E '63
 Reinhardt Jr., William H., *IA* A '48
 Sax, Franklin S., *MO* Γ '55
 † Scheffler, P.E., Paul H., *PA* Z '48
 Schmoller, Ralph H., *OH* Δ '61
 † Scribner, A. Clayton, *NY* Γ '29
 † Sickafoose, Robert D., *IL* B '50
 Siller Jr., Ph.D., Curtis A., *TN* A '66
 Slafer, Loren I., *CA* Δ '68
 Smith, Andrew L., *MS* A '48
 Smith, Richard N., *OR* A '57
 Smith, Rodger F., *WI* A '64
 Soderberg, Peter H., *CT* A '68
 † Stechmeyer, John P., *OH* E '48
 Stella, P.E., Damien F., *AK* A '82
 † Strom Jr., George J., *CA* Γ '56
 † Swalin, Ph.D., Richard A., *MN* A '52
 Swanson, P.E., Hilmer S., *WA* A '76
 Swanson, Ph.D., John A., *NY* Δ '62
 Taber, Norma J., *MO* Γ '80
 Tarwater, James P., *MO* B '51
 † Taylor, Paul D., *KS* A '58
 Tydeman, Frederick J., *CA* Δ '73
 Tyson, Samuel E., *PA* B '48
 Weissman, Martin J., *NY* E '58
 Wetenhall, Paul D., *GA* A '76
 White, Robert C., *IL* Γ '53
 Widmann, Bradley H., *NY* A '69
 Williams, David C., *TX* B '47
 † Wilson, Charles N., *WA* A '70
 † Winkler, Albert H., *AZ* B '75
 † Wisner, Benjamin G., *CA* Δ '49
 † Zimmerman Jr., Marlin U., *MD* A '44
 Zuurbier, George W., *IL* A '53
 († indicates that member is deceased)

Please contact Patricia McDaniel at pat@tbp.org if you wish to be included as a member of the Heritage Society.

ZETA CLUB, CONTINUED

- PA A Wagner, Theodore Walter '71
 PA B Stockburger, Richard '73
 PA E Babbitt, Walter Howard '77
 PA Z Dieter Jr., George Ellwood '50
 PA Ø Gigliotti, Michael Philip '73
 PA A Honath, Mark F. '80
 RI B Luz, James J. '80
 SC A Jones, Walter Fleming '78
 Roat, Suzanne D. '85
 TN A Froula, James Dewayne '67
 Jennings-King, Sherry D. '93
 King, Gregory Tyler '93
 Massimini, Michael Ian '76
 Peishel, Frank Louis '61
 Pentecost II, James Miller '69
 TN B Marianelli, Walter David '75
 TX A Carroll, Billy D. '64
 Dorr, Lawrence Daniel '68
 Klump, Delbert Craig '77
 Smith, Matthew Thomas '93
 TX B Tye III, John M. '67
 TX E Sams, William Neal '81
 TX Z Wint, Stephen Peter '83
 TX H Schmidt, Robert William '84
 TX Ø Barrett, Gerald George '70
 UT A Davidson, Stuart W. '83
 Eide, Eric Norman '89
 VT B Urciuoli, Joseph Charles '68
 VA A Anderson, Robert Steven '80
 Hardy Jr., Edward I. '69
 †Morgan III, Edward '48
 VA B Harras, Edgar D. '67
 VA Γ Glass, Christopher Earl '83
 WAA McDonald, Bruce G. '91
 WAB Cass, Robert Dennis '83
 Grossman, Robert J. '59
 WV B Ashman, Michael D. '84
 WI A Delucca, Gregory James '59
 GA Gallensky, Neil E. '82
 CHI CLUB
 AL A Cowles, Gary D E '87
 Goodwin, James Joseph '58
 Hartley Jr., John T. '55
 Rayborn, Timothy Johnson '87
 Smith, David Buck '70
 Talbot, Thomas F. '52
 Trapane, Karen L. '82
 Vollberg, Walter K. '73
 AL B Bess, William Ernest '46
 Delocenzo, Joseph David '57
 AL Γ Jacobs, Bryan K. '81
 AL Δ Wilkinson, Brian Duncan '87
 AK A Braun, David R. '74
 Cline, John Robert '81
 Dombrowski, Roger Alan '69
 AZ A Atkinson, Dale Robert '85
 Berg, Jeffrey Roy '93
 Brock, Steven B. '66
 Da Silva, Eduardo G. '58
 Davis, Robert Allen '79
 Erickson, Kenneth Lynn '68
 McLaughlin, Dennis P. '80
 Steinwachs, Donald M. '68
 Womaek, Donald E. '50
 AZ Γ Bruening, Brenda I. '82
 Bruening, Gregory Wilfred '80
 AR A Jones, Michael D. '67
 Kimmel, Dennis Edward '88
 CA A Bassett, James Harold '50
 Feldsher, Theodore Baker '85
 Hoe, Albert '92
 Johnson, Albert W. '50
 Kirschman, Randall Keenan '66
 Masson Jr., James Ross '42
 Ravenscroft, Dewey S. '63
 CA B Creutz, Michael J. '66
 Lee, Roland R. '75
 Young, Lawrence Renwick '71
 CA Γ Cotton, Thomas A. '85
 Dohner, John W. '72
 Edmundson, Bruce James '71
 Hetzel, Geoffrey O. '82
 Inouye, Lance M. '68
 McClendon, Scott '60
 Palmer III, Everett Arthur '65
 Rodriguez, David A. '58
 Roodhouse, James Greenlee '59
 Sansbury, James Douglas '66
 Ullman, Marc A. '83
 CA Δ Agajanian, Shooshanig D. '79
 Barr, Juliana '80
 Fong, Franklin M. '69
 CA E Evtahov, Viktor '56
 Gaunt, Arnold J. '86
 Gritton, Eugene Charles '63
 Karagozian, Ann R. '78
 Masumura, Robert A. '62
 Perrine, Richard L. '49
 Woo, Raymond '72
 CA Z Benson, Chris Alan '84
 Cancilla, Charles E. '59
 Downey, James B. '62
 Perrin, Michael Elton '67
 CA H Akers, Joe Lee '69
 Battersby, Leslie Charles '98
 Broadston, Robert Dean '94
 Burrows, Stanford '63
 Chin, Victor H. '74
 Cirigliano, Richard L. J. '81
 CA Ø Kawahara, Lester M. '80
 CA I Tam, Clement '73
 CA K Bethune, Edwin M. '84
 Humphreys, Evan '75
 Ramirez, Marvin Jerome '82
 CA A Horn, Jeffrey Ben '79
 Stanley, Richard L. '79
 Yamamoto, Ko '84
 CA M Keiser, Randy Jay '73
 Mitsuka, Jeffrey Minoru '79
 Rodgers, Patrick James '80
 CA N Bishop, Douglas Steven '73
 Emery, Linda R. '82
 Fujita, Jerry Satoru '84
 Lamoureux, Mark S. '81
 Reukauf, Paul J. '70
 Ruud, John E. '73
 CA E St Clair, Christine Marie '81
 CA O Caballero, Ross Charles '72
 Elliott, Pamela Ann '88
 Fitzsimons, Michael Joseph '79
 Page, John A. '61
 CA Π Beavers, Timothy R. '78
 CA Y Gruspe, Nancy T. '88
 CO A Kranzler, Irvin '54
 Roberts, Christopher R. '78
 Van Dinter, Jennifer Ann '97
 CO B Bartlett, Paul E. '51
 Colnell, Joseph M. '58
 Eason, Ernest D. '71
 Luppens, John C. '76
 Semerak, Steven N. '76
 Shapiro, Robert Joseph '47
 Tinnan, Mitchell Todd '76
 Wood, John A. '71
 CO Δ Mehring, James Warren '72
 CT A Fischer, Edward Michael '89
 McLeod, Christopher Kevin '77
 CT B Layman, Timothy Paul '79
 Thompson, Gerald Franklin '50
 Tyllaska, Theodore Thomas '85
 DC A Gathungu, Peter Maina '93
 Karydas, Apostolos E. '62
 Long, Michael E. '72
 DC B Lee, Wah H. '73
 Maggio, John Joseph '81
 DC Γ Haldeman, Paul Metz '70
 FL A Evans Jr., Andrew J. '75
 Hayden, James George '69
 FL B Ault, Richard H. '64
 Elnaggar, Suzanne '93
 FL Γ Collins Jr., William Louis '75
 Copeland Jr., Charles Edwin '73
 Lancor, Barbara Jean '79
 Shimura, Mitsuo '74
 Stagner, Ralph Scott '82
 FL E Skemp, Susan H. '81
 Stierlen, Lorelei Beth '97
 GA A Backhaus, George P. '83
 Barber, Brian Robert '81
 Coons, Louis Whately '81
 Cooper Jr., Basil Pearson '65
 Driggers, Herbert H. '63
 Kadnick Jr., William Walter '76
 LeCroy Jr., Edwin Poteat '67
 Malone, Thomas Joseph '63
 Mowrey, Daniel B. '65
 Negro, James Eugene '68
 Siemens III, John Frederick '75
 ID A Erickson, Leif '80
 IL A Davison, Brian C. '87
 Flitman, Jeffrey Edward '82
 Gromala, Edward Joseph '79
 Hanus, Daniel Joseph '68
 Hebenstreit, Richard Henry '45
 Jones, Douglas Warren '80
 Kasik, Phillip M. '88
 Krupka, John Frank '52
 IN Δ Nelson, Gordon K. '51
 Nolte, Kenneth George '64
 Ostrodka, David Leon '70
 Pubentz, Lawrence James '81
 Schuhrke, Donald Kenneth '55
 Snyder, Dan W. '50
 Tataru, Richard Michael '78
 Williams, Allan Richard '71
 Zielinski, Edward Lee '74
 IL B Gurney Jr., Donald P. '59
 Hughes, Joseph L. A. '79
 Kinast, John Arthur '79
 Lewis, Burton A. '48
 IL Γ Aggaard, James Stuart '53
 Cunningham, Richard G. '43
 Fenton, Suzanne Schadel '79
 Guest, Howard Brandon '81
 Kirshner, Brian M. '82
 IL Δ Hachtel, Dale Arnold '68
 Klasing, Wayne Gill '65
 Zeller, Sean Michael '92
 IL E Hopkins, Mark A. '82
 IL Z Glat, Scott S. '84
 IN A Wislek, Michael Anthony '89
 Bullions III, Robert J. '64
 Chrisman, Donald Wray '42
 Davis, Duane Madison '55
 Eglisrud, Richard L. '81
 Hanover, Marilyn Kay '78
 Hereenden, Robert Oliver '65
 Jicha, Albert John '52
 McGraw, Earle Phillips '50
 Novy, Robert Alan '85
 Orr, Donald J. '61
 Roth, Robert H. '72
 Sosnay, Richard Gordon '66
 Sublette, Ivan H. '49
 Warren, Scot William '83
 White, Harvey Clinton '49
 Yackish, Thomas Michael '60
 Yoder, Norman E. '71
 IN B Malone, Henry E. '57
 Noblitt, Niles Leonard '73
 Powell, Robert Lowell '51
 Ruddick, Everett Lindley '64
 Waterman, Robert C. '70
 IN Γ Heidrich, Steven John '82
 Kast, Steven James '69
 Kukla, Michael Alfred '72
 Lombard, Michael Gerard '76
 Pottmyer, James J. '62
 Richter, Richard Terrell '70
 Schuster, Gregory M. '77
 Brems, Robert R. '63
 Schmalz, Peter B. '69
 IA A Bosshart, David John '80
 Coffey, Leo Frederick '64
 Crawford, Brian Matthew '04
 Cronk, John Otis '60
 Drumm, Alfred W. '64
 Henderson, James Allen '70
 Liu, Lee '57
 Paris, Stephen Warren '75
 Reinhardt Jr., William H. '48
 Shepherd, Kevin J. '83
 Zwiebel, Jeffrey L. '82
 IA B Coe, Roger N. '67
 Corrao, Debbie G. '93
 Roach, John Urban '78
 KS A Black, Arthur Geiger '70
 Johnson, Lee Samuel '77
 Knapp, Roy Marvin '63
 Leamon, Richard Gaylord '67
 Massoth, William Henry '82
 Saller, George Edward '50
 Seamans, David Alvin '50
 Shankles, Larry E. '69
 KS B Howe, Donald Craig '78
 KS Γ Benton, Kirk '78
 McKinnis, Steve R. '74

CHI CLUB, CONTINUED

KY A	Bauer, Arthur Robert '63	MS A	Severson, John Albert '72	NC G	Yohman, Donald Forest '73	Heflinger, Richard Scott '72	Johnson, Clare Bannister '80	
	Howe, Richard Samuel '59		Cargile, James Donald '81		Ando, Robert Ryoichi '73	Johnston, Julia Wallace '81	McSpadden Jr., William R.'56	
	Rhoads, Harold Spencer '68		Jerome, Dennis C. '67		Chambers, William Jay '76	Johnston, Stephen Jay '76	Young, James Roy '80	
KY B	Hundley, John Smith '87		Jones, Donald Rush '61		Hansen, Mikkel Anders '78	Morrison, William Harvey '70	AZ B	Hislop, James S. '69
	Hundley, Theresa Elizabeth '87		McDonald Jr., Harold R. '65	NC A	Jackson, James Roy '69	Petersen, Eric Scott '84		Sykes, William C. '82
	Yee, Ngai Sandy '82		McKay Jr., Frank Fay '60	NC A	Langelotti, Carolyn B. '86	Prilly, Debra Domino '78	AR A	Zaleski, Michael Ernest '63
LA A	Angelo Jr., Ernest '56		McMahon, John W. '67	ND A	Dahlin, Earl Charles '58	Bullett, Thomas Carter '88	CA A	Criswell Jr., Thomas F. '72
	Compton, Leon R. '72		Mills, Marvin Leon '65	OH A	Bondor, Paul L. '63	Steeleman, James Taylor '71		Kapelgier, Thimer F. '42
	Franklin Jr., Duard D. '74		Siler, Raymond David '83		Hamilton, Joshua James '09	TN A	Ng, Lloyd '71	
	Richardson, John Daniel '72	MO A	Crabbe, Emmanuel F. '81		Klinch, Kathleen Ann '90	TN E	Wilcox, Leslie M. '73	
	White Jr., Kenneth E. '69		Merz, Jeffrey B. '67		Thro, Stuart W. '64	TX A	Baker, William E. '52	
LA B	Buesinger, Robert Ford '78		Myles, Thomas D. '82	OH B	Zeis, John Frederick '62		Glavson, Brian Scott '99	
	Chaffe III, David B. H. '55		Raines, Gary Keith '65		Christie Jr., Ralph William '73		Goff, David L. '89	
	Perrin III, Shepard F. '83		Stiefemann, Michael C. '86		Fazzoni, Gregory Francis '76		Haschke, Chester Glen '50	
LA G	Ball Jr., John G. '61	MO B	Ash Jr., Richard Lawrence '70		Hamilton, Edward L. '73		Herring, David M. '55	
	Poole, Ronald Gene '69		Bondi, James O. '71	OH H	Harner, Brian Lee '85		Hickox, Robert Elvin '69	
	Sigmund, John A. '75		Eldred, Benjamin Todd '96		Balthaser, James L. '71		Kopecky, Johnny Anthony '65	
	Wright, Cameron H. G. '83		Ernest, Terry Lee '82		Becher, Charles David '72		Le Bleu, Robin Boyce '65	
LA A	Frederick, Presley J. '57		Fennewald, Gary Joseph '73		Deerhake, William Franklin '66		Lyle Jr., Fred F. '62	
	Landy, Glen Ray '75		Hacker, Alden Gerock '41		Fling, Russell Sharon '49		Marshall, James L. '72	
	Vinet Jr., Percy Bernard '57		Horstmann, Paul William '73		Guins, Thomas S. '69		Porch, Calvin E. '48	
LA E	Champion, Robert Pierre '76		Hoglocker, Robert James '62		Haganlock, Robert Edward '62		Schiff, Samuel R. '69	
ME A	Atkinson III, Leland Guy '78		Schmidt, Thomas Edward '70		Hohman, Charles M. '67		Stanbery, Sam R. '64	
	Blackstone, Bradford Earl '91	MO G	Burgi, Charles E. '51		Miligan, George Clarence '50		Sweet, Paul A. '70	
	Palmer, Gerald Milton '61		Kilert, Albert Harold '63	OH A	Orkins, James E. '66	TX G	Hunter, David George '79	
	Plesset, Robert Jordan '81	MT A	Hammell, Allan Keith '51		Pass, Brian C. '86		Johnson, Terry R. '55	
MD A	Becker, William Henry '65		Osgard, Dennis M. '62	OH A	Daubenmire, Richard Leo '63		Turvey, Harry Douglas '73	
	Scheinin, Warren M. '74	MT B	McDonnell, Kathleen Gayel '83		Moore, Mathew Franklin '62	TX A	Biard, James Robert '54	
	Wiseman Jr., William J. '64	NE A	Criswell, Marvin Eugene '65		Wismar Jr., Harry Robert '52		Crosser, Robert E. '50	
MD B	Bromley, Ralph Weaver '44		Hannon, Gregory Michael '86	OH E	Bathen, Robert E. '57		Dokos, Nick George '57	
	Devereaux, John P. '67		Patterson, Roger Kent '73		Cull, Ronald Carl '70		Garner, Scott J. '77	
	Dinkle, Ralph Edward '65		Stransky, David Wayne '92	OH Z	Konsevick, Walter Joseph '53		Goodson Jr., Alfred Wesley '70	
	Ewing, Robert Alan '67	NH A	Hildreth, Howard Russell '56		Allman, Susan Jane '85		Kasch, Vernon Ray '73	
	Gaske, Thomas P. '76		Jarvis, John Edward '79	OH H	Hager, Douglas Scott '85		Knowles, David Wayne '80	
	Greville, Edgar M. '67		Kiefer, Roger Alan '61		Kohlbas, Richard L. '82		Madeley, Hulon Matthews '58	
	Hardesty, Donald H. '64		Scharfe, Alan Charles '78		Nelson, James Ralph '65		Mitchell, Melvin M. '52	
	Jansen, Richard Onas '74	NJ A	Murphy, Kevin Jay '78	OH G	Doyle, James Thomas '65		Smith, Manning D. '64	
	Kirschbaum, Alan Ira '71		Schmidt, Arthur Joseph '68		Luhan, John Bernard '70	TX E	Swink II, Marvin Neal '80	
	Lambrechts, James R. '73	NJ B	Cohen, Robert B. '77		Davis, John Paul '76		Badgett, James G. '81	
	Perkins, Michael Joseph '95		Kaufman, Peter Andrew '84	OH I	Strausbaugh, Patrick D. '86		Bailey, Robert R. '70	
	Schaefer Jr., William Joseph '70		Plant, Stephen Irving '65	OH K	Krause, Leonard Edward '76		Herrmann, Edwin Peter '67	
	Toense, Robert E. '76		Tanner, Robert Brand '64		Maki, Luke Richard '78		Hon, Wai-Leung '67	
MA A	Bernacki, Stephen Edward '70	NJ G	Wollmann, Norman P. '81		Morrison, Donald Paul '89	TX H	Valka, William Allen '75	
	Bujaucius, Gerald Alan '79		Dickson, W. Henry '50	OH A	Murphy, Charles J. '77	TX G	Nooyi, Raj Kishan '78	
	Chase, Brian D. '69		Kunysz Jr., Joseph J. '73	OK A	Leaman Jr., Gordon James '73	TX A	Foster, Otis Charles '82	
MA B	Clauz Jr., John Sebold '54		Padgett, Richard J. '72		Streitmatter, Randy '92	UT A	Alsop, Albert W. '80	
	Ditmyer, Steven Roland '63		Reitano Jr., Anthony James '72		West, Earl Ray '59	UT B	Dewey, William Alfonso '67	
	Evans, Lary Lewis '67		Reitsma, David '65	OK B	Waldorf, John '83	UT B	Piccolo, John Frank '58	
	Fresman, Reed Harlow '64	NJ A	Sharon, Anthony Peter '74	OK F	Basore, William Alan '78	VT A	Enke, Glen Graham '82	
	Heatwole, Antony J. '61		Liste Jr., Thomas K. '69		Freese, William E. '50		Butterfield, William F. '67	
	Hui, Richard C. '70		Meyer, John E. '81	OR A	Andresen, Kenneth Wayne '53	VT B	Simonetti, William James '59	
	Kornafel, Peter Robert '65		Prutzman, Robert Austin '72		Arant, Eugene Wesley '43		Ketcham, Kenneth James '68	
	McKin, Thomas Francis '75		Raffeyan, Kamran Lee '89		Beard, James L. '61		Berkman, Richard L. '69	
	Nobel, Sanford Millard '58	NM B	Busch, Robert D. '72		Geer, Edward Douglas '52	VA A	Cobb, Eben Charles '77	
	Patterson, John Bryan '68		Ballaro, Charles Anthony '87		King, Warren E. '69		Anderson, Willie Corevis '75	
	Pershing Jr., John A. '75	NY B	Fedoroff, Oleg Vsevolod '61		Marsa, Arnold Ray '49		Fair, Robert Richard '70	
	Smallwood, Richard Dale '57		Stanton, James William '61		Niedermeyer, Rex '77		Garner, Patrick L. '52	
MA A	Colen, Frederick Haas '69	NY G	Bornhorst, Bernard R. '60		Pengelly, David Douglas '78		Matthews, Nancy N. '81	
	Osborn, Henry Hooper '50		Bruch, Charles G. '59	PA A	Barndt, Ronald LaMar '58		Orphan, Victor John '62	
MA E	Frost, George C. '50		Leqaur, James Kay '87		Bradley Jr., Charles William '51	VA B	Powell, Joseph Brent '79	
MA Z	Cain, John Francis '61		Levinson, Stanley H. '78		Brownlie, Thomas John '71		Croy, Alvin Quentin '54	
	Flynn, Mamit Michael '04		Limlam, Mamit Michael '04		Doughty, Gary S. '74		Doughty, Gary S. '74	
	Gusciora, Kenneth H. '69		Lynch, Gascora Michelle '86		Lester, Jacob Graham '96		Shannon, James Douglas '62	
	Smith, Richard G. '78		Mohr, Wendell C. '53		Lindval, Scott Guthrie '80	CA E	Nicoloff, Louise D. '83	
MA G	Smith, Gerard Patrick '83		Pennis, Joseph Michael '89		Long, David A. '91		Steckel, David Edward '89	
MI A	Bachman III, Charles W. '48		Sacks, Alexei Hiram '90		Motyka, Timothy John '78	CA II	Barchichat, Emile Nissim '79	
	Griffin, Albert Walter '80		Spengler, Stewart R. '52		Knorr, David Bruce '74		Crampton, Glen Howard '71	
	Houthoofd, Janet Marie '76		Stallman, Thomas F. '59		Ring, Robert B. '55		Reading, Christopher R. '00	
MI B	Bohren, James F. '67		Staudinger, James Robert '77	VA G	Sherman, William Joseph '60		Campbell, Dale A. '72	
	Bohrer, Timothy H. '71		Thal Jr., Herbert Ludwig '53		Talhelm, Donald Lee '59		McGowan, David Michael '89	
	Henriksen, Leslie Louis '58	PA B	Walter, John Arthur '60		Anderson, Charles Alfred '57		Wood, Travis B. '83	
	Hutula, David Norman '66		Weinberg, Richard Sheldon '81		Best, William Joseph '80	VA A	Gehr, David R. '68	
	Leven, Peter Johannes '93		McCloskey, Charles C. '71	WA A	Ciucca, James Allen '72		Confer, Peggy Jean '81	
	Sandretto Jr., Peter Patrick '64	NY A	Taylor, Edgar Rives '52		Magnus, John C. '48		Oyie, Martin Yasuyuki '76	
	Scott, Kenneth John '55		Leung, William L. '74		Meader, Erik John '90		Reichel, Gerald Dave '66	
	Smegal Jr., Thomas F. '57	NY E	Grinthal, Edward Ted '62	PA G	Helfer Jr., Arleigh Pritchard '67	WAB	Rosen, Donald G. '58	
	Stromp, John Edward '78		Kammenzind, Henry A. '50		Sheker, Robert E. '91		Rosen, Donald G. '58	
	Wacker, Don Herbert '52		McCaffrey, Ronald Walter '52	PA A	Sokal, Allen M. '68		Smith, Jeffrey August '82	
MI G	Albrecht, Terry Erwin '67		Niebanek, Charles F. '54	PA E	Mansfield, Brian David '91		Hudspeth, James Charles '88	
	Baxter, John Edward '57		Rubin, Lowell '61		Nolan, Christopher William '86		Langley, Duane D. '55	
	Cameron, John J. '66	NY Z	Chu, Lawrence Joseph '71	PA Z	De Maio, Joseph Anthony '75	WVA	Trippel, Robert Carl '57	
	Capelli, Ronald B. '73		Labianca, Frank Michael '61		Ebner, Alan Martin '61		Washburn, Arthur King '67	
	Daniel, Richard Irvine '48		Sindel, Fred H. '59	PA H	Boldt, Charles M. '73		Yates, David A. '53	
	Drago, Gary Alan '75	NY H	Bergh, Gerald Kenneth '58		Gilman, Thomas Carter '66	WVA	Blackshaw, George Lansing '58	
	Engelhardt, Larry Norbert '77		Beron, Michael '71		Hills, Frederick James '61		Campbell, Donald Franklin '78	
	Friess, John G. '57		Lauer, Spencer David '67		Reetz, Helen A. '78		Engle, Geoffrey Stuart '94	
	Gray, Jeffrey J. '94		Minton, Evelyn Apicella '73		Swartz, William E. '54		Fleischer, Charles John '70	
	Hammond, Duane Ivan '52		Pasquelli, Louis R. '79	PA G	Daniels Jr., Harold E. '66	WVB	Gould, Marvin Burl '63	
	Hansen, Charles '46		Valcourt, Jean-Mary E. '85		Beseler, Jan W. '88		Koval, John Stephen '78	
	Isackson, Robert Michael '78	NY G	Crompton, Kenneth H. '67		Schurko, Robert John '78		Tompkins, Joseph Andrew '76	
	Maacka, Raymond Edward '86		Kaylor, James M. '88	PR A	Biasini, Francois Rene '82		Johnson, Newton E. '75	
	Maker, Pamela Allyn '81		Kelley, F. Douglas '78		Irizarry, Arcelio '86		Thornton, James R. '81	
	Nicols, George '85	NY I	Calkin, Edwin Theodore '61		Saharian, Alexander '56	WI A	Torre, Linda Raines '83	
	Prescott, Thomas Jay '69		Koch, Peter Matthew '79	RI A	Bimms, George '59		Forkner, Stacy L. '96	
	Reines, Jose '59		Ablowitz, Mark Jay '67	RI B	Brady III, William James '80		Guelker, Eric James '90	
	Seidel, E. Michael '62	NY K	Alcario, Domenic John '87		Dalrymple, Gerald Andrew '83		Lee, Jun Wai '68	
	Sheets, Alan '81		Brown, George Albert '48	SC A	Rushton, Floyd Robert '63	WI B	Delgado, Jose Manuel '69	
	Stewart, Stephen Russell '66		Hinshaw, David John '86		Scherer, John H. '65		Hughes, Philip J. '66	
	Taylor, Mark E. '74	NY A	Ball, James Edward '75		Brady, Jeffrey Ervin '85		Mooney, Thomas J. '79	
	Toliver, Christopher M. '74		Czasczynski, Warren Michael '75	SC B	Feldman, Andrew Russell '89		Murawski, Steven Lee '80	
	Trecha, Theresa M. '81		Deichert, Robert W. '48		Harris, Raymond E. '87		Murawski, Steven Lee '80	
	Trojan, Paul Keith '44		Silverman, Joel Stuart '74		McCaskery, Harold Orr '79	FL A	Byrum, Bruce Banks '77	
	Warner, Caleb '44		Czuba, John Stanley '78		Skvortez, Jonathan Maxwell '95		Digby, Thomas Graham '62	
	Zuk, David Michael '70	NY M	Aloysius, Ronald J. '85		Thomas Jr., Cunningham P. '58		Loeberbaum, Henri Stuart '77	
MI A	Conti, Mark '66		Gluszk, Timothy John '88	SC G	Adkins Jr., Henry Grady '66	WI G	Lerch, Stephen James '89	
	Culver, Walter '60		Morris, George Craig '63		Reed III, Henry M. '85	WYA	Cavalli, Matthew N. '98	
MI E	Brooks, Vern Eugene '60		Mathews, Joseph R. '81		James, Karleen Kay '86		Cook, Norman L. '79	
	Durisin, Michael John '81	NY E	Rubano, Vincent Francis '73	SD A	Bocklund, Lori Sue '83		Fasset, Gordon W. '74	
	King, James Bartholomew '65		Baxter, Scott Charles '85	SD B	Chambers, George Philip '58		Lester, Roger N. '87	
	Mutzelburg, Ronald E. '68	NY O	Courter, Jeanne Lynn '75	TN A	Conner Jr., Harold Tilton '68		Scharton, Craig Allen '85	
	Zickfoose, Michael Wayne '97		DeVoe, Charles George '76		Davis Jr., Fred Thomas '74	AL A	Colburn, Bruce K. '71	
MI Z	Haines, John G. '72	NY P	Curran, Paul J. '83		McCaskey, Suzanne D. '80		Downs, Brian Joseph '07	
	Lachele, Roger Eric '75		McBrien, William J. '87		Metzger, Robert James '66	AL B	Backoek, Roger Lee '57	
	Volpe, David Randall '74		Roldan, William J. '85		O'Quinn, Alethea Hood '77		Backoek, Roger Lee '57	
MI H	Hohncox, Robert Allen '83	NC A	Crotts, Marcus Bowman '53		Shoenmaker Jr., Thomas E. '85		Gachet, Thomas H. '60	
	Pascency, Kenneth Michael '86		MacHnik, Nicholas J. '76		St. Clair, Edward G. '70	AL G	Banasiyev, Kenneth A. '79	
MI G	Edwards, Steven C. '80		Maybee, Clarion Lee '77		Convery, Thomas Patrick '02		Sahawneh, Mary C. '76	
MN A	Duscha, Lloyd Arthur '45		Redano, Richard T. '78	TN B	Green Jr., Thomas B. '75	AL E	Mincey, John Wayne '65	
	Hanson, Henry A. '66		Shelton, Monty Lee '84		Hauenstein, Stephen F. '77	AK A	Leonard, Leroy Edward '72	
	Hennen, Harry Anthony '66		Wilson, Mark P. '79		De Shazo Jr., Thomas E. '62	AZ A	De Shazo Jr., Thomas E. '62	
	Lapacko, Kim Alan '76							
	McLeod, Gary W. '70							

SECOND CENTURY CLUB, CONTINUED

- SC A Davenport Jr., Charles F. '79
- Harley, John Price '78
- Kragas, Tor Kristian '79
- Paskel, Sheila Ann '86
- Stecker, Marc K. '82
- SC B Bailey, Mickey James '82
- Haggerty, N. Kent '72
- SC F Baggitt, Kevin '82
- Petersen, Stephen '82
- Barton, Kevin Lane '90
- Julich, Thomas Frank '76
- Langston, Ronald E. '64
- Lindsay, Craig Thomas '86
- Sullivan, Jack L. '79
- SD A Beacom, E. Kevin '82
- Bier, James J. '84
- Stieha, John Kevin '80
- TN A Blazier, Stephen Draper '74
- Cashion, Gregory Lee '79
- Cavender, James Milton '66
- Eby, Robert Stewart '75
- Fee, Gordon G. '56
- Jackson, Kenneth '63
- Jenkins, Alvin Leigh '61
- McCracken, Stephen H. '72
- Meriwether, George H. '74
- Sarnaik, Jagadishchandra '81
- Sheffey, David Wells '66
- Snyder, Kevin Lloyd '93
- Williamson, James M. '79
- Zimmerman, James Leonard '58
- TN B Brown, George Arthur '55
- Campbell Jr., Henry G. '59
- Hancock, Mark R. '83
- Lyle, Stephen Michael '79
- Petersen, Stephen '81
- Badiru, Adefede B. '93
- TN G Crawford Jr., Walter K. '62
- TX A Ammerman, Wesley Barlow '70
- Badgwell, Thomas Alan '92
- Cardwell, John Wesley '68
- Gribble, Robert Fonda '56
- Huang, Lawrence P. '81
- Kumpf, David Kenneth '70
- Machemehl Jr., Charles A. '57
- Matlock, John Hudson '67
- Meers, Steven W. '72
- Tedeschi, William John '84
- TX B Gates, Robert Douglass '72
- Houston, Scott Lee '96
- Shacht, John Paul '63
- TX G David, Anne Marie '87
- Flatt, Robert N. '69
- Jackman, Alan P. '64
- Poppewell, Thomas R. '74
- TX A Boedecker, Thomas Jay '64
- Caso, Gregory Scott '87
- Cox, Ralph Frank '53
- Crews, James A. '58
- Dowling Jr., Cloyd J. '51
- Dyson, Norman Kenneth '60
- Fink, Tami N Glenn '91
- Gray, Foster L. '53
- Hall, Robert Alan '63
- Hill, Thomas A. '69
- Hill, Thomas A. '69
- Kramm, Robert C. '81
- Masset, Donald A. '70
- Nuccio, Robert Peter '51
- Roberts, Thomas Anthony '69
- Rueter, Curtis O. '86
- TX E Damoff, Howard A. '84
- Palavan, Jim Ali '82
- Weaver, Drew S. '69
- TX H Collins, Clyde Williams '69
- Godwin, Albert Eugene '84
- Norwood Jr., Edwin B. '67
- TX O Hippenstiel, Ralph D. '72
- TX A Perez, Jose F. '85
- Schultz Jr., Alvin Frederick '73
- Wallace, Weldon Lee '74
- UT A Ellsworth, Richard D. '48
- Matthews, George Morris '73
- Spong, Robert Neil '58
- UT B Craig, Donald D. '82
- Hart, Robert Evan '73
- VT A Shatz, Jonathan Ary '82
- Sleeper, Gregory Douglas '86
- VT B Clark, David Thomas '81
- Henry, Thomas Arthur '70
- VA A Barnes, Lowell Paige '67
- Benneche, Paul Eric '74
- Binder, Ronald W. '74
- Byers, Duane Michael '80
- Colonna, James Lewis '65
- Cosby, James Gordon '61
- Rubenstein, David N. '79
- Wyant III, Thomas R. '71
- VA B Barnes, Edgar Eugene '68
- Bucklen, Jerry Coleman '62
- Dalton Jr., Eddie Gene '86
- Davidson Jr., Charles A. '70
- Ernest Jr., Charles L. '70
- Gibbins, Martin Neil '78
- Gresham, James A. '83
- Kern, David Paul '86
- Lechner, Richard Albert '59
- Parris Jr., Donald S. '72
- Sloan, Forrest Eugene '83
- Snavey, Charles Goble '78
- Wayne, Jennifer Susan '83
- VA G Carlson, Diana Lu Weaver '91
- Korte, John J. '80
- Rausch, Leonard Earl '80
- Swats, Charles Frederick '74
- WAA Cahill, Robert S. '72
- Davis, Beverly Z. '80
- Levin, Marc E. '80
- Melton, Ronald Benjamin '77
- Miller, Stefan '63
- Perrault, William Richard '59
- Pizzano, Robert Carl '80
- Purdy, Catherine Patricia '72
- Searing, John Emery '68
- WAB Comstock, Lori A. '83
- Sarles Jr., Daniel A. '83

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For more information, contact Pat McDaniels at pat@tbp.org or call 865-546-4578.

- Stevens, John Lawrence '51
- Wahl, David John '62
- WV A Bibbee, Dennis Evans '75
- Britton, Barry Kevin '85
- Kaek, Richard J. '84
- Mongold Jr., Guy Earl '50
- Pellegrin, John Daniel '73
- Rowe Jr., Eldridge E. '68
- Zimmerman Jr., Albert R. '58
- WV B Harding, Thomas Wayne '86
- WI A Christenson, Solveig Ann '86
- Diedrich, Donald L. '69
- Easton, David W. '68
- Fahrbach, David R. '69
- Meister, James Richard '78
- Niemeyer, John Allen '68
- Pietrski, James Stanley '66
- Tausche, Paul Everett '48
- Wellauer, John C. '65
- WI B Bella, Robert Allen '65
- Donovan, Dennis Michael '67
- Ellis, Thomas E. '84
- Graef, Luther William '52
- Jaye, Deborah Ann '03
- Lenz, Marsha Joann '86
- Lubinski, Paul John '87
- Oehler, Daniel Arthur '79
- Pelt, Thomas Eugene '70
- Sullivan, Barry J. '78
- Wentink, William Stewart '68
- Wick, Paula B. '81
- Wilhelmi, James J. '69
- WI G Jendrzejek, Gary S. '75
- Scherer, Richard A. '74
- Thomas, David E. '85
- WYA Hill, Janet Lynn '95
- Simon, Ronald Wayne '81
- FOUNDERS CLUB**
- AL A Murray, Scott Blansit '69
- Phinney Jr., Thomas W. '66
- Romine Jr., J. D. '50
- AL B Moyer, Robert E. '65
- Price, Marion R. '75
- Ramsey, James David '64
- AZ A Kerber, Joel F. '85
- Blake, Gordon S. '75
- Brush, Richard Gervais '65
- Chen, Daniel J. '83
- Holsclaw, Lynden Edward '73
- Shaver, Frederick W. '55
- AZ B Rasmussen, Brenda Kay '91
- Reedy, William J. '82
- AR A Clark, Terence B. '56
- CA A Bocast, Donald Rocco '45
- Chew, Richard S. '85
- Chu, Jeffrey M. '82
- Holzer, Peter John '79
- Hong, Wilbur E. '80
- McKams, Robert Alan '77
- Osborne, Lee Kevin '72
- Spilman, Larry D. '69
- Widergren, Steven E. '75
- CA B Colgrove, Robert Charles '81
- Manatt, Stanley Lawrence '55
- Sato, Kazuhiko '51
- Tokheim, Jerry E. '58
- CA G Bateman, Terry S. '58
- Conti, Walter '81
- Ma, Conlan Liang '99
- Nagel, John Frederick '91
- Richardson, John L. '56
- Ries, Carol '73
- Yolk, Robert D. '51
- CA A Lerma, Malvina C. '82
- Salin, Irwin '48
- CA E Bienstock, Bernard Joel '68
- Marcy, William L. '53
- Wagner, William Richard '58
- CA Z Mei, Anthony Louis '70
- Sabbatini, Julian '68
- CA H Bahr, Alfred Joseph '58
- Daniels, Ramin '91
- Holstead, Raymond H. '71
- CA O Fuentes, Jorge Salomon '84
- CA I Au, James T. '61
- Kwong, Ray S. '65
- CA K Bodnar, James David '93
- Smoots, Neil Randall '80
- Swayne, Garret '85
- CA A Reynolds, Hugh M. '69
- Sanicky, Susan Rudy '72
- CA M Chang, Fu-Lien '74
- Taylor, Michael S. '78
- CA N Amirhosseini, Michael M. '90
- Bales, Deborah O. '77
- Darlington, William E. '66
- Nadasdi, Kristina '00
- Pitzer, Allan Glen '66
- CA E Bloomer II, Thomas Wayne '99
- Fowler, David Michael '92
- Oneil, Patrick M. '82
- CA P McPherson, Glenn Allen '79
- Motogawa, Bruce A. '75
- Ramirez Jr., Jose Juan '05
- CA S Miller, Thomas '82
- CO A Darling, Edwin E. '68
- Gardner, Glenn Curtis '76
- Miks, Kathryn F. '87
- Ralph, Patricia McMillan '48
- Smith, Steven Duane '90
- Swartz, Douglas W. '82
- Wade, Jonathan F. '84
- CO B Chappra, Cynthia Kiessig '90
- Hora, Keith Yoshio '87
- Morgan, James I. '55
- Olson, David R. '79
- Weber, Douglas C. '70
- CO A Dallinger, Curtis Calvin '78
- Longino, James L. '81
- Middlekauff, Stephen Allen '09
- CT A Feinman, David Mayor '49
- Williams Jr., John Horter '66
- CT B Donaty, Gerald Francis '66
- Glagowski, Terry Gene '69
- MD G Godbout, Louis F. '72
- DE A Seitzer, Kenneth E. '78
- DC A Burge Jr., Legand L. '72
- Hawkes, Mavis R. '77
- Rosen, Avey '63
- Sharpe, Irene W. '63
- DC B Bonuccelli, Hugo A. '73
- Campoli, Carl '76
- Ratto, Christopher R. '07
- Trifari Jr., Edmund F. '62
- DC F Laguarda, Leonel '79
- Tsakos, Steven '61
- FL A Adams, Donald W. '89
- Brinkman, William C. '80
- Talbot, Michael Thomas '71
- FL G Belt, Joseph W. '75
- Bowman, Harold Jackson '77
- Brown III, Norman Luce '96
- FL E Guerin, Jim J. '92
- FL O Tracy, William Andersen '06
- GA A Axon, Michael William '90
- Daniel, John Kent '70
- Olive, Charles Michael '70
- Taylor Jr., George B. '75
- Williamson, Michael F. '79
- IL A Allison, Herman D. '69
- Archinger, Ed Lee '82
- Hang, Kenneth Warren '66
- Herning, Joel Gregory '69
- Loos, James E. '51
- Quiros Jr., Jorge L. '75
- Ross Jr., William Charles '86
- Stutzman, Byron William '60
- IL B Hinman, Clyde D. '49
- Kufta, Richard Walter '77
- Taylor, Robert Spalding '57
- IL G Borden Jr., Roy H. '80
- Derlack, Walter R. '75
- Henze, Edward Durand '50
- Ho, Benjamin '87
- Miller, Kristen Lee '82
- Nudd, Oliver R. '92
- Pector, Scott Walter '78
- IL A Dahm, Robert D. '85
- IN A McPherson, Robert '00
- IL Z Bottos, Beth Antoinette '79
- Bower, William Walter '67
- Capasso Jr., Vincent N. '54
- Cohen, Raymond '47
- Derrick, David Gaskill '68
- Eastmond, Bruce C. '65
- Edelsohn, Charles R. '48
- Howard, Howard Lee '58
- Hammond, Joel Charles '83
- Houshell, William Harrison '65
- Kim, Chang W. '61
- Meier II, Lewis '60
- Miller, James Richard '86
- Myers, John E. '58
- Peter, David Lawrence '85
- Riley, Daniel Wayne '71

- Shimp, Alan Burke '55
- Snook Jr., Carl Thomas '63
- Stepro, Dennis C. '71
- Tufts, Juri '54
- Vanderheyden, Greg Paul '80
- Zygmunt, Roger Walter '74
- IN B Raff, Barry E. '67
- Repp, Bruce Thomas '88
- IN G Coolahan Jr., James E. '71
- Dickens, Michael Loren '10
- Markel, Michael Lawrence '78
- Morrissey Jr., Thomas N. '64
- Turek, Joseph Anthony '79
- Walsh, John S. '80
- IN A Kastman, Kenneth Herbert '66
- Thiele, Frederick William '57
- IN E Nagielski, Lawrence S. '81
- IA A Brackett, Robert Chase '48
- Dick-Peddle, John I. '53
- Eybers, Lance Carl '81
- Mehrad, Mojan '82
- Neumayer, Robert '85
- Oney, Patrick R. '89
- IA B Braet, Ronald Lee '63
- Nicodemus, Keith L. '52
- KS A Flood, Patricia S. '74
- Givechi, Mehrdad '85
- Regan, Margaret Mary '86
- Rock, Brian A. '85
- Rozych, Frank John '49
- KS G Gudenkauf, Wayne Anthony '93
- Heronemus, Daryl L. '77
- Kottwitz, Donna Dale '75
- KY A Cates, Terry D. '83
- White, Garey Lee '51
- Wolterman Jr., David Scott '82
- KY B Klingenfus, John Allen '80
- Leep, Herman R. '63
- LA A Bouvier Jr., Maurice Joseph '59
- Bullard, Salem C. '63
- Lam, Chi-Kwong '66
- LA G Barron, Tim C. '81
- Guice, Leslie K. '78
- Madden, Ronald Marion '72
- Sutton, Jerry Kent '67
- LA A Falterman Jr., Gerald J. '89
- ME A Flavette, Danny Richard '93
- Win, Gary Y. '71
- Lamoureaux Jr., David Bishop '86
- Winslow, Arthur Clifford '79
- MD A Catlin Jr., John Carey '69
- Wills, James E. '76
- MD B Cascio, Horace E. '77
- Cederman, Candace Foster '82
- Ciente, Anthony Thomas '71
- Darwin, Robert Leo '62
- Effland III, John Edward '78
- Heuckeroth, Deborah May '88
- Lawrence III, Joseph P. '68
- Ornett, William S. '69
- Rosen, Robert Harold '55
- Van Epoeel, John Michael '00
- MD G Ostinski, John Edward '86
- MA A Engman, George E. '50
- Jacques, Donald A. '83
- Manning, Robert James '88
- Schurky, Kenneth George '67
- MA B Chiappetta, Vincent F. '73
- Foster, Edward T. '63
- Frassinelli, Guido J. '48
- Fuhrman, Linda Sophie '86
- Harris, Marvin Sims '55
- Hartzell, Frank C. '53
- Keast, David N. '53
- Lord, Robert Leo '51
- Post, Allen Edward '66
- Seagle, John Peters '59
- Strause, Philip Edward '65
- Wampler, Charles Weldon '79
- Wasem, Ondria J. '85
- Weston, Theresa A. '80
- Zukowski, Charles A. '81
- MA A Anderson, Thomas T. '57
- Levin, Neil '80
- Raisler, Richard Allen '72
- Wren Jr., Paul Ingraham '57
- MA E Field, Leslie Ann '83
- Le Rette, William Edward '92
- Nordstrom Jr., Carl H. '73
- Root, Christopher E. '82
- Takvorian, Andrea '82
- Herning, Harry J. '72
- Tremontozzi, Venus K. '84
- Tsang, Janis Chan '87
- Tsang, Paul Tze Leung '84
- MA Z Beerman, Maxim Victor '86
- Guros, Francis Bernhard '75
- Hazelton, Arthur R. '66
- Queoney, Paul H. '81
- Walsh, James Edward '76
- Wylie, Bruce K. '66
- Zarbo, Richard M. '85
- Salem, Hisham M. '86
- Walsh, Edmund John '83
- MA O DeMartinis, Guy Bernard '08
- MA I Zawacki, David Vincent '98
- MI A Conklin, Daniel L. '65
- Heimiller, Wayne R. '80
- Hole, Kevin Michael '90
- Lipsitt, Harry A. '52
- Su, William Perry '90
- Williams, Robert G. '59
- MI B Barnhart, Kent Thomas '83
- Dykema, Adrian Henry '44
- Gosling, Christopher David '79
- Gulliver, Michael Douglas '81
- Hux, Susan B. '77
- Jones, Eric Peter '94
- Kranz, Paul Richard '63
- Luttinen, Gail Lee '68
- McNeil, Michael T. '86
- Meiselman, Herbert J. '62
- Oliver, Bruce L. '63
- Stone, David G. '69
- Zollinger, Howard Allison '51
- Andersland, Mark Steven '83
- Brunais, Ellsworth George '52
- Fishback, James Allen '74
- Frantz, John A. '75
- Geib, Arthur John '44
- Gnievek, Kenneth John '77
- Goodenough, Richard D. '74
- Gross, Paul Henry '83
- Jackson, William Longstreth '70
- Kahwati, Ghassan '64
- McCallon, Larry Keith '62
- Mehlhorn, Thomas Alan '74
- Passman, Richard A. '44
- Schepis, Deborah Kalef '83
- Stoughton, Herbert W. '73
- MI A Dierker Jr., Joseph B. '85
- Gallagher, James A. '68
- Olex, Michael Bernard '74
- MI E Bolgiani, Giovanni '70
- Grant, Robert M. '75
- Mahanes Jr., Anthony Patrick '65
- Yarne, Victor Carl '66
- MI Z Carpenter, Robert Daniel '82
- Holland, Gerald Willard '62
- Kipp, Carl Robert '83
- MI H Kipp, Eric Michael '98
- MI O Pope, Charles E. '83
- Zarins, Paul Steven '87
- MI I Haupt, Eric Keith '84
- Haupt, Shelby Elaine '84
- MI A Hupick, Angela Kay '02
- MN A Grill, Susan M. '82
- Johnson, Lowell Gale '69
- Larson, Keith Anthony '84
- Martin, Bruce Douglas '97
- Ness, Valoree J. '73
- Radermacher, Joseph B. '74
- MS A Davidson, John Howlett '90
- McVea III, Albert N. '79
- MO A Campen, Kenneth Wilbur '55
- Overlag, Gerald Allan '66
- Salerno, Michael Joseph '84
- Sandridge, Jack Richard '65
- MO B Bach Jr., Wilbert Edward '50
- Hargrave, Aaron Tyler '02
- Katz, Manfred '53
- Preston, Scott Steven '97
- Yip, Kenneth G. '86
- Shank, Donald Russell '67
- Vandergriff, Leland Edward '71
- MO F Mitzel, Kevin Raymond '95
- Schlagler, Lynn M. '77
- Smith, Richard Lawrence '56
- Wessling, Donald R. '60
- Winshy, Don W. '50
- MT A Bozik, Frank '59
- Fischer, Douglas A. '74
- Johnson, John Lowell '49
- White, Richard Henry '72
- MT B Jones, Sharon Alane '93
- Hofen, Diane J. '82
- NV A Rieder, Laura L. '87
- NH A Bean Jr., Stanley Oscar '57
- Russell, Earl David '57
- NH B Price, Alexander Daniel '05
- NJ A Appleton Jr., Herbert M. '44
- Boardman, Thaddeus J. '52
- Chen, Kevin Emmanuel '06
- Force Jr., Howard Joseph '76
- Kuhlberg, Joel Frederick '59
- NJ B Brandenburg, Dan S. '72
- King, Caroline '02
- Lawler, Barbara E. '82
- Young, Clifford N. '83
- NJ F Busch, Robert E. '88
- Camporini, George Alfred '67
- Kobylarz, Thaddeus John '58
- NJ A Aughenbaugh, Jason M. '01
- Beatty, Douglas Nellis '57
- Chen, Ephraim Jonathan '09
- Moshe, James Holloway '84
- MA B Boarkin, Bernard B. '52
- Leight, David M. '75
- Olson, John Frederick '64
- Rice, Ann C. '78
- Rooney, Robert Richard '79
- Rubinstein, Ian Z. '69
- NY F Beesley, Arthur H. '75
- Foust Jr., William Harrison '68
- Hruza, Prokop '83
- Ives, Jon Robert '61
- Lenney, Robert V. '62
- Pattso, Daniel Alexander '05
- Timour, Sune E. V. '52
- Wedgwood, Janet E. '80
- Ziegler, John Lewis '06
- NY A Ball Jr., Robert W. '65
- Beaubien, Robert Patrick '90
- Hiehle, John Frederick '83
- King, Darren Franklin '02
- Lazar, Dale S. '74
- Munch, William D. '76
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IN THE COLLEGES

SPOTLIGHT

Where Will the Jobs Be?

The U.S. Bureau of Labor Statistics (BLS) says the two engineering disciplines expected to offer substantial growth in the coming years are biomedical and civil.

The BLS, which is part of the Labor Department, projects a 27% increase in employment of biomedical engineers by 2022, due to the fact that “an aging population is likely to need more medical care, and also because of increased public awareness of biomedical engineering advances.”

Also expected is a 20% increase in the number of civil engineers over the same period, given aging infrastructure and increasing water needs.

- The Bureau has predicted there will be no overall job growth in electrical and electronics engineering for the next decade. The Institute of Electrical and Electronics Engineers (IEEE) has said such predictions “are probably correct.”

IEEE Government Relations Director Russ Harrison said the forecast conflicts with the notion that the U.S. is in dire need of skilled foreign workers, a claim often made by those who support raising the cap for H-1B visas.

- *The Dallas Morning News* reports that the boom-and-bust cycles in the oil business “can be brutal for those wanting to make it a career” as recent graduates struggle to enter the field.

The next two graduating classes of petroleum engineers “are still the largest in history” even with enrollment caps in place at major Texas universities.

Last year, about 80% of Texas A&M graduates were placed in full-time positions or in graduate programs, but a recent poll found that “only 50% of those graduating have job offers, and 10% plan to go to graduate school.

“Published More, Cited Less”

Science Magazine outlined a study that found female engineers are more likely to be published in prestigious journals than their male peers, but that the studies written by females are less likely to be cited.

The study was completed by Ph.D. candidate Gita Ghiasi at Concordia University in Montreal by examining the influence of journals as ranked by Thomson Reuters and that of individual papers by the number of citations.

The article quotes Ghiasi offering one possible explanation for the study’s results: “Women engineers are complying with the male-dominant engineering scientific system instead of changing its structure.”

Space Programs

Several universities in the Arab world have launched aerospace engineering programs to meet a growing demand, reports *U.S. News & World Report*.

The article highlights Adnan Saeed, a Yemeni who earned a B.S. and is pursuing a masters in the field, both from Khalifa University in the United Arab Emirates. Some of the programs have ties with counterparts in the U.S. Saeed competed in an engineering competition sponsored by American companies.

A Moroccan university with such a program has established ties with the Georgia Institute of Technology and Mississippi State University.

Community Bachelors

Fresno Pacific University is launching a two-year “graduation guarantee program” this fall for community college students seeking a bachelor’s degree in STEM fields.

Supporting Transfers in Reaching Education Aspirations in Math and Science (STREAMs) will guarantee that students who graduate from a local community college with an associate’s degree will earn a bachelor’s in two years if they make

“satisfactory academic progress.”

The program aims to increase diversity in STEM fields by targeting students who are the first in their family to go to college or who are part of groups underrepresented in STEM fields. The National Science Foundation is funding the program and associated scholarships.

PEOPLE

John L. Hennessy III, Ph.D., Pennsylvania Theta '73, is to step down



as Stanford University’s 10th president. The school’s announcement said that since assuming the presidency in October 2000, he had placed an academic emphasis on interdisciplinary teaching and research that is also reflected in a physical transformation of the campus. Hennessy joined the Stanford faculty in 1977 and became chair of the computer science department in 1994.

Hossein Haj-Hariri, Ph.D., Massachusetts Beta '84, is now dean of



the University of South Carolina’s college of engineering and computing. He was previously a professor and chair of the department of mechanical and aerospace engineering at the University of Virginia, where he was an Advisor to Virginia Alpha.



Richard J. Koubek, Ph.D., Ohio Mu '85, has been named the new executive vice president and provost at Louisiana State University. He had

held the posts on an interim basis. Koubek began his tenure at LSU as engineering dean and chair six years ago. He earlier served on the faculties of Pennsylvania State University, Wright State University and Purdue University.

Elizabeth G. Lobo, Ph.D., *California Lambda '95*, is the new dean of the University of Missouri college of engineering.



Previously, she was associate chair and professor of the joint department of biomedical engineering at University of North Carolina-Chapel Hill and North Carolina State University. She is the 11th full-time and first female dean in the MU college of engineering's history.

of Howard University's college of engineering, architecture, and computer sciences. He came from Mississippi State University where he was dean of engineering, and professor of aerospace engineering after serving at Syracuse University and Rensselaer Polytechnic Institute. Messac is a fellow of both ASME and AIAA.

Achille Messac, Ph.D., *Massachusetts Beta '80*, has become dean



of Mississippi State University where he was dean of engineering, and professor of aerospace engineering after serving at Syracuse University and Rensselaer Polytechnic Institute. Messac is a fellow of both ASME and AIAA.

Daniel J. Pack, Ph.D., P.E., *Indiana Alpha '94*, is now dean of the college of engineering and computer science at the University of Tennessee at Chattanooga. He was a professor and chair of electrical and computer engineering at the University of Texas at San Antonio. Earlier, Pack was founding director of the Academy Center for Unmanned Aircraft Systems Research at the U.S. Air Force Academy in Colorado.



at the University of Tennessee at Chattanooga. He was a professor and chair of electrical and computer engineering at the University of Texas at San Antonio. Earlier, Pack was founding director of the Academy Center for Unmanned Aircraft Systems Research at the U.S. Air Force Academy in Colorado.

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FACILITIES

University of Delaware has opened what is described as “one of the most advanced” nanofabrication laboratories in the Mid-Atlantic region. The \$30 million, 8,500-square-foot facility is part of the research wing of the 194,000-square-foot Patrick T. Harker Interdisciplinary Science and Engineering Laboratory. **Patrick T. Harker**, Ph.D., *Pennsylvania Delta, '81*, was UD president for eight years before being appointed last year as president of the Federal Reserve Bank of Philadelphia.

Its primary objective is to provide the infrastructure, equipment, and staff support necessary to enable existing faculty, new faculty, and academic and corporate partners to undertake competitive research and development in the growing number of fields that rely on nanofabrication.

Areas of related research at UD include photonic devices, nanostructured solid-state materials with unique optoelectronic and magnetic functionality, biomedical devices, and nanoscale biomaterials.

University of Florida's college of engineering has received a \$50 million pledge from **Herbert A. Wertheim**, Ph.D., *Florida Beta '62*, the optometrist who invented the eyeglass tints that block UV rays. His gift will fund the largest expansion in UF's history of the engineering school, which will be known as the Herbert Wertheim College of Engineering.

Plans include adding an 80,000-square-foot engineering innovation building, which will also be named in his honor. There will be collaboration between the FIU Herbert Wertheim College of Medicine and FIU's College of Engineering.

Wertheim donated \$20 million to help launch FIU's medical school, which opened in 2009. UF engineering student enrollment is expected to rise from the current 8,700 to 10,000 by 2022.

University of Illinois at Urbana-Champaign is launching a new cam-

pus design center, which will open in 2018. Inspired by former students who launched successful start-up



companies based on technology developed at school,

the center expands on the maker labs and design studios already on campus.

The \$48 million center is envisioned as a space where students from different disciplines can come together to bring ground-breaking ideas to life, said engineering professor **Andrew C. Singer**, Ph.D., *Massachusetts Beta '89*, chairman of the design center program working group.

The 60,000-square-foot facility will be built in the grass field south of Huff Hall on Fourth Street. Singer said an unidentified donor had contributed half the cost, and the remainder would be covered by the state and campus and gift funds.

University of Wyoming is partnering with computer hardware firm Nvidia to replace the National Center for Atmospheric Research-Wyoming Supercomputing Center's Yellowstone supercomputer. The three-year-old computer is the 50th fastest in the world, but is reported to be nearing the end of its working life.

Suresh S. Muknahallipatna, Ph.D., *Wyoming Alpha '94*, professor of electrical and computer engineering at UW, said the new computer could top the www.top500.org list of fastest computers — a list created by “high-performance computer experts, computational scientists, manufacturers, and the Internet community.”

Nvidia produces graphics processing units widely used in computer gaming. However, in recent years, GPUs have featured increasingly in supercomputers for superior speeds in comparison to central processing units, which the computers traditionally use.



Brain Ticklers

RESULTS FROM FALL

Perfect

*Bohdan, Timothy E.	IN	Γ	'85
*Couillard, J. Gregory	IL	A	'89
*Gulian, Franklin J.	DE	A	'83
Gulian, William F.	Son of member		
Kimsey, David B.	AL	A	'71
*Quan, Richard	CA	X	'01
Strong, Michael D.	PA	A	'84

Other

Aron, Gert	IA	B	'58
Bernacki, Stephen E.	MA	A	'70
Brule, John D.	MI	B	'49
Ehrgott Jr., Charles	FL	E	'92
Grafflin, Dennis	Non-member		
*Griggs Jr., James L., Jr.	OH	A	'56
Handley, Vernon K.	GA	A	'86
Hill, Chris D.	KY	A	'86
Janssen, James R.	CA	Γ	'82
Johnson, Mark C.	IL	A	'00
Jones, John F.	WI	A	'59
Jones, Jeffrey C.	Member's son		
Kramer, J. David	PA	Δ	'57
Lalinsky, Mark A.	MI	Γ	'77
Lloyd, Margaret M.	MA	B	'12
*Norris, Thomas G.	OK	A	'56
Parks, Christopher J.	NY	Γ	'82
Prince, Lawrence R..	CT	B	'91
Rentz, Peter E.	IN	A	'55
*Richards, John R.	NJ	B	'76
Schmidt, V. Hugo	WA	B	'51
Schweitzer, Robert W.	NY	Z	'52
Sigillito, Vincent G.	MD	B	'58
Spong, Robert N.	UT	A	'58
Stadlin, Walter O.	NJ	Γ	'52
*Stribling, Jeffrey R.	CA	A	'92
*Voellinger, Edward J.	Non-member		

*Denotes correct bonus solution

FALL REVIEW

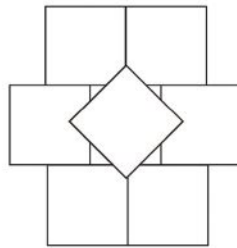
The Fall Ticklers appear to have been a little harder than usual, as we received somewhat fewer entries. Fall No. 2, about the location of the pub called The Swan, and No. 5, the cryptic addition, were the easiest with no wrong answers submitted. About half of the answers submitted to the Bonus, about seating people at a round table, were correct. Less than 1/3 of the answers to No. 4, about near-squares, were correct with most wrong answers overstating the number of squarelets required by one. **Timothy E. Bohdan**, IN Γ '85, believes that the correct answer to Fall No. 3 is 665. He points out that two of the 9 pairs adding to 350 we gave are: 1(7)(5)+9(5)(7) and

9(7)(5)+1(5)(7). Although, at a quick glance these might look different, when multiplied out they are 35+315 and 315+35, in reality the same. Tim presents the logic behind his solution of 665. We admit he has a valid point and have marked him correct.

WINTER SOLUTIONS

Responders' entries for the Winter Ticklers will be acknowledged in the Summer '16 *Bent*. Meanwhile, here are the answers:

1 Twenty is the maximum number of green cubes that can simultaneously touch a red cube and completely cover all its faces. Visualize a red cube resting on an assemblage of green cubes and rotated 45 degrees



to have two of its corners touch 2 green cubes each. The figure shows the red cube touching 7 green

cubes; 6 more can be added in a second layer, and 7 more in a top layer that mimics the bottom layer. If you remove the requirement that the red cube's surface be completely covered by touching green cubes, then 22 green cubes are possible. An arrangement with 24 cubes has been reported, but it is very complicated.

2 The triangle has legs of 75 mm and 100 mm and a hypotenuse of 125 mm. It is apparent that the triangle must be a Pythagorean triangle, probably a variation of a (3, 4, 5) triangle. Since $127/5 = 25.4$ mm, try a 25 multiple, i.e., a triangle with sides 75, 100, and 125 mm. The length of the altitude on the hypotenuse is $h = ab/c = 75(100)/125 = 60$ mm. (Since $60 \text{ mm} < 76.2 \text{ mm}$, this triangle fits on the card.) Cutting along the altitude divides the triangle into two triangles, one with sides (60, 80, 100; altitude = 48) and the other with sides (45, 60, 75; altitude = 36). Dividing

along the altitudes gives four triangles with sides (27, 36, 45), (36, 48, 60), (36, 48, 60), and (48, 64, 80).

3 There are 768 times in the first 9 months of the year (and 0 times in the last 3 months) when the date/time display uses each of the digits 1 to 9 exactly once. To make referring to specific digits in the display easier, let the date/time be $MD_{10}D_1H_{10}H_1M_{10}M_1S_{10}S_1$, where subscripts 1 and 10 refer to the one's and ten's digits, respectively, of the day, hour, minute and seconds values. Since 0 is not used, H_{10} must be either 1 or 2 (maximum $H_{10}H_1 = 23$). If $H_{10} = 2$, then D_{10} and H_1 must be 1 and 3 or 3 and 1, but D_{10} cannot be 3, because that would require $D_1 = H_1 = 1$. So $D_{10} = 1$ and $H_1 = 3$. Of the remaining digits, the only possible values for M_{10} and S_{10} (which must be less than 6) are 4 and 5 or 5 and 4. The final four digits (6, 7, 8, and 9) can be assigned to M , D_1 , M_1 , and S_1 in $4! = 24$ ways. So, if $H_{10} = 2$, the date/time display using the digits 1-9 can occur in $2(24) = 48$ ways. Alternatively, if $H_{10} = 1$, then D_{10} must be 2 ($D_{10}D_1$ must be 31 or less, but $D_{10} \neq 3$, which would require $D_1 = 1$). Then, M_{10} and S_{10} can be assigned two of the digits 3, 4 or 5 in $P(3, 2) = 6$ ways, where $P(i, j)$ is the permutations of i things taken j at a time. The final five digits (6, 7, 8, 9, and the digit not used for M_{10} or S_{10}) can be assigned to M , D_1 , H_1 , M_1 , and S_1 in $5! = 120$ ways. So, if $H_{10} = 1$, the date/time display can occur in $6(120) = 720$ ways. Therefore, the total number of times a year that the date/time is displayed using the non-zero digits 1-9 is $48 + 720 = 768$.

4 The three integers are 165, 308, and 792. It is well known that an integer is divisible by 11 if the sum of the even digits minus the sum of the odd digits is divisible by 11. Since one integer is divisible by 7, one by 8, and one by 9, and all three by 11, one of the integers must be divisible by 77, one by 88, and one by 99, although some of these may

be the same integer. Furthermore, one must end in 0 or 5, and one must be even and divisible by 3. Let us try $8(99) = 792$ (which is divisible by both 8 and 9, as well as, 2, 3, 4, 6, and 11) for one of the integers. Look for multiples of 77 that don't have a digit in common with 792; these are 154, 308, 385, and 618, which give (0, 3, 6, 8), (1, 4, 5, 6), (0, 1, 4, 6), and (0, 3, 4, 5), respectively, as the digits available for the third integer. Of these possibilities, only 308 leads to unused digits (1, 4, 5, 6) that give an integer divisible by 55, namely 165. Thus, the three integers 792, 308, and 165 meet all the divisibility requirements of the problem.

5 There are **6 ways** the integers from 1-12 can be placed on the sides and vertices of a regular hexagon such that the values on the sides are equal to the sum of the values on the two adjacent vertices and **0 ways** for 1-16 on an octagon. Let V equal the sum of the integers on the vertices, S the sum of the integers on the sides, and T their total. Now, $V + S = T$, but each vertex is adjacent to two sides, so each vertex is counted twice relative to the sides, so $S = 2V$. Therefore, $V + 2V = 3V = T$, but $T = 12(1 + 12)/2 = 78$. Therefore, $V = 78/3 = 26$, and $S = 52$. To look for solutions, start by dividing the 12 integers into two groups: vertex values (1, 2, 3, 4, 5, 6) and side values (7, 8, 9, 10, 11, 12). The V group sums to 21 and the S group sums to 57. Therefore, we need to shift 5 from the S group to the V group. This can be done in several ways: by exchanging a 3 for an 8; or a 9 for a 4; or a 5 for a 10; a 4 and 6 for a 7 and 8; or a 5 and 6 for a 7 and 9. Not all of these lead to a solution, and some lead to two solutions. A little calculation and trial will give (not counting rotations and reflections) the following 6 solutions, starting and ending with 1 at a vertex, and alternating side/vertex:

1-3-2-7-5-11-6-10-4-12-8-9-1
 1-4-3-11-8-10-2-9-7-12-5-6-1
 1-5-4-6-2-11-9-12-3-10-7-8-1
 1-5-4-7-3-9-6-8-2-12-10-11-1
 1-7-6-11-5-9-4-12-8-10-2-3-1
 1-8-7-11-4-6-2-5-3-12-9-10-1

For an octagon, $T = 16(1 + 16)/2 = 136$, but 136 is not divisible by 3, so there are no solutions for an octagon.

Bonus The ratio of the probability of getting a BINGO using the *Free* cell to the probability of getting a BINGO not using the *Free* cell in 7 numbers or fewer is **71/6**. Getting a BINGO without using the *Free* square requires getting 5 specific numbers plus any 2 other numbers, so there is one way to get the 5 specific numbers (not counting permutations) and $C(70, 2)$ ways to get the other 2 numbers. Since there are 8 possible no *Free* square BINGOs on each card (4 horizontal and 4 vertical), we must multiply by 8. There are $C(75, 7)$ ways to call 7 numbers, so the probability of getting a 5 number BINGO in 7 calls is $P_5 = 8C(70, 2)/C(75, 7)$. Similar reasoning gives for the probability of a 4 number BINGO (there are 4 possible 4 number BINGOs—1 horizontal, 1 vertical, and 2 diagonal): $P_4 = 4C(71, 3)/C(75, 7)$. The ratio of these is: $R = [4C(71, 3)/C(75, 7)]/[8C(70, 2)/C(75, 7)] = 4C(71, 3)/8C(70, 2) = (4/8)(71!/68!3!)/(68!2!/70!) = (1/2)(71/6)(2) = 71/6$.

Computer Bonus The **maximum value of N is 58560**, and the **minimum value is 6970**. There are several ways the 10 digits can be grouped to form four integers. If we assume A and C are two-digit numbers and B and D are three-digit numbers, we find $ab \times cde = fg \times hij = N$ has 64 solutions, with $64 \times 915 = 80 \times 732 = 58560$ giving the maximum value. If A and C are one-digit numbers and B and D are four-digit numbers, $a \times bcde = f \times ghij = N$ has 36 solutions, with $1 \times 6970 = 2 \times 3485 = 6970$ giving the minimum value. Investigating $ab \times cde = f \times ghij$ does not yield any improvement to the given answers.

NEW SPRING PROBLEMS

1 Solve the following cryptic multiplication. Each different letter stands for a different digit, and each different digit is always represented

by the same letter; there are no leading zeros.

TRY×THIS = TICKLER

—H. G. McIlvried III, PA Γ '53

2 What is the largest integer n such that $7^{2048} - 1$ is exactly divisible by 4^n ?

—2015 Quant Quiz, National Museum of Mathematics

3 On their birthday, twins Jackie and Jill received from their uncle a set of 12 wooden cubes and a two-pan balance. Each cube was a different color and integral number of cm (1 through 12 cm) on a side, but they all were the same density. The colors of the cubes were azure, brown, crimson, drab, ebony, fuchsia, gold, heliotrope, ivory, jade, khaki, and lilac, not in order of size. Their uncle challenged the twins to find combinations that balanced some of the cubes against others. Four of the balances the twins discovered were: (1) the drab and gold cubes balanced the brown and heliotrope cubes; (2) the khaki cube balanced the azure, ebony, and lilac cubes; (3) the ebony, gold, jade, and khaki cubes balanced the azure, brown, drab, fuchsia, heliotrope, and ivory cubes; and (4) the brown cube balanced the drab, ivory, and khaki cubes. When they were called in to supper, they ran in quickly, forgetting to take their cubes with them. It rained that night and washed the colors off all the cubes. The twins were very unhappy and asked to have the cubes repainted in the same way as they were originally. Match the size of each cube to its original color.

—Madachy's Mathematical Recreations by Joseph S. Madachy

4 On their next birthday, the twin's uncle gave them a big pile of unpainted 1-cm cubes and suggested they glue some of the cubes together to make larger cubes. Jill quickly produced a larger cube (without any voids). Not to be outdone, Jackie formed an even larger cube (also without any voids). Then, each twin painted some of the faces of her large cube. As happened the previ-

(Continued on page 41)



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 additional facts (if available) concerning the following deceased members. The assistance of all is earnestly sought in reporting the deaths of Association members, with appropriate details. You may report the death of a member by sending an email to chapter.eternal@tbp.org.

- AL A '41 **Adams, Nathan Jasper**; November 24, 2008.
 '49 **Burleson, William Morris**; June 7, 2009.
 '49 **Lewis Jr., Edward Nolan**; September 18, 2008.
 '49 **Patty, Paul Louis**; March 29, 1989.
 '50 **Rowe Jr., Alvah Leo**; January 10, 2016.
 AL B '41 **Spencer, Alfred Otis**; March 8, 2009.
 '50 **Vogler, William Harold**; April 11, 2009.
 '57 **Dodson, Gene Austin**; December 31, 2015.
 '57 **Hand, Billy Jordan**; December 17, 2008.
 '60 **Maughan, William Gerald**; November 23, 2015.
 '84 **Waldron Jr., William Boyd**; November 11, 2008.
 AL Δ '85 **Compton, Charles Tracy**; October 26, 2008.
 AL E '98 **Evans, Richard Wade**; November 5, 2008.
 AZ A '55 **Knox, James Donald**; June 21, 2009.
 '67 **Biggs, Donovan Reese**; January 20, 2008.
 AZ B '88 **Heeley, David E.**; December 24, 2007.
 AR A '68 **Lee, James Richard**; April 5, 2009.
 '72 **Ford, Dalmer Roy**; August 5, 2008.
 '88 **Simpson, Searcy Levert**; April 2, 2009.
 CA A '42 **Peterson, Jerome Leadholm**; March 21, 1984.
 '49 **Weiner, Frederick Richard**; March 12, 2009.
 '56 **Basore, Carl Edward**; December 2, 2014.
 CA B '41 **Richardson, John Mead**; February 17, 1996.
 '43 **Douglas, David Lewis**; November 24, 2014.
 '44 **Cox, Charles Shipley**; November 30, 2015.
 '44 **Sandell, Wesley Robert**; December 5, 2015.
 '50 **Schroeder, Dwight Clare**; December 30, 2015.
 '74 **Batthey, James Francis**; September 21, 2008.
 CA Γ '47 **Patty, Duncan Victor**; December 25, 2015.
 '50 **Bauer, Paul Sherman**; May 9, 2014.
 CA E '72 **Pine, Jerry M.**; January 18, 2008.
 CA Z '68 **Austin, Donald Howard**; March 31, 2013.
 CA H '59 **May, Frank Harold**; March 24, 2008.
 '07 **Chiang, Ellen**; June 30, 2008.
 CA Θ '46 **Arnell, Walter James**; April 1, 2015.
 '65 **Coolbaugh, Ronald Gilbert**; April 18, 2008.
 '73 **Schirmer Jr., Theodore C.O.**; January 27, 2015.
 CA I '71 **Yamasaki, Nobuo**; April 30, 2008.
 '73 **Zeh, David Elmer**; January 17, 2009.
 '02 **Alarcon, Jorge Israel**; June 2, 2008.
 CA Λ '77 **Eribarne, Joseph Paul**; June 27, 2009.
 '87 **Barnard, William Louis**; November 19, 2008.
 CA M '46 **Horton, William F.**; February 2, 2009.
 '50 **Clerkin, Edward Joseph**; July 30, 1994.
 '95 **Day, Laura Jeanne**; January 23, 2008.
 CA N '88 **Fallis, Gregory Bruce**; May 28, 2008.
 CA Ξ '87 **Wood, Joan Grigg**; February 22, 2005.
 CA Π '76 **Lyons, Eddie Lee**; June 14, 2014.
 CO A '52 **Best, Lloyd Earl**; July 3, 2008.
 '66 **Rosecrans, Richard Galen**; September 3, 2008.
 '69 **Haynes, Gregory Allen**; April 26, 2008.
 '72 **Maxwell, Raymond Bruce**; July 7, 2009.
 CO B '42 **Kellogg, Richard Webster**; September 27, 2008.
 '42 **York, Robert William**; August 13, 2008.
 '43 **Baroch, George Frank**; April 21, 2008.
 '49 **Abrams, James Demar**; January 29, 2009.
 '50 **Ilyin, Alexander Gleb**; April 9, 2008.
 '51 **Chase, David Marion**; March 1, 2008.
 '54 **Coffey, James M.**; June 23, 2008.
 '57 **Adams, Michael James**; June 24, 2008.
 '57 **Cox, Howard Standish**; December 28, 2007.
 '57 **Janssen, Roger Gary**; December 23, 2008.
 '57 **Riedesel, Philip Ellsworth**; November 25, 2015.
 '74 **Anderson, John Lorin**; July 22, 2008.
 CO Δ '50 **Dobler, Donald William**; December 8, 2015.
 CT A '45 **Honey, David Charles**; July 29, 2009.
 CT B '50 **Fedor, Joseph Vincent**; January 12, 2009.
 DE A '51 **Williams, Walter Fred**; November 28, 2015.
 '52 **Brown, Joseph Marshall**; March 19, 2005.
 '57 **Williams, Roger Lee**; no details.
 '74 **Long, Thomas Charles**; January 9, 2008.
 FL A '56 **Langston, Clarence Ambers**; August 17, 2008.
 '62 **Tustison, Galen Fred**; June 1, 2008.
 FL B '50 **Sampson, James Philip**; December 10, 2008.
 FL Δ '61 **Jammal, Suheil Elias**; December 16, 2012.
 '67 **Riley, Glenn E.**; May 20, 2009.
 '72 **Culpepper, Thomas H.**; June 27, 2009.
 '99 **Butler, Chandrae**; September 2, 2013.
 FL Z '91 **Kirschner, Kenneth Karl**; April 12, 2009.
 GA A '41 **Cheek, Robert Chase**; February 17, 2008.
 '44 **Morris, Robert Emuel**; November 29, 2008.
 '48 **Baggett, Lester Marchant**; June 3, 2011.
 '48 **Ethridge, Noel Harold**; March 17, 2015.
 '48 **Pinkerton, David Walker**; January 8, 2008.
 '49 **Branson, Carl Ford**; August 5, 2008.
 '49 **Fiveash Jr., Charles Oliver**; November 16, 2015.
 '49 **Rees, Myron Ely**; August 6, 2008.
 '49 **Ziegler, John Malcolm**; October 13, 2008.
 '50 **Carver, John Guilli**; April 1, 2009.
 '50 **Skellie, Albert Cheves**; September 24, 2008.
 '51 **Bryant, Joseph Franklin**; February 20, 2008.
 '52 **Morris, Kent Broyles**; December 27, 2015.
 '53 **Dunlap, Peter**; June 4, 2009.
 '58 **Kowalsky, Bradley Dean**; April 9, 2008.
 '60 **Boutwell Jr., Gordon Powers**; September 2, 2008.
 '64 **Crowell, John Marshall**; September 30, 2008.
 '65 **Hinson, Jerry Tom**; December 5, 2008.
 '67 **Hnat, John Allen**; December 22, 2007.
 '72 **Laing, Alan Clyde**; July 6, 2009.
 '75 **Hall, Phillip Michael**; June 27, 2009.
 ID A '87 **Cleveland, Gregory Paul**; October 26, 2015.
 IL A '37 **Purl, Raymond Charles Arthur**; February 5, 2015.
 '39 **May, Walter G.**; February 18, 2015.
 '41 **Janos, Alfred Gabriel**; December 26, 2008.
 '42 **Giles, Robert Arthur**; February 11, 2008.
 '44 **Wilson, Wendell H.**; January 26, 2008.
 '48 **Saar, Robert Peter**; February 14, 2008.
 '49 **Hunter, Robert L.**; June 16, 2009.
 '49 **Novak, George Joseph**; August 24, 2008.
 '49 **Ocnaschek, Frank Joseph**; May 13, 2009.
 '49 **Taylor, Donald Edward**; June 16, 2008.
 '50 **Nordstrom, Gordon L.**; August 5, 2003.
 '51 **Long, Walter William**; February 27, 2008.
 '52 **Beling, Thomas Earl**; February 21, 2009.
 '52 **Fisher, Robert Hyatt**; April 25, 2009.
 '52 **Frick, Donald Herbert**; May 15, 2009.
 '53 **Levitan, Edwin Stanley**; July 11, 2008.
 '54 **Mieher, Robert Lee**; December 4, 2007.
 '57 **Weir, Donald Edward**; March 20, 2009.
 '60 **Koch, Eric Neal**; May 18, 2009.
 '60 **Spillman, Charles Kennard**; April 22, 2009.
 '64 **Volodka, Liudas Kestutis**; August 14, 2008.
 '68 **Knitter, Donald Joseph**; January 29, 2008.
 '68 **Motluck, Raymond**; January 11, 2016.

'89 **Glackin, David R.**; October 8, 2008.
 IL B '48 **Brockmeier, Warren G.**; December 8, 2015.
 '48 **Gauthier, William Davis**; May 5, 2009.
 '48 **Tornheim, Harold**; no details.
 '49 **Greenstein, Jerome**; November 15, 2015.
 '49 **Kuehl, Thomas John**; September 15, 2015.
 '51 **Davidson, William Albert**; December 27, 2014.
 '52 **Kelly, Peter Wilson**; August 9, 2008.
 '64 **Kasten, Robert E.**; May 5, 2008.
 '66 **De Bates, Richard A.**; October 17, 2014.
 '93 **Chang, Chun Chieh**; November 21, 2008.
 IL Γ '42 **Pomerene, James Herbert**; December 7, 2008.
 '47 **White, Joseph Charles**; June 4, 2009.
 '71 **Bedford, Michael Ray**; February 21, 2008.
 IL Δ '78 **Williams, Gregory Michael**; December 28, 2007.
 '84 **Jeffries, James R.**; April 22, 2009.
 IL E '99 **Tewinpagti, Itti**; June 18, 2009.
 IL Z '85 **Malott, Doris Marie**; November 6, 2008.
 '92 **Koval, Kathleen Mary**; June 4, 2009.
 '03 **Shah, Manan M.**; December 7, 2008.
 IN A '39 **Rudolph, Jack Marlin**; January 17, 2008.
 '42 **Deiser, Elmer Elvin**; June 12, 2009.
 '42 **Topinka, George Frank**; March 26, 2009.
 '43 **Esenwein, Fred Theodore**; March 30, 2009.
 '44 **Goldsmith, Joseph Kuhn**; May 2, 2009.
 '45 **Berger, Joseph Arnold**; August 8, 2008.
 '45 **Bower, Paul Leroy**; April 17, 2009.
 '45 **Collings, Joe Allen**; August 14, 2009.
 '48 **Arthur, Richard Jardine**; December 18, 2007.
 '48 **Pauling, Wendell Frederic**; October 29, 2008.
 '48 **Sample, Norris L.**; May 18, 2009.
 '49 **Caryl, Leonard Howard**; April 30, 2008.
 '49 **Kolar, Robert Frank**; February 27, 2009.
 '49 **Neff, Philip George**; January 29, 2008.
 '50 **Heiss, William Henry**; December 13, 2008.
 '50 **Rigoni, Kenneth Angelo**; June 5, 2009.
 '52 **Bradburn, David Denison**; October 18, 2008.
 '53 **Archibald, Gordon R.**; December 19, 2015.
 '53 **Bruckner, Martin Joseph**; June 19, 2009.
 '53 **Haser Jr., Harry William**; June 30, 2009.
 '53 **Hession, Joseph Paul**; March 2, 2009.
 '53 **Plettner, Richard Maxwell**; October 9, 2008.
 '56 **Geyer, Norman M.**; September 23, 2008.
 '56 **Grady, Ronald Keeney**; June 13, 2008.
 '56 **Henry, Edwin Keith**; May 19, 2008.
 '57 **Jones, Herman Willoughby**; April 21, 2008.
 '58 **Broemmelsiek, Raymond Lee**; May 9, 2009.
 '58 **Lingren, Gordon Curtis**; May 15, 2008.
 '59 **Axson, Larry Earl**; December 15, 2008.
 '59 **Jones III, Jesse Newton**; August 19, 2011.
 '61 **Anderson, Raymond V.**; November 11, 2015.
 '62 **Kahler, Stephen Carl**; February 8, 2008.
 '63 **Matovina Jr., Mark Joseph**; March 14, 2008.
 '63 **Shapiro, Michael David**; July 18, 2008.
 '64 **Evitts Jr., James Clinton**; September 18, 2012.
 '64 **Maskell, Charles Michael**; September 30, 2015.
 '64 **Murray, Dennis Patrick**; December 9, 2007.
 '64 **Smith, Donald Thal**; May 17, 2008.
 '68 **Hallett, Robert Joseph**; January 28, 2009.
 '71 **McKee, David Ned**; September 7, 2008.
 '71 **Whitacre Jr., Robert Franklin**; January 5, 2008.
 '73 **Jakowatz Jr., Charles V.**; February 7, 2015.
 '76 **Frey, Sue M.**; May 12, 2013.
 '80 **Provence, John Darold**; August 15, 2008.
 IN B '41 **Beckman, Eldred Wilbur**; December 6, 2008.
 '46 **Strum, Robert Denney**; November 21, 2008.
 IN Γ '59 **Hartigan, Terrence Leftus**; October 23, 2008.
 IN Δ '58 **Lux, George Richard**; March 6, 2009.
 '72 **Herron, William Lee**; March 26, 2008.
 IA A '42 **Percival, Worth Harris**; January 29, 2008.
 '43 **Lueder, Robert Gregg**; November 22, 2013.

In Memory

Donald Lee Bender, Ph.D., P.E., Wyoming Alpha '53, passed away November 13, 2015, in Spokane, WA. He was Tau Beta Pi's President from 1978-82. Don began his career as an engineering educator on the faculty at Washington State University (then College). After obtaining his Ph.D. at the University of Wisconsin, he returned to Pullman to resume his professorship at WSU and eventually became associate dean of engineering. Don returned to Spokane and took a faculty position at Gonzaga University. He was a member of NSPE and the National Society of Civil Engineers.

'45 **Brodahl, Raymond Gilbert**; December 22, 2015.
 '45 **Dutton, Arthur Morlan**; November 5, 2008.
 '47 **Becker, Edwin Norbert**; February 23, 2009.
 '47 **Kemp, John Bernard**; June 6, 2008.
 '51 **Baldrige, Donald Bruce**; December 1, 2008.
 '51 **Shane, Richard Falk**; September 27, 2008.
 '52 **Ameriks, Arturs Reinholds**; December 2, 2007.
 '52 **Dougal, Arwin Adelbert**; July 30, 2012.
 '52 **Stegelman, Albert Fred**; June 21, 2009.
 '53 **Faulkner, John Frederick**; February 24, 2008.
 '55 **Christensen, Thomas Lange**; June 4, 2008.
 '59 **Christensen, Paul Mandall**; August 11, 2008.
 '62 **Bremer, Walter Leo**; July 14, 2008.
 '63 **Griffith, Ronald James**; March 12, 2009.
 '64 **Conklu, Ozdemir**; December 11, 2007.
 IA B '48 **Nilsson, James William**; December 26, 2015.
 '50 **Evans, Frederick Melton**; April 12, 2008.
 '50 **Rehberg, Forrest Gavin**; May 30, 2008.
 '51 **Thistlewood, Howard T.**; October 21, 2008.
 '53 **Rose, Vernon Andrew**; December 14, 2007.
 '60 **Odell, Richard Louis**; July 9, 2008.
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 '44 **Prewitt, Robert Lycurgus**; September 4, 2008.
 '46 **Stong, Hildreth Lewis**; May 3, 2009.
 '49 **Lewis, Wayne Thomas**; March 18, 2008.
 '50 **Hayward Jr., James Charles**; April 6, 2009.
 '50 **Olson, Raymond Eugene**; December 12, 2008.
 '50 **Smith, Stanley Monroe**; March 20, 2015.
 '51 **Wiley, James Amos**; March 23, 2009.
 '52 **Drummond, Donald Foster**; July 9, 2008.
 '53 **Beasley, Wallace Walter**; January 11, 2008.
 '55 **Swarts, Daniel Frederick**; November 2, 2008.
 '57 **Landauer, Donald Harold**; March 16, 2009.
 '57 **Lucas, W. Max**; September 4, 2015.
 '60 **Bowser, John Virgil**; June 20, 2008.
 '86 **Unger, Mark Bryan**; May 17, 2009.
 KS B '86 **Oakley, Nathan Lee**; February 16, 2009.
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 '51 **McMurry, Charles Leroy**; May 27, 2009.
 '61 **Lewis, Colin Campbell**; June 4, 2008.
 '64 **Dattilo, Anthony Joseph**; March 30, 2009.
 '66 **Maddox, Randall A.**; January 25, 2009.
 KY B '44 **Scovic, James M.**; April 22, 2009.
 '55 **Bratcher, Collen Dale**; November 30, 2015.
 '56 **Hurko, Bohdan**; December 11, 2008.
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 '50 **Bowron, John Henry**; March 21, 2009.
 '51 **Dulany, George Benjamin**; May 2, 2008.
 '51 **Lancon Jr., Curtis James**; June 13, 2009.
 '52 **Cantrell, Claude Jack**; May 30, 2008.
 '57 **Dragna, Peter Anthony**; April 20, 2015.
 '64 **Friday, Thomas Fleming**; December 8, 2008.
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 '59 **Redman, James Paul**; December 13, 2008.
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 '49 **Johnson, David Edsel**; September 4, 2008.
 '50 **Little, Clayton Dale**; January 4, 2008.

- '51 **Johnson, Johnny Ray**; November 15, 2015.
 '55 **Megison, Donald Ray**; October 10, 2008.
 '55 **Pranter, James Albert**; January 8, 2008.
 '58 **Barber, John Merrell**; January 30, 2009.
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 '58 **Cronquist, Neil Russell**; April 20, 2009.
 '75 **Dodds, Angus Jefferson**; April 4, 2009.
 '79 **Horton, Raymond Harrison**; March 8, 2008.
 '91 **Bowman, Harry Albert**; December 2, 2015.
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 '52 **Ludtke Jr., William P.F.**; June 15, 2015.
 '55 **Mortimer, Thomas Samuel**; February 12, 2014.
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 '46 **Lee, Wilfred John**; April 21, 2008.
 '46 **Muller, Walter Otto**; March 3, 2008.
 '50 **Barna Jr., George E.**; June 19, 2006.
 '50 **Danielson, David Warren**; January 31, 2009.
 '51 **Griswold, Halsey Edward**; May 24, 2009.
 '64 **Gendron, David Louis**; September 19, 2008.
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 '47 **Jayne, Allan W.**; May 31, 2009.
 '48 **Feist Jr., Howard Needham**; February 24, 2009.
 '48 **Friedman, Robert Sumner**; June 22, 2009.
 '48 **Mullery, Edward A.**; January 19, 1990.
 '49 **Spencer, Richard Winslow**; May 4, 2009.
 '51 **Counihan, Richard George**; September 9, 2008.
 '51 **McGrew, John Douglass**; June 5, 2014.
 '52 **Curlee Jr., Neil James**; March 29, 2008.
 '61 **Gray, Peter Russel**; May 17, 2009.
 '62 **Ruiter, Earl Rogers**; June 19, 2008.
 '64 **Gallant, John Marion**; July 28, 2008.
 '64 **McMullin, Paul George**; October 5, 2008.
 '64 **Wang, Leon Ru-Lang**; October 25, 2006.
 '65 **Ross, Arthur Howarth Macneal**; July 3, 2008.
 '81 **Mullen, Gregory Patrick**; April 30, 2008.
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 '49 **Sorota, Max David**; March 1, 2009.
 '66 **Halvorsen, Ronald E.**; November 27, 2008.
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 '55 **Howell, Robert Sherman**; June 1, 2008.
 '60 **Gutauskas, John Albert**; June 19, 2008.
 '66 **Swanson, John Lawrence**; July 11, 2009.
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 '59 **Senecal, Thomas Peter**; January 27, 2009.
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 '80 **Grubka, Thomas J.**; April 28, 2009.
 '95 **Norris, Brian Clifton**; March 3, 2009.
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 '49 **Prisk, Bert Charles**; April 14, 2008.
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 '50 **Williams, Dean N.**; March 18, 2013.
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 '75 **Fudaly, Thomas John**; February 20, 2009.
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 '48 **Tersoff, Abraham Isaac**; February 12, 2009.
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 '50 **English, Alfred Charles**; June 5, 2009.
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 '50 **Robertson Jr., John**; May 12, 2014.
 '52 **Kanno, John Sakai**; October 2014.
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 '56 **Rock, Allan Lewis**; June 7, 2009.
 '57 **Cherry, David Bruce**; August 15, 2008.
 '63 **Bradshaw, Bruce William**; April 26, 2009.
 '75 **Massey, Robert Neil**; May 21, 2008.
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 '53 **Colwell, Daniel Gurney**; August 20, 2008.
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 '96 **Austin, Jeffrey James**; February 5, 2009.
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 '48 **Kelly, Gordon Emmet**; May 22, 2008.
 '49 **Cloud, Harold Arthur**; February 8, 2008.
 '52 **Hamre, William Baldwin**; December 2, 2008.
 '55 **Herrst, Leonard Reid**; May 28, 2013.
 '59 **Lubinski, Lloyd Dennis**; June 15, 2008.
 '63 **Bartley, Bruce Byron**; 2014.
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 '54 **Davis, Fred Ervin**; April 17, 2008.
 MO A '61 **Plackmann, Daniel George**; January 1, 2016.
 '62 **Casady, Larry Carmie**; September 1, 2008.
 '64 **Tillman Jr., George Edward**; July 1, 2014.
 '67 **Hubbert, William Joseph**; November 28, 2008.
 '67 **Shumaker, Paul Kenneth**; July 5, 2009.
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 '41 **Strunk, Mailand Rainey**; May 29, 2008.
 '44 **Dietz, Robert Otto**; January 19, 2008.
 '44 **Larson, Warren LeRoy**; June 14, 2009.
 '48 **Hasko, Stephen**; April 25, 2008.
 '49 **Lenox, William Hamilton**; December 14, 2008.
 '49 **Straub, Harold Elmore**; January 26, 2008.
 '50 **Ruprecht, William Joseph**; July 10, 2008.
 '51 **Fris, Joseph Paul**; July 5, 2008.
 '52 **Guinn, William Burlin**; December 18, 2007.
 '54 **Barylski, Martin William**; February 12, 2009.
 '56 **Hygh, William Edward**; June 9, 2015.
 '56 **Muhlbauer, Karlheinz C.**; October 28, 2008.
 '57 **Buschman, Henry William**; May 16, 2008.
 '57 **Dever, John Preston**; July 4, 2008.
 '58 **Bertorello, Thomas Alvin**; April 16, 2008.
 '58 **Eaker, Thomas William**; March 26, 2009.
 '59 **Smith, Homer Dallas**; January 11, 2008.
 '61 **Shy, Paul N.**; February 13, 2009.
 '62 **Fadler, Eugene Charles**; September 30, 2008.
 '66 **Reedy, Clyde Milstead**; February 7, 2008.
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 '48 **Jennings, Alfred Stonebraker**; May 19, 2009.
 '49 **Halter, Jerome Barth**; April 16, 2009.
 '50 **Horn, Robert Edwin**; June 6, 2009.

'51 **Boedy, Donald Dean**; April 17, 2008.
'56 **Duncker, Charles Petring**; December 28, 2008.
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'49 **Brunken, Carrol O.**; July 1, 2008.
'82 **Meyer, Paul S.**; March 11, 2008.
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NJ A '37 **Braxton, James S.**; November 29, 2015. [*Cent. 114*]
'42 **Greeff, Carl Emil**; December 22, 2015.
'42 **Lowenberg, Homer**; December 24, 2015.
'49 **Sweeney, John Patrick**; May 16, 2009.
'49 **Wagner, Richard S.V.**; July 6, 2013.
'50 **Littleboy, Henry Stephen**; April 26, 2008.
'51 **Wooster, Tristan Mark**; December 24, 2007.
'63 **Greenberg, Philip Joel**; December 26, 2015.
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'50 **Van Brunt, Leroy Bernard**; July 9, 2008.
'51 **Wetzel, William Philip**; January 25, 2009.
'66 **Abarbanel, Jerome**; April 20, 2015.
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'43 **Rusher, Gerald Hartman**; January 11, 2008.
'54 **Hilsinger, Harry Alburtus**; December 25, 2008.
'57 **Kopf, Joseph E.**; January 13, 2009.
'59 **McGuire, Leon David**; January 29, 2009.
'61 **Weinstein, Oscar**; May 8, 2009.
'63 **Gibson Jr., James Monroe**; August 1, 2008.
'65 **Allan, Ronald N.**; November 24, 2015.
'65 **McGrath, Ronald Howard**; May 30, 2009.
'65 **Zych, Victor John**; November 17, 2008.
'71 **Ginga, Nicholas Anthony**; April 22, 2009.
'72 **Healey, John Thomas**; August 30, 2008.
'81 **Grazioso, Michael Joseph**; December 9, 2008.
'87 **Davis, Kevin Christopher**; April 16, 2009.
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NM A '54 **Kleine, Louis William**; May 15, 2008.
'77 **Jedlicka, Russell Paul**; March 11, 2008.
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'55 **Leach, George H.**; June 2, 2008.
'61 **Sawin, Ernest Edward**; April 4, 2008.
NY B '43 **Lindsey, Robert Leyden**; March 20, 2009.
'48 **Sparling, Robert John**; November 8, 1999.
'49 **Bussey, Howard Charles**; January 11, 2009.
'50 **Harvey, Eugene Phillip**; May 25, 2009.
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'45 **Duke, James Burnham**; July 21, 2008.
'45 **Maslen, Stephen Harold**; March 24, 2015.
'46 **Matthews, Edgar Wesley**; March 7, 2008.
'49 **Gale, Austin Harold**; January 20, 2008.
'50 **Bargeski, Alexander James**; July 9, 2009.
'50 **Devlin, John Gratan**; December 3, 2008.
'51 **Campbell, Charles Thompson**; August 18, 2015.
'51 **Duffy, Robert Edward**; October 12, 2015.
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'51 **Lautensack, Harry**; April 10, 2009.
'53 **Roloson, Robert James**; March 21, 2009.
'55 **Gersten, Edward Joseph**; July 5, 2009.
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'80 **Schaefer, Robert Allen**; October 24, 2008.
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'68 **Gompf, Henry Lewis**; July 5, 2008.
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'58 **Richter, Philip**; August 26, 2008.
'62 **Kraus, Frank F.**; March 21, 2009.
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'53 **Hughes, Martin Peter**; July 1, 2008.
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'65 **Doll, John Raymond**; August 23, 2008.
'70 **Cuccia, Salvatore Anthony**; December 8, 2007.
'79 **Mirecki, Anthony Vito**; July 7, 2009.
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'65 **Sgro, Thomas R.**; December 14, 2008.
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'66 **Thayer Jr., Gaylord B.**; February 27, 2008.
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'89 **Rosten, David Paul**; September 17, 2008.
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'79 **Demiccio, Bonnie Marie**; November 24, 2008.
NY O '71 **Snyder, James J.**; November 29, 2007.
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'50 **Almond, Glenn Conrad**; November 15, 2008.
'50 **Fuller Jr., Roy Edwin**; December 5, 2015.
'52 **Erwin, Max L.**; December 26, 2007.
'53 **Rose, Billy**; August 20, 2008.
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'50 **Tager, Milton Lee**; January 21, 2009.
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'85 **Wald, Timothy John**; September 29, 2008.
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'52 **Profant, Daniel David**; October 2, 2008.
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'57 **Maloney Jr., William T.**; December 14, 2015.
'60 **Kulinski, Edmund Sylvester**; June 26, 2008.
'61 **McLean, Robert Bruce**; January 1, 2009.
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'48 **Leaverton, Joseph Nelson**; January 11, 2008.
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'53 **Rudy, James Arthur**; February 7, 2009.
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'61 **Lyles, Rudolph**; March 17, 2009.
'61 **Sandwisch, Galen Jay**; March 8, 2008.
'63 **Reinoehl, James Earl**; December 24, 2007.
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'93 **Indieke, Timothy Glen**; May 3, 2008.
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'69 **Hilton, Richard Cline**; December 27, 2008.
'70 **Pederson, Jerard Marshall**; January 11, 2009.
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'53 **Corsaro, Lewis John**; February 17, 2008.
'79 **Elliott, David Michael**; January 26, 2009.
'83 **Culp, Richard Earl**; January 3, 2008.
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'64 **Hughes, Joseph Vincent**; June 24, 2008.
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'56 **Cummings, Gene Alvin**; December 28, 2015.

- '60 **Alguire, Robert Thornton**; June 6, 2015.
 '72 **Fox, Dave Ted**; March 16, 2009.
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 '85 **Moeller, William Walter**; January 16, 2008.
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 '50 **Foster, Dirks Bruce**; June 13, 2008.
 '50 **Lee, Alan Hilman**; June 6, 2009.
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 '41 **Gitzendanner, Louis George**; February 25, 2008.
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 '53 **Otter Jr., Frederick August**; March 21, 2014.
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 '81 **Jonas, Gordon Mark**; December 17, 2014.
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 '71 **Yoder Jr., Carl Jonathan**; January 2, 2008.
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 '47 **Pederson, Jerard Marshall**; no details.
 '52 **Markas, Stephen Emmanuel**; May 11, 2012.
 '61 **Queener, Carl Allan**; September 5, 2008.
 '62 **Houck, James R.**; September 18, 2015.
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 '61 **McCracken, Charles Michael**; October 6, 2008.
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 '71 **Kennedy, Peter J.**; February 9, 2009.
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 '46 **Hovden, Charles Neilan**; April 23, 2008.
 '49 **Walker, Terry**; December 21, 2008.
 '50 **Layne, Fred Austin**; no details.
 '51 **Howe, Emmett Ervin**; May 26, 2009.
 '56 **Magee, James Bluford**; August 15, 2010.
 '64 **Taylor, Donald Ray**; November 12, 2015.
 '66 **Pearre III, Charles Morgan**; November 23, 2015.
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 '47 **Ferguson, Raymond William**; April 27, 2009.
 '47 **Haynes, Harold Jean**; July 8, 2009.
 '48 **Lindsay, Wilbur Jerome**; May 10, 2009.
 '49 **Byrd, Truman Morris**; June 19, 2009.
 '49 **Fox Jr., Milden Jean**; December 16, 2015.
 '49 **Lowes, George Allen**; November 16, 2008.
 '49 **Rice, Warren**; June 5, 2009.
 '49 **Silber Jr., Paul George**; November 19, 2015.
 '49 **Thomas, William Rufus**; September 23, 2008.
 '50 **Peterson, Glenn William**; February 11, 2009.
 '50 **Selle, Eugene Proctor**; May 4, 2008.
 '50 **Taylor, John Francis**; January 22, 2009.
 '52 **Gee, John Dwelly**; January 10, 2008.
 '53 **Sabo, Wayne Lyle**; March 31, 2001.
 '54 **Nygaard, James Lyle**; July 3, 2009.
 '55 **May, Jimmy Dale**; July 3, 2009.
 '56 **Dausin, Lawrence Raymond**; January 18, 2008.
 '59 **McQuitty Jr., Forest Eugene**; April 11, 2008.
 '63 **Jordan, Lavell**; February 18, 2008.
 '70 **Knowles, Jerry Michael**; September 7, 2008.
 '70 **Rosenstein, Daniel Arthur**; April 29, 2009.
 '75 **Wells, Boyd Keith**; March 25, 2008.
 TX E '57 **James, Jack Edward**; April 21, 2009.
 '96 **Qiu, Hai**; December 6, 2008.
 TX Z '72 **Jackson, Larry Leroy**; November 4, 2014.
 TX H '89 **Fowler, Robert Jeffrey**; June 23, 2009.
 TX Θ '95 **Gardiner, David E.**; August 6, 2008.
 TX I '95 **Randall, Scott Curtis**; September 14, 2008.
 TX Λ '61 **Tucker, Robert Frederic**; November 26, 2010.
 UT A '47 **Birk, Jack Neldon**; August 22, 2015.
 '57 **Black, Kennard Powell**; December 15, 2015.
 '63 **Killam, David Gary**; July 19, 2008.
 '82 **Nelson Jr., Franklyn Stewart**; March 8, 2009.
 '91 **Walters, Michael Alan**; November 28, 2008.
 VT A '74 **Masten, Paul Winfield**; February 24, 2008.
 '82 **Wagner, David Clinton**; June 22, 2008.
 VA A '47 **Eastwood, Charles R.**; October 20, 2008.
 '50 **Stone, Robert Francis**; December 20, 2007.
 '57 **Stickley, Beryl Cleveland**; November 29, 2008.
 '63 **Oliver, Dennis Neal**; December 5, 2008.
 '81 **Primeau, Stephen Joseph**; June 28, 2008.
 VA B '40 **Wilson, Frederick Joseph**; December 4, 2007.
 '41 **Tait, Lee Campbell**; December 27, 2007.
 '43 **Young, Billy Jackson**; July 6, 2009.
 '44 **Gillette, Leroy Owen**; August 10, 2008.
 '47 **Darden, Julian Allen**; January 23, 2009.
 '53 **Torgersen, Paul E.**; March 29, 2015.
 '99 **Novak, Julia Ann**; August 10, 2008.
 VA Γ '95 **Kinney, John Dale**; September 23, 2008.
 WA A '46 **Riese, Russell Lloyd**; February 21, 2009.

'50	Skoglun, Mervin Edward; July 23, 2008.	'89	Benedict, Damon Stephen; May 1, 2009.
'51	Lee, Harold Chock; January 2, 2008.	WI A '41	Allman, James Martin; May 3, 2009.
'51	Peterson, Robert Irwin; July 6, 2008.	'42	Gehrke, Willard Herman; October 1, 2008.
'53	Wiprud, Glenn Clifford; May 28, 2009.	'43	Brenner, Harold Andrew; April 30, 2009.
'58	Ellestad, Thomas Gordon; October 1, 2008.	'43	Buckley, Robert Allen; March 19, 2008.
'58	Hanson, Wayne Allen; November 22, 2008.	'49	Downham, Cyril Edward; June 28, 2008.
'60	Dunford, Edsel Delano; October 3, 2008.	'51	Anderson, Robert Berge; February 26, 2009.
'71	Akai, Terrence John; February 28, 2009.	'52	Rutz, Lenard Otto; February 4, 2015.
'76	Higley, Bruce Ardys; July 2, 2009.	'52	Wong, George H.; December 21, 2015.
'76	Steendahl, John David; June 30, 2015.	'56	Bender, Ostap; December 25, 2008.
'80	Tulberg, Dean Martin; December 20, 2008.	'63	Sitzman, Jerry Clayton; January 1, 2008.
WA B '33	Kasline, Fred E.; October 4, 2015. [<i>Cent. 90</i>]	'82	Kelbe, Richard Robert; October 23, 2008.
'41	Rhiger, Richard Robert; February 28, 2008.	WI B '43	Schaeffer, Clifford Otto; December 26, 2008.
'44	Eschbach, Eugene Arment; June 16, 2009.	'44	Suster, Robert James; May 21, 2005.
'49	Hubbell, Frederick Thomas; October 5, 2008.	'45	Zuercher, John David; May 7, 2011.
'51	Nelson, Oliver A.; no details.	'49	Panlener, Robert A.; April 9, 2010.
'52	Lecompte, George William; February 5, 2008.	'49	Zaffrann, Albert Anthony; April 2, 2008.
'52	Tripp, Reginald Dean; June 2, 2008.	'51	Bartels, Donald Henry; December 7, 2008.
'53	Paeth, James Albert; November 17, 2008.	'52	Heinrich, Bernard Fredrick; March 16, 2008.
'62	Botchek, Charles Martin; January 29, 2008.	'55	Schutz, William George; January 1, 2008.
'75	Roy, George Steven; March 14, 2009.	'57	Langteau, Palmer Joseph; December 20, 2008.
WA Γ '53	McCauley, Edward Willette; January 11, 2016.	'57	Petersen, John L.; April 16, 2009.
'91	Buslach, Kyle L.; August 10, 2008.	'61	Gillis, Edward Allan; April 11, 2008.
WA Δ '95	Anthony, Peter; May 31, 2009.	'64	Petrie, Thomas Walter; December 2, 2008.
WV A '45	Friant, David Robert; February 13, 2015.	WY A '53	Bender, Donald Lee; November 13, 2015.
'49	Bridson, George Edmund; March 11, 2008.	'98	Melinkovich, Mike; May 21, 2009.
'74	Swogger, George Earl; December 29, 2007.		

Brain Ticklers

(Continued from page 35)

ous year, when they were called in to supper, they left their cubes outside, and the next morning found that an overnight rain had dissolved the glue (but had not washed off any paint). Each twin examined the pile of small cubes that had made up her large cube, and each found that exactly 100 of her small cubes had no paint on any of their faces. How large was each twin's cube, and how many of its faces had each twin painted?

—Adapted from *Mathematical Puzzling* by A. Gardiner

5 You have a copy machine that lets you scale your original from 100% (no enlargement) to a maximum of 155% in increments of 1%. How can you use this machine to produce a copy of a square picture such that the length of the side of the final copy is exactly double the length of the side of the original? (A setting of xxx% means that the ratio of the length of the side of the copy to the length of the side of the original is x.xx.)

—Mathematics Teacher

Bonus. The number $365 = 13^2 + 14^2 = 10^2 + 11^2 + 12^2$ is the smallest integer which is both the sum of the squares of two consecutive positive integers and the sum of the squares of three consecutive positive integers. The second smallest such integer is $35,645 = 133^2 + 134^2 = 108^2 + 109^2 + 110^2$. What is the tenth smallest such integer and what is the exact ratio of the $(n+1)$ st such integer to the n th such integer as n gets very large? We want the ratio in terms of simple mathematical functions, such as surds. A computer is not necessary, except to do the math.

—*Time Travel and Other Mathematical Bewilderments* by Martin Gardner

Computer Bonus What are the smallest and next smallest bases for which the integer ba exactly divides $abcde$? For bases 11 and higher, letters are used to represent digits greater than 9, that is, a is used to represent 10, b to represent 11, c for 12, etc. Present your answer as base 10 integers.

—Don A. Dechman, TX A '58

Here is a little extra Tickler to see if you are smarter than a third grader. The following problem appeared on my granddaughter's 3rd grade math test.

Double Bonus In the table, # represents an unknown operation on two numbers to yield a third number. Given that:

$$1 \# 4 = 5$$

$$2 \# 2 = 6$$

$$3 \# 6 = 1$$

What is the # operation, and what is the value of $4 \# 4$?

Send your answers to any or all of the Spring Brain Ticklers to Curt Gomulinski, Tau Beta Pi, P. O. Box 2697, Knoxville, TN 37901-2697 or email to BrainTicklers@tbp.org as plain text only. The cutoff date for entries to the Spring column is the appearance of the Summer Bent in mid-June (the electronic version is a few days earlier). The method of solution is not necessary. We welcome any interesting problems that might be suitable for the column. The Computer Bonus and Double Bonus are not graded. Curt will forward your entries to the judges who are **F. J. Tydeman, CA Δ '73; D. A. Dechman, TX A '57; J. C. Rasbold, OH A '83; and the columnist for this issue,**

—H. G. McIlvried III, PA Γ '53



FAMILIES

Centenarians

We add the names of three members who have reached their second century and been recognized in *The Bent*. The full list is available at www.tbp.org under Distinguished members.

Theodore D. Bender, *WA A '41*
b. January 6, 1914
d. July 17, 2015

James S. Braxton, *NJ A '37*
b. July 21, 1914
d. November 29, 2015

Norman H. Moore, *NY Γ '37*
b. September 19, 1914
d. July 12, 2015

Bi-Spousal

We welcome more Tau Beta Pi couples to this most popular category.

Marcus J. Bracey, *OH M '16*
Michelle L. Bracey, *OH M '16*

Cynthia A. Cronin, *NY N '84*
Robert J. Cronin, *NY N '84*

James P. Fairbanks, *GA A '16*
Meghan C. Ferrall, *FL A '12*

Jayne M. Allgood, *AL A '09*
Neal A. Allgood, *AL A '10*

Janice S. Ferguson, *MA Z '82*
John Mardirosian, *MA Z '81*

James L. Griffin, *NY N '81*
Patience A. Jackson, *MO A '93*

Andrew W. Korinda, *DE A '07*
Christina D. Korinda, *MI Γ '07*

Darlene S. Michelson, *VA B '86*
Gregory J. Michelson, *CA N '88*

Amanda N. Parker, *KS Γ '04*
Nathan K. Parker, *KS Γ '03*

Korey M. Reber, *OH Z '03*
Susanne M. Reber, *OH Z '01*

Adrienne L. Spencer, *KY A '13*
David S. Spencer, *KY A '13*

Ines C. Stuckert, *MI Γ '13*
Nicholas R. Stuckert, *WY A '08*

Cynthia A. Vinoski, *TN Δ '84*
Stephen B. Vinoski, *TN Δ '85*

James L. Woidt, *NH A '10*
Stacey K. Woidt, *MA H '10*

Laura M. Zitella Verbick, *IL Z '11*
Zachary T. Verbick, *WI Δ '11*

Multi-Generation

Here are families with at least two generations.

The Angileri Family
Frank A., *MI Γ '88*
Michael A., *MI Γ '83*
Michael C., *MI Γ '15*

The Atkinson Family
Lowell G., *IN A '63*
Mark A., *IN A '94*

The Barberio Family
Yvonne L., *NJ B '83*
Antonio J., *NY E '82*
Andrea Lynn, *PA Δ '11*
Antonio E., *PA Δ '15*

The Badiru Family
Adedeji B., *TN Γ '79*
Ibrahim A., *OK A '99*

The Bolender Family
John W., *WI A '51*
Robert J., *CA B '86*

The Bowman Family
Jeffrey L., *PA B '73*
Rebecca A., *PA B '76*
Joshua S., *PA B '16*

Bretschneider Family
Danny C., *TX Δ '81*
Macy L., *TX Δ '14*

The Buran Family
Joseph E., Jr., *IN Γ '75*
Joseph R., *FL A '13*

The Bussiere Family
Neil E., *PA Γ '86* (uncle)
Nathan A., *PA Γ '11*

The Comoglio Family
Rick F., *MD B '75* (uncle)
Caleb C., *IN Z '15*

The Debortoli Family
Mark J., *VA A '87*
Robert A., *NY N '16*

The Dechman Family
Don A., *TX A '57*
David A., *VA B '82*
James W., *TX A '89*

The Eason Family
Ernest D., *CO B '71*
Eric V., *CO B '09*

The El-Sharkh Family
Mohamed Y., *AL E '87*
Hadil M., *AL E '16*
Mohamed M., *AL E '17*

The Feidt Family
†William E., *PA A '67*
William N., *MS B '93*

The Gabriele Family
Gary A., *VT B '73*
Jennifer A. Currey, *NY Γ '00*

The Gaw Family
Craig A., *IL Γ '70*
Nathan B., *AZ B '13*

The Gurniak Family
Anne E., *NC Γ '83*
David T., *PA E '81*
Emily J., *PA Δ '15*

The Hampel Family
Daniel, *NJ Γ '53*
Howard, *MD A '90*

The Harenberg-Martinez Family
Donald D., *CA N '61* (grandfather)
Ashley N. Martinez, *OR Γ '17*

The Hedstrom Family
†Robert A., *NY Γ '39*
Joseph C., *AL B '76*

The Hockstad Family
Douglas M., *MI Γ '89*
Kelsey A., *MI Γ '15*

The Homiller Family
Annette Marie T., *GA A '86*
James D., *NC A '17*

The Hrabak-Walder Family
Marguerit J. Hrabak, *OH E '74*
Charles E. Walder, *MI Z '79*
Karen Hrabak Walder, *MI Z '84*

(† indicates that member is deceased)

- The Jacobson Family
Geoffrey L., *NY* Θ '76
Kaitlyn E., *NH* *A* '11
Matthew, *NY* Γ '14
- The Jakobatz Family
† Charles V., *KS* *B* '44
† Charles V., Jr., *IN* *A* '73
- The Johnson Family
Paul R., *MI* *Z* '55
Mark A., *MI* *Z* '84
Mitchell A., *MI* Γ '17
- The Johnson Family
Roger W., *MN* *A* '79
Benjamin R., *SD* *A* '14
- The Kaltenbach Family
Karl W., *NY* Γ '77
Patrick W., *NY* Γ '15
- The Kayse Family
Kevin S., *CO* *B* '78
Jordan L., *TX* *I* '16
- The Kelnhofer Family
Richard W., *WI* Γ '87
Elizabeth K., *WI* Δ '14
- The Kewley-Port-Reading Family
Diane Kewley-Port, *MI* Γ '64
Christopher R., *VA* *B* '00 (in-law)
- The Klauber Family
† Laurence M., *CA* Γ 1908
† Philip M., *CA* Γ '37
- The Knisely Family
Robert C., *OH* *Z* '48
† Charles W., *PA* *B* '49
Charles W., Jr., *PA* *H* '75
Carleton P., *PA* *H* '14
- The Kolevar Family
Kris T., *MI* *I* '85
Matthew P., *MI* Γ '14
- The Langenderfer Family
Brian A., *OH* *Z* '85
Claire R., *OH* *K* '18
- The Lewis Family
† Clarence I., *TX* Γ '39
Clarence I., Jr., *LA* *B* '63
- The Lott-Swofford Family
Charles R. Lott, *LA* Γ '59
Ellen Lott Swafford, *LA* Γ '88
Michael F. Swafford, *LA* Γ '88
David C. Lott, *NC* Γ '94
Christa A. Swafford, *LA* Γ '15
- The McGinnis Family
R. Eugene, *TN* *E* '79
Raymond E., III, *TN* Δ '17
- The McIlvried Family
Howard G., III, *PA* Γ '53
Heather Himmelberger, *PA* *B* '85
- The McLaurin Family
† Banks, Sr., *TX* *A* 1911
† Banks, Jr., *TX* *A* '44
- The Maxwell Family
† Jewell C., *TN* *A* '47
Jewell C., Jr., *AL* *A* '75
- The Misnick Family
Susan A., *NY* *O* '85
Emily M., *MA* *H* '16
- The Mortenson Family
Victor A., Jr., *ME* *A* '70
Kathleen T., *MD* Γ '06
- The Moyer Family
† Harrison L., *ME* *A* '30 (grandfather)
Stanley L., *ME* *A* '87
Kathleen, *NJ* *A* '16
- The Narkiewicz Family
Gerard J., *MA* *Z* '82
Sophia D., *RI* *B* '08
- The Pederson Family
† Jerard M., *PA* Γ '47
† Jerard M., *OH* Δ '70
- The Penberthy Family
John T., *MT* *A* '75
Cailin M. Ventresco, *ID* *A* '13
Evan J., *ID* *A* '14
- The Petroccia Family
Malcolm W., *CT* *B* '75
Heather M., *FL* *A* '14
- The Pierre Family
Donald S., Sr., *AL* *A* '58
Donald S., Jr., *AL* *E* '90
- The Potvin Family
Karen C., *MA* Δ '83
Nicholas B., *MA* *A* '16
- The Presnell Family
Mary J., *KY* *A* '82
Kristin V., *GA* *A* '16
- The Renard-Irvine Family
Guy D. Irvine, *CA* *T* '83
Catherine A. Irvine, *AZ* Γ '15
- The Riedel Family
Nelson A., *OH* Γ '67
Kimberly S., *OH* Γ '90
- The Rockhill Family
† Richard A., *WI* *B* '65
Andrew A., *WI* Γ '90
- The Rojas Family
Mario B., Jr., *FL* *A* '83
Mario B., IV, *FL* Θ 15
- The Saville Family
† Thorndike, *NC* *B* 1914
† Thorndike, Jr., *CA* *A* '47
- The Sayre-Cole Family
Clifford L., Jr., *MD* *B* '47
Marie S. Cole, *NY* Γ '84
- The Scala Family
Anthony J., *NY* Ξ '74
Christopher W., *NY* Ξ '05
Victoria A., *NJ* Γ '15
- The Scarbrough-Hoover Family
† Robert E. Scarbrough, *TN* *A* '53
Ashby B. Hoover Jr., *FL* Γ '92 (in-law)
- The Scruggs Family
Sue T., *NC* *A* '84
Thomas A., *FL* *A* '15
- The Streng Family
Martin K., *NV* *A* '83
Brian K., *NV* *A* '12
- The Suchyta Family
Thomas J., *MI* Δ '85
Linda A., *MI* Δ '78
Paul J., *MI* *A* '08
- The Sukup Family
Charles E., *IA* *A* '76
Eugene G., *IA* *A* '10
Jonathan H., *IA* *A* '12
- The Sverdrup Brothers
George M., *MN* *A* '71
Keith A., *MN* *A* '75
Per G., *OH* Γ '96 (nephew)
- The Swalec Family
John J., Jr., *MA* *A* '77
John W., *MA* *A* '14
Caitlin M., *MA* *A* '16
- The Termaath Family
Stephen G., *TX* *A* '69
Stephanie C., *PA* *B* '93

The Tielking Family

†John W., *OH B '26*
John T., *MI Γ '62*

The Tom Family

†Bernard J., *CA I '65*
Eric E., *CA Θ '16*

The Troner Family

William A., *FL A '80*
David B., *FL A '15*

The Wells Family

Eugene F., *NY Θ '50* (grandfather)
Judith Wells Vigar, *RI A '83* (aunt)
Alan T., *RI B '16*

The White Family

Robert D., *VA A '76*
Melissa J., *NY Γ '14*

Siblings

The Bent publishes brother and sister members, plus twins as indicated.

The Bramblett Brothers

†Ernest K., II, *CA E '58*
George C., *CA E '59*

The Carter Brothers

Reid, *NY H '75*
Bruce W., *TX E '82*

The Cattoi Brothers

Robert L., *WI A '50*
William J., *WI A '57*

The Cesiel Brothers

Gregory G., *MI Z '83*
Douglas S., *MI Z '89*

The Cortes Sisters

Stephanie P., *PA A '17*
Jennifer A., *PA A '17*

The Creveling Siblings

Christopher J., *UT A '13*
Peter J., *UT A '15*
Polly, *UT A '17*

The Dangora Siblings

Lisa M., *MA Θ '12*
Daniel, *MA Θ '16*

The Davidson Brothers

Lee A., *OH Δ '65*
Lynn E., *OH Δ '76*

The Dean Twins

Randolph H., *IL Γ '77*
Robert K., *IL Γ '77*

The Dean Twins

Aaron T., *MI K '15*
Jacob T., *MI K '15*

The Denninghoff Brothers

Daniel J., *CO Z '04*
Matthew A., *KY A '15*

The DeOre Twins

Alan M., *NC A '16*
Ryan P., *NC A '16*

The Egbert Brothers

Ryan J., *UT B '15*
Scott C., *UT B '17*

The Emberton Brothers

†George E., *MA B '44*
†Thomas S., *MA B '44*

The Friant Brothers

†David R., *WV A '45*
Ray J., *WV A '52*

The Fricks Siblings

Charles T., *TN Γ '14*
Amy M., *TN Γ '15*

The Graves Twins

Daniel A., *TN A '16*
Robin C., *TN A '16*

The Greenwood Twins

Jacob R., *UT B '17*
Taylor E., *UT B '17*

The Harkous Sisters

Giselle F., *CA T '15*
Janelle G., *CA T '17*

The Hasnain Twins

Aqib A., *TX E '16*
Munib A., *TX E '16*

The Herzberg Brothers

†Ernst, *MA E '51*
†Robert F., *MA E '51*

The Huynh Twins

Nicholas D., *NV B '17*
Randolph Chase D., *NV B '17*

The Iaquinta Brothers

Eugene J., *WI A '74*
Lawrence J., *WI A '83*

The Inan Brothers

Baris E., *OR Γ '16*
Nihat C., *OR Γ '16*

The Jewett Twins

Michelle, *CA Z '17*
Nicole M., *CA Z '17*

The Kanaby Brothers

Randel R., *MI Z '70*
Kenneth D., *MI Z '73*

The Kanadi Brothers

Richard V., *CA A '15*
Patrick S., *CA A '15*

The Kent Twins

Katherine E., *MT A '15*
William H., *MT A '15*

The Khan Brothers

Saad N., *FL Γ '15*
Sarmad N., *FL Γ '16*

The Knapen Twins

Elisabeth M.-S., *NV A '17*
Helena M.-R., *NV A '17*

The Lallmamode Sisters

Tasleema T., *AZ B '97*
Noor, *AZ B '15*

The Leung Twins

Jordan J., *CA A '17*
Preston M., *CA A '15*

The Louis Brothers

Mitchell A., *OH Γ '14*
Michael F., *OH Γ '16*

The Love Brothers

Matthew Y.L., *WY A '16*
Michael E., *WY A '17*

The Mallery Brothers

Eric, *NY Θ '16*
Peter M., *NY Θ '18*

The Martin Brothers

Sean P., *NY N '16*
Conor, *NY N '17*

The Moore Twins

Caden J., *AL E '16*
Matthew E., *AL E '16*

The Murphy Twins

Conor J., *CA O '16*
Sean M., *CA O '16*

The Notaros Sisters
Jelena, *CO B '15*
Milica, *CO B '17*

The Olsen Twins
Luke, *NV B '17*
Zakai, *NV B '17*

The Parrott Twins
Benjamin D., *TN A '15*
Alexander C., *TN A '16*

The Pedrazas Hinojosa Twins
Micaela N., *CO A '17*
Michelle A., *CO A '17*

The Pierce Brothers
Connor D., *NY P '17*
Reginald D., *NY P '15*

The Plascencia Brothers
Joel P., *CA K '16*
Rogelio I., Jr., *CA K '16*

The Pons-Siepermann Siblings
Carlos A., *MI Γ '13*
Ines C. Stuckert, *MI Γ '13*

The Ray Twins
Gannon J., *AL A '17*
Tanner N., *AL A '16*

The Rodi Siblings
Christina M., *VA E '06*
Robert M., *VA E '17*

The Rojas Twins
Santiago, *MA A '16*
Sebastian, *MA A '16*

The Roswurm Brothers
Jacob S., *OK A '17*
Stephen J., *OK A '17*

The Ruberte Siblings
Ramon A., *PR A '00*
Lissette M., *PR A '01*

The Rucinski Twins
Justin W., *MI A '15*
Scott H., *MI A '14*

The Ryan Brothers
Tyler J., *MO B '15*
Nathan P., *MO B '17*

The Schaeffer Twins
Bryan A., *DE A '15*
Shaun B., *DE A '15*

The Scheffel Siblings
Kera N., *IL Γ '15*
Kyle P., *IL Γ '15*

The Steiner Brothers
Colton D., *NY N '11*
Mitchell D., *NY N '13*

The Snodgrass Twins
Allison M., *AZ B '15*
Amanda, *AZ B '15*

The Sunyecz Twins
Alec J., *OH Γ '16*
Ian L., *OH Γ '16*

The Tate Brothers
Zachary G., *TN E '15*
Hunter L., *TN E '16*

The Teich Twins
Benjamin P., *WI B '17*
John M., *WI B '17*

The Vinoski Brothers
Stephen B., *TN Δ '85*
James M., *TN Δ '87*

The Watts-Willis Brothers
Ian L., *CA Y '15*
Tristan A., *CA Φ '15*

The Zamin Brothers
Syed Ali, *LA A '11*
Syed Abbas, *LA A '16*

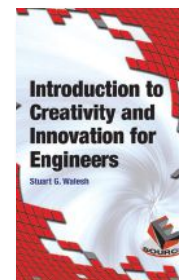
The Zarei Siblings
Keyan, *IA B '15*
Sanam, *IA B '15*
Kasra, *IA B '16*

Authors

(Continued from page 19)

those of Scott Adams, the creator of *Dilbert*. He has written *Random Musings of an Ordinary Guy*, a collection of witty anecdotes, political and social commentary, humor, wide-ranging ideas, and thought-provoking observations. Publisher is CreateSpace.

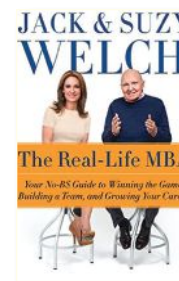
Stuart G. Walesh, Ph.D., P.E., Indiana Delta '63, has published his latest work *Introduction to Creativity and*



Innovation for Engineers. Following from his 40 years of engineering, education, and management experience in the government, academic, and private sectors, he offers neuroscience-based

knowledge and methods to enable you your organization to work smarter.

Jack Welch, born John F. Welch, Ph.D., Massachusetts Zeta '87, and wife Suzy have authored *The Real-*



Life MBA: Your No-BS Guide to Winning the Game, Building a Team, and Growing Your Career. It's the latest follow-up to their international blockbuster *Winning* and is billed as an "essential

guide for everyone in business today that explores the most pressing challenges related to creating winning strategies, leading and managing others, and building a thriving career." Publisher is HarperBusiness.

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ALUMNI NOTES

California Alpha

Michael E. Navolio Jr., '73, has received a Lifetime Legacy Award from Child Legacy International and a Southwestern Energy President's Award (stewardship category) for leading the Mount Kilimanjaro Clean Water Climb for five consecutive years. This raised over \$1.1 million dollars bringing clean water to over 2 million people in Malawi, Africa. He has worked in the oil and gas industry for 40 years.



Colorado Delta

Wade O. Troxell, Ph.D., '80, has been elected to his first term as mayor of Fort Collins, CO. Previously, he was a NATO Post Doctoral Fellow at the University of Edinburgh and has been on the faculty in the Colorado State University department of mechanical engineering since 1985. He has been elected twice as a member of Fort Collins City Council and held posts including chair of the National League of Cities Universities Communities Council.



Georgia Alpha

Zahed Siddique, Ph.D., '94, has been appointed associate director of the school of aerospace and mechanical engineering at Oklahoma University. Siddique is also a professor



of engineering at OU. His new role will include working "to improve the school's profile to both internal and external stakeholders, involvement in special projects, and the capstone program."

Indiana Beta

Gregory A. Hubbard, '94, received a master's degree from MIT and has become chief engineer for General Motors' extended-range vehicle and hybrid propulsion systems divisions. He leads engineers from throughout the world to develop propulsion systems for the Chevrolet Volt, Cadillac ELR, and other sustainable cars of the future.



Indiana Gamma

Ted H. McCourtney, '60, and wife Tracy have gifted \$2 million to Pennsylvania State University. This will create two new professorships, in the McCourtney Institute for Democracy and in the department of psychology. She graduated from the university and became a social worker, while he became a partner at pioneering capital fund Venrock.



Iowa Alpha

Richard S. Graff, '48, is a World War II combat veteran in Ashburn, VA. He now puts on his U.S. Army uniform and speaks at local school students to tell them about the war and the meaning of being thankful. Graff wants them to know that "a combat death is not a



statistic." The 91-year-old retired engineer has 4 children and 11 grandchildren.

Massachusetts Beta

Arvind Malhan, '95, has been named as a partner of the private equity firm New Silk Route in New Delhi, India. He joined NSR in 2010 as a principal and previously worked as an executive director at JP Morgan Private Capital Asia, and director of TVG Capital.



Massachusetts Epsilon

Logan C. Jackson, '16, has been named as Northeastern's first Rhodes Scholar and will do an M.Sc. in social intervention and policy, and an M.Sc. in education at Oxford. She is a civil engineering major, chapter president for the National Society of Black Engineers, and plays viola in her university's symphony orchestra.



Massachusetts Iota

Stephen J. Adamshick, Ph.D., '10, has become an assistant professor of electrical engineering in the Western New England University college of engineering. Adamshick has an extensive research background in nanotechnology, where he worked for both the college of nanoscale science at SUNY Polytechnic and most recently IBM Research developing 7 nm transistor technology.

Missouri Alpha

Darrell E. Melton, '56, is a retired NASA engineer who began his career in 1960 with the Marshall



Space Flight Center, Huntsville AL. He invented a rocket engine pressure switch which allowed a dual means of operating the switch, either with system pressure or calibrating pressure. It was a quick way to check pressures up to launch, and was used in Saturn V. Since retirement, Melton has lived in Springfield, MO.

Missouri Epsilon

Adnan Gabeljic, '14, has re-signed with United Soccer League club Sacramento Republic. He first joined the club in 2015, appearing in 17 matches and scored five goals in all competitions, including a hat trick against



Chula Vista FC in the U.S. Open Cup. Gabeljic's hat trick was the first by a player of Bosnian heritage in U.S. Open Cup history. The forward has been training with Mexican Liga MX club Atlas FC. He will train with the Atlas FC first team during the USL off-season.

New Jersey Delta

Sarah H. Cen, '16, has been awarded a Daniel M. Sachs Class of 1960 Graduating Scholarship to travel abroad after graduation. She is a mechanical and aerospace engineering major and will pursue a master's degree in engineering science at the University of Oxford's Worcester College. Cen will focus her research on mobile robotics and autonomous transportation systems.

New York Kappa

John W. Betz, Ph.D., '76, has been honored by the International Association of Institutes of Navigation with its John Harrison Award. This award for out-



standing contributions to navigation is presented once every three years at the IAIN world congress. Betz received it in Prague. He is a fellow of The MITRE Corporation and was recognized for innovations in signal modernization for global navigation satellite systems, and contributions to global navigation satellite systems.

Tennessee Alpha

Chad L. Davis, '07, has been promoted to scientist at Orbital ATK (formerly Orbital Sciences Corp.) where he is the Houston Operations Lead. He supports the commercial contract delivering supplies to the



International Space Station as a mission ops lead working directly with Mission Control at NASA Johnson Space Center. He is also deputy project manager on NASA's project developing a deep space habitation system for exploration in support of the journey to Mars. Davis serves as an Air National Guard reserve pilot.

South Dakota Alpha

Larry A. Simonson, Ph.D., P.E., '69, has been named the new alumni director of the South Dakota School of Mines and Technology Alumni Association. He had been a development officer at the SD Mines Foundation for the past eight years, and served as TBII Association President from 2006-14. Professor Emeritus Simonson was a faculty member in the electrical and computer engineering department for 32 years, including four years as department chair.



Texas Alpha

Joan F. Brennecke, Ph.D., '84, is the recipient of a U.S. Department of Energy grant "for research that could fundamentally change the way the country uses and produces



energy." This was announced by the University of Notre Dame where she is a chemical and biomolecular engineering professor. Brennecke

will study how ionic liquids, or salt in a liquid state, can improve the efficiency of carbon dioxide capture. She previously led a research team in 2004 that demonstrated ionic liquids have the potential to efficiently capture CO₂ from the flue gas of coal-fired plants.

Wyoming Alpha

Gordon W. "Jeff" Fasset, P.E., '74, has become director of the Nebraska Department of Natural Resources.



He was director of the water rights strategic program for HDR Engineering, Inc., where he was involved with water supply, water rights, and water resources development projects across several states. Fasset also kept a water rights and resources engineering practice in Wyoming and Colorado for municipal and state government, energy, mining, and private landowner clients.

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!

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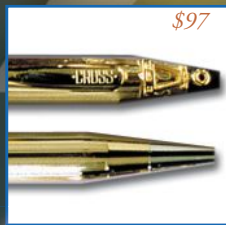
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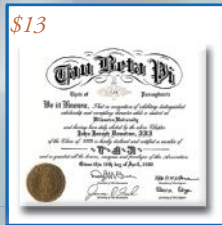
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