actuarial REVIEW

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PUBLISHED BY THE CASUALTY ACTUARIAL SOCIETY

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CAS ELECTIONS 2015

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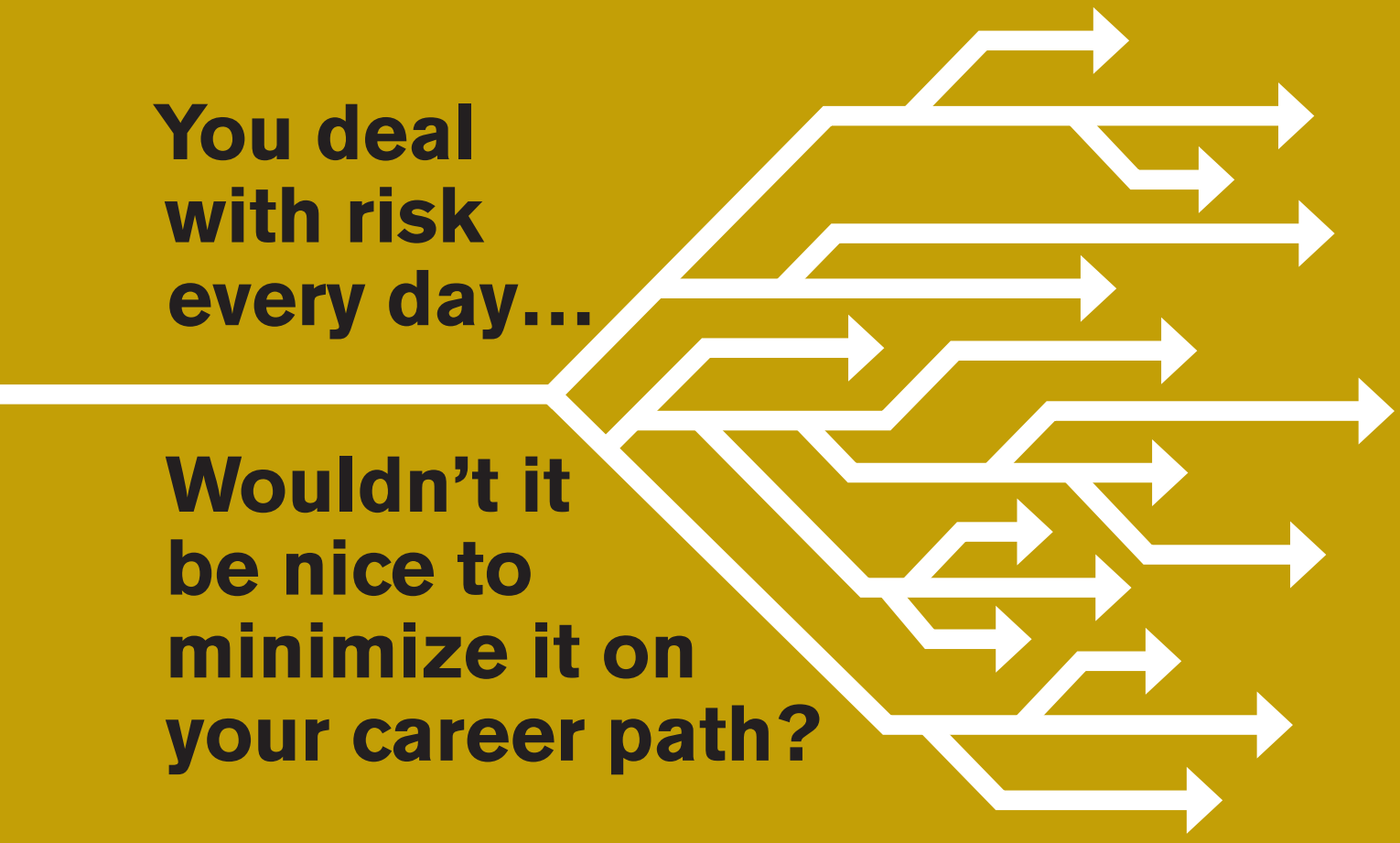

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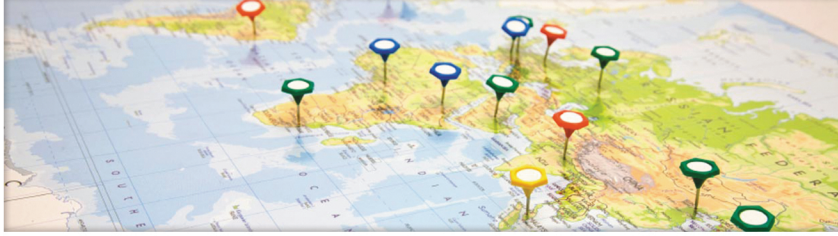

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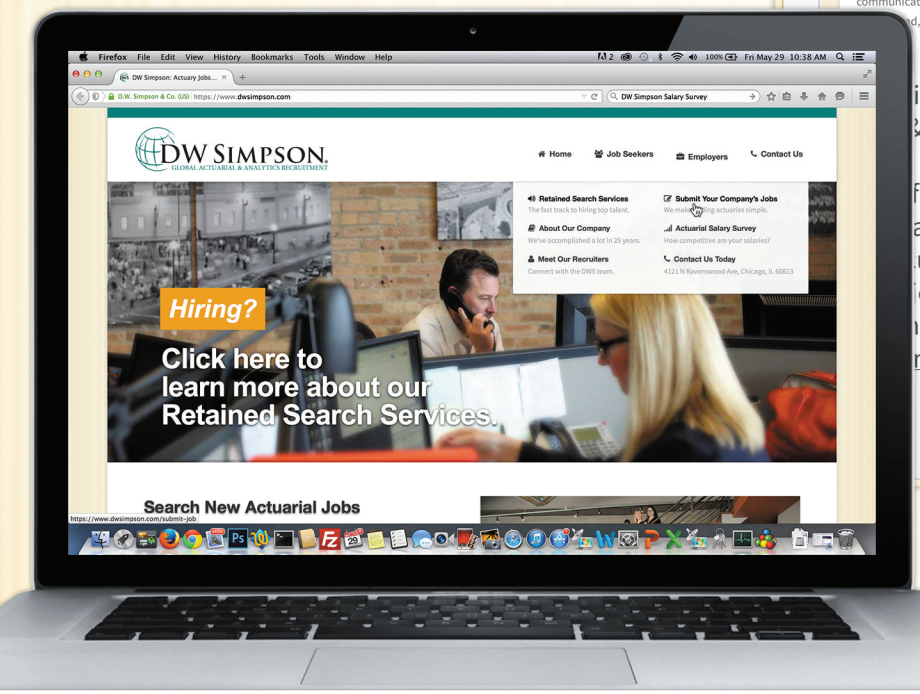

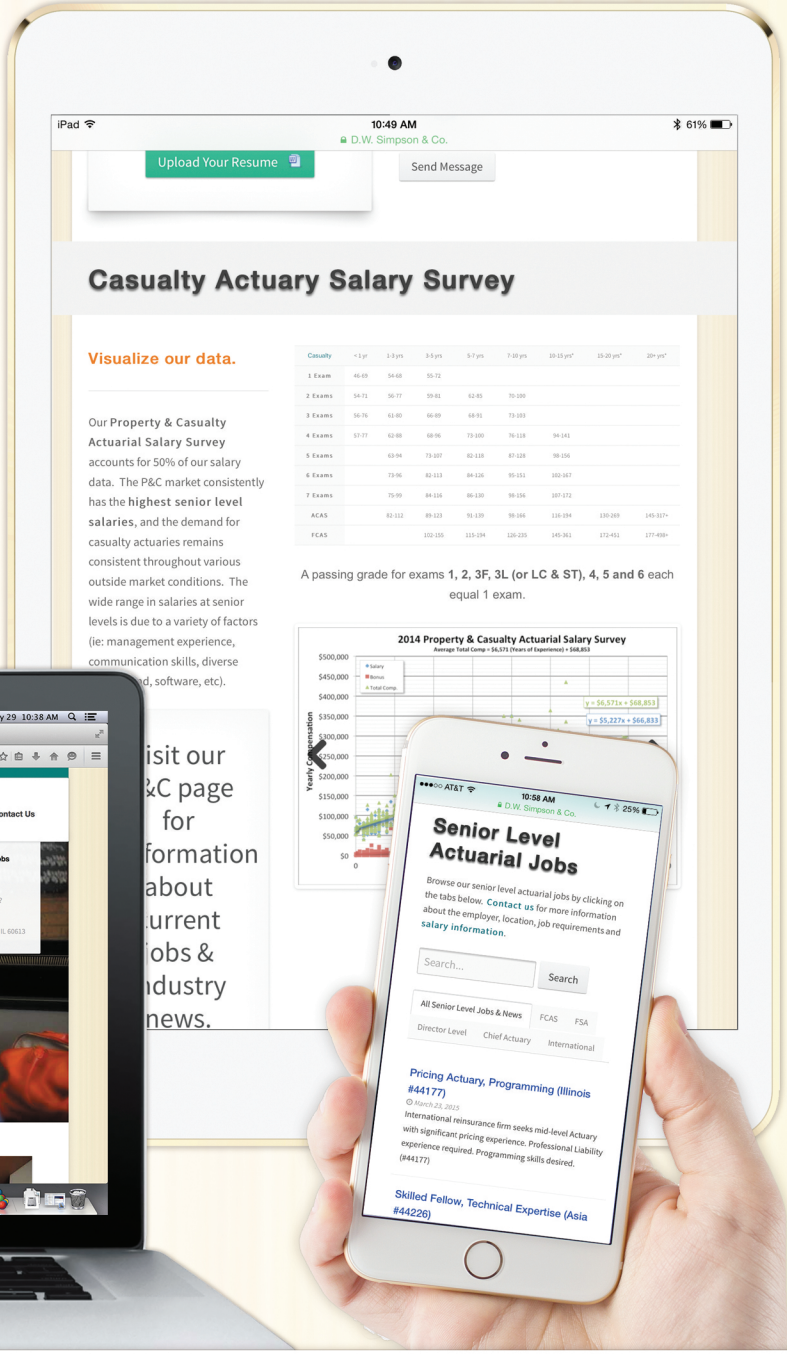

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July/August 2015

actuarial REVIEW

departments

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on the cover

CYBER INSURANCE
THE ACTUARIAL CONUNDRUM

BY ANNMARIE GEDDES BARIBEAU

With scarce data and its ever-evolving risks, cyber coverage poses vast challenges for actuaries working in this emerging line of business.

CAS Election 2015

Meet the nominees for CAS president-elect and board of directors.

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actuarialREVIEW
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Some Things Never Change

Flummoxed. That's what I felt when I read "Latest Trends in Auto Insurance Fraud," an article in the issue by Joe Wehrle, of the National Insurance Crime Bureau.

What was so perplexing?

Some people still leave the keys in their cars and then their cars get stolen!

It's a very simple anti-theft measure people can perform — don't leave keys in the car — yet this type of auto theft is on the rise. (Now I understand why keyless ignition is an important feature.) This was a problem when I first got into the industry, and it's *still* not resolved.

Some things never change, but some things that never change *can* be good things. Take CAS elections. Now the candidates do change, but the importance of voting does not. I hope all members will read the bios of dedicated members up for election in the "Meet the Candidates" section.

Another thing that never seems to change is the creative mind of our "Humor Me" Editor Michael Ersevim. He proposes some new actuarial holidays in addition to "pi-day," which I understand is celebrated in at least one insurance company.

Laurie McClellan also returns to the pages of *AR* with an "On the Shelf" column on Marc Goodman, the author of *Future Crimes*. If you don't believe that cybercrime is a problem, you must read this column, which is a fitting complement to our cover story by Annmarie Geddes Baribeau.

And finally, I was struck by a point Kate Niswander made in "CAS Staff Spotlight":

> My job is to help nonactuarial audiences make the connection between our members' skill sets and the public issues in which actuaries can contribute valuable insight…

Niswander and the CAS have quite a challenge before us. It's one that hasn't changed in a very long time, but we are making progress.

Postscript:

Those of you who attended the 2015 ERM Symposium might find the *AR* cover artwork familiar. Featured speaker Peter Singer had a slide show of similar representative visuals on cyber insecurity. Special thanks go out to GRAPHEK, the award-winning design firm that created this cover.

Actuarial Review always welcomes story ideas from our readers. Please specify which department you intend for your item — Member News, Solve This, Professional Insight, Actuarial Expertise, etc.

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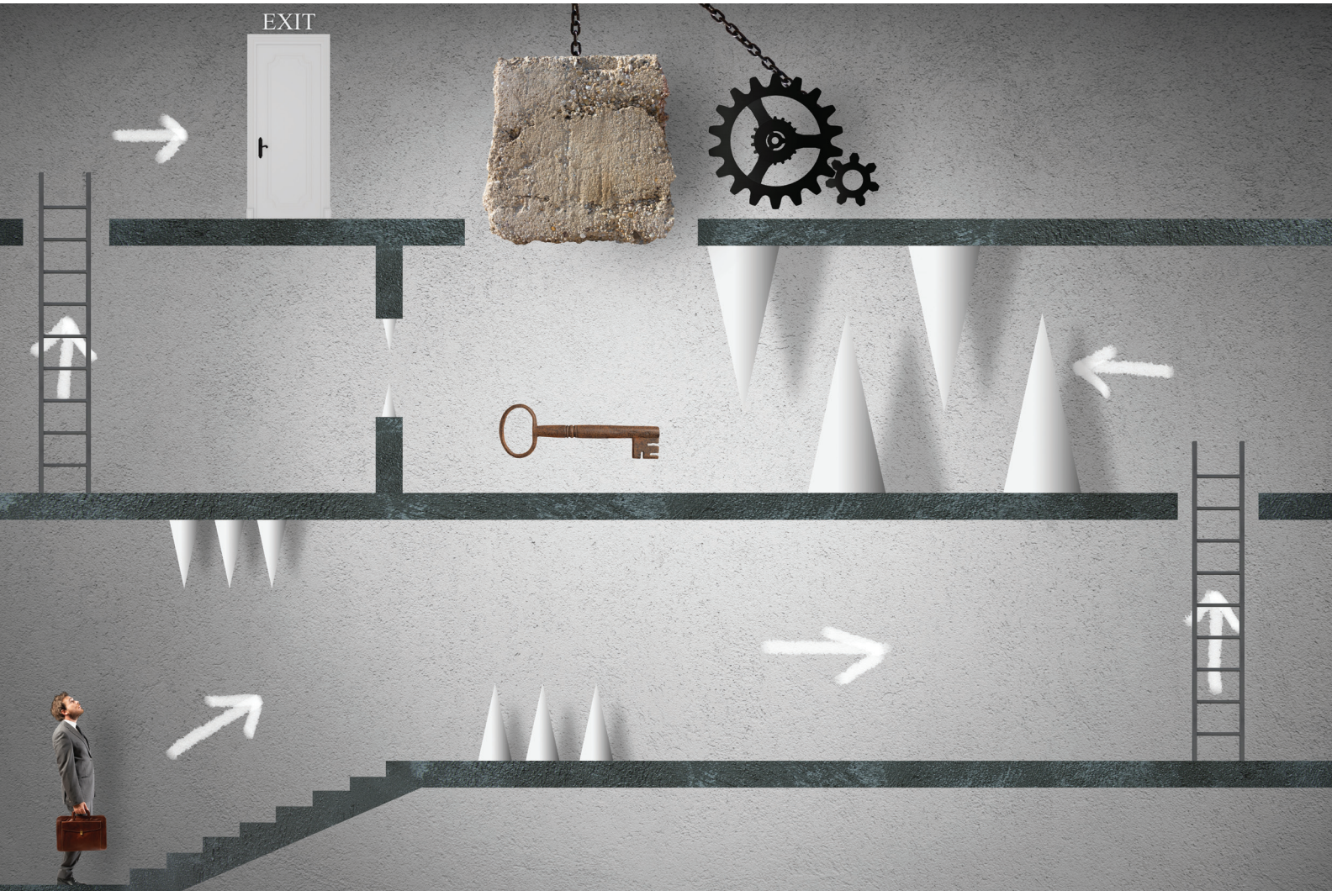

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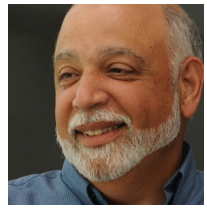


Collaboration with Competitors — What Do We Stand to Gain? What Might We Lose?

Whether we like it or not, the environment for the Casualty Actuarial Society and its members is changing. One might paint different pictures of these environmental changes. One picture might be a major paradigm shift for the CAS that drives innovation and excellence. Another picture might be an evolution of our actuarial profession and the role of the CAS among other organizations in the profession, perhaps including some vision of consolidation, or another picture might be an end to our tidy view of the world, perhaps a more chaotic conglomeration of our profession with data scientists, financial engineers and behavioral architects.

As a CAS member and as an actuary, I have always put a very high value on the ability to share knowledge and expertise among colleagues who do the type of work and face the same problems that I do. Some of that sharing is among actuaries who work for competitors. Nonetheless, we all can and do gain from the community of knowledge sharing and collaborative spirit. Many other professional disciplines also experience the value of collaboration, in particular among scientists and academic scholars. They also operate in environments that can be quite competitive.

Big data, data science and data analytics are changing the way we work and think. They have already had an impact in many aspects of our personal and professional lives. It is not simply a matter of what we have to offer or how we get recognized in this crowded, confusing and competitive field. Rather the questions are how do we accelerate our knowledge, practical experience and insights, and how do we make a difference where data-driven decisions are most needed.

One of the most important talents that I have gained from my CAS education and being a part of the CAS culture has been studying other disciplines and learning how to integrate various concepts from mathematics, statistics, economics, law, business, behavioral science, finance, accounting, technology, medicine, engineering, environmental science and public policy. I could not have learned so much of value to my work and my career, if it were not for the multidisciplinary approach to professional education that is core to the CAS. It is this core that teaches how to separate the "signal" from the "noise."

In his book *The Signal and The Noise*, Nate Silver refers to the Russian novelist Leo Tolstoy's essay "The Hedgehog and the Fox," the title of which was borrowed from Greek poet Archilochus. The hedgehog is described by Silver as one who trusts "in governing principles about the world that behave as though they were physical laws." Silver calls the fox a scrappy creature "who believes in a plethora of little ideas and in taking a multitude of approaches towards a problem." Silver further portrays foxes as multidisciplinary, adaptable, self-critical, complexity-tolerant, cautious and empirical. According to Silver, it turns out that foxes have some key tendencies, such as finding new approaches, pursuing multiple approaches, acknowledging prediction errors, making predictions in probabilistic terms and relying more on observations. Silver has discovered that foxes are pretty good at forecasting.

Foxes have some key tendencies, such as finding new approaches, pursuing multiple approaches, acknowledging prediction errors, making predictions in probabilistic terms and relying more on observations. … There is no doubt in my mind that the CAS has taught me how to be a fox.

So do you want to be a fox?

There is no doubt in my mind that the CAS has taught me how to be a fox. Many of the problems actuaries work on require decisions where the outcomes are not inherently predictable. Hence, the field of data analytics and its application to data-driven decision making is a natural fit for a CAS-trained actuary.

Today, however, we are vastly outnumbered by growing herds of wannabe foxes. Predictive analytics, data analytics and data science are the territory that attract this new breed of fox. Big data is their source of energy.

So our challenge is to expeditiously collaborate with this new breed of fox.

President's Message, page 8

President's Message

from page 6

It is a time to build upon our current alliances, form new ones and expand our sphere of influence. We should be inviting and recruiting these new foxes into our "den."

Our CAS actuarial community has long advocated collaboration, but we have become distracted from these values by the potential for competition among actuarial organizations. This distraction should not direct our attention away from the new breed of fox surrounding us. We need to have a clear vision of how to be a world-class collaborator, especially beyond our traditional actuarial boundaries.

Let's not dial down our collaborative efforts or narrow our views of collaboration because of changes in competitive attitudes — to do so is the antithesis of being a fox.

We have a century of learning from many disciplines as our foundation. This foundation has helped us solve problems and make well-informed, data-driven decisions, sometimes beyond traditional actuarial problems. Our future contributions to society are tied to our collective and individual skills as world-class collaborators. Those who share our view of collaboration should earn our respect, and they should be respected as kindred collaborators by our leaders, even if we do compete in some areas.

Competition is the noise. Collaboration is the signal. Be a fox.

Please share your reactions and ideas by leaving a comment on the CAS Roundtable Blog, where a version of this column has been posted.

COMINGS AND GOINGS

Anusha Anantharaju, FCAS, MAAA, has joined IFG Companies as assistant vice president in the corporate actuarial department. She will be responsible for the strategic application of predictive analytics for use in underwriting, production processing and other targeted areas. Anantharaju brings seven years of progressive experience in predictive modeling, pricing, reserving and reporting within the property-casualty insurance industry. Most recently, Anantharaju worked as an assistant actuary at Liberty International Underwriters in its energy and construction areas.

Kinsale Capital Group has promoted **Brian D. Haney, FCAS, MAAA**, to the position of chief operating officer. Haney's responsibilities will include Kinsale's underwriting operations and investor relations. Haney has been Kinsale's chief actuary since the company's founding in 2009. Prior to joining Kinsale, Haney held the chief actuary position at James River Insurance Company and Colony Insurance Company.

W. R. Berkley Corporation has appointed **Dana R. Frantz, FCAS, MAAA**, as vice president-corporate actuary. Frantz, who joined W. R. Berkley Corporation in 2010 as assistant vice president - corporate actuary, has over 15 years of actuarial experience. She holds a BS in mathematics from the Pennsylvania State University and a MBA from the University of Illinois at Chicago.

Ted Wagner, FCAS, MAAA, has joined The Warranty Group as executive vice president and global chief underwriting and actuarial officer. In this role, he will be responsible for the organization's global underwriting and actuarial functions. Wagner brings nearly 25 years' experience to the role having previously held a variety of positions at Amerisure Insurance Company including both chief actuary and chief underwriting officer.

Vincent T. Donnelly, FCAS, MAAA, received the 2015 Franklin Award from the Philadelphia CPCU Society Chapter. The annual award recognizes individuals, groups or organizations for outstanding achievements and contributions to the insurance industry in the Delaware Valley. Donnelly is the president and chief executive officer of PMA Companies, a role he has held since 2004. He also serves as president and chief operating officer of the PMA Insurance Group.

Charles F. "Chap" Cook, FCAS, CPCU; **Bob Daino, FCAS**; **Owen Gleeson, FCAS, Ph.D**; and **Lawrence Williams, ACAS**, have organized their consulting practice as MBA Actuaries LLC, and are now located in Parsippany, New Jersey. All are insurance, reinsurance and expert witness veterans, as well as members of the American Academy of Actuaries. Their combined years of experience as seasoned property-casualty actuaries create an excellent dynamic when complex, new and unusual solutions are required. Insurance, reinsurance and expert witness veterans.

Tom DeFalco, FCAS, MAAA, retired from NJM Insurance Group on May 1, 2015 as vice president and chief actuary after 30 years of service. During

his tenure at NJM, the actuarial function grew from one actuary to a total of 14 employees and four members of the department achieved ACAS and three FCAS. DeFalco served on essentially all New Jersey-specific actuarial committees over the past 30 years. He was most notably involved in the transition from the large residual market of the 1980s and his work on the Territorial Study Commission in the early 2000s. He will continue to serve on several CAS and Academy committees, panels and task forces, including the Committee on Property and Liability Financial Reporting and the Actuarial Standards Board Casualty Committee.

EMAIL "COMINGS AND GOINGS" ITEMS TO AR@CASACT.ORG.

ACTUARIAL REVIEW *LETTERS POLICIES*

Letters to the editor may be sent to ar@casact.org or the CAS Office address. Include a telephone number with all letters. Actuarial Review reserves the right to edit all letters for length and clarity and cannot assure the publication of any letter. Please limit letters to 250 words. Under special circumstances, writers may request anonymity, but no letter will be printed if the author's identity is unknown to the editors. Announcement of events will not be printed.

We're Number 1! Again!

In its annual Jobs Ranking report, Careercast.com has again rated "actuary" the number one job in the United States — a rank it previously held in both 2010 and 2013. This year, actuaries beat out 200 other professions by showing consistently high ratings in categories such as job satisfaction, hiring outlook and average pay. The profession's continued growth is paralleled in the CAS membership, which now totals over 6,500 and saw the addition of 266 new Fellows and 453 new Associates in 2014. University students have also demonstrated an increased interest in learning about the CAS career path: CAS Student Central, the student membership program that provides numerous actuarial resources to college students, gained over 2,400 student members from over 350 different universities in its first year.

CALENDAR OF EVENTS

Interactive Online Courses
"Understanding CAS Discipline Wherever You Practice"
"Introduction to Predictive Modeling"
www.casact.org/education/interactive/

September 9-11, 2015
Casualty Loss Reserve Seminar (CLRS) & Workshops
Omni Hotel at CNN Center
Atlanta, GA

October 1-2, 2015
CAS Enterprise Risk Management Seminar
Minneapolis, MN

October 22-23, 2015
In Focus Seminar — Expanding the Toolset: Underwriting Collaboration
Hyatt Regency Cambridge
Boston, MA

November 15-18, 2015
CAS Annual Meeting
Philadelphia Marriott Downtown
Philadelphia, PA

March 14-16, 2016
Ratemaking and Product Management (RPM) Seminar & Workshops
Disney's Yacht & Beach Club Resort
Orlando, FL

HUMOR ME BY MICHAEL ERSEVIM

Proposed Holidays for Actuaries

In addition to the common company holidays, I would humbly suggest a few extra days off for actuaries.

1/1, 2/4, 3/9, 4/16 and 5/25 — (Month² = Day) Days

C'mon, whenever the day is equal to the month squared, you should be able to sleep in. Notice that 1/1 and 5/25 have already been given to us in 2015, so three more shouldn't have taken too much effort. Going forward …

1/6/18 — Rho Day

Plan now as there are less than three years to go for this once-in-a-century phenomenon. It promises to be a "golden" day!

1/1/23, 1/12/35, 11/23/58 — Fibonacci Days

These are good days to binge watch your favorite TV series on Netflix or whatever entertainment conveyances exist in the future — microchip brain implant, anyone? Be sure to watch the shows in pairs and always re-watch the prior episode first.

2/7 — "e" Day

Clearly, 2/7/18 will be part of a big year (along with Rho Day) for the irrational and transcendental numbers. I've already booked my dinner reservations.

3/14 — Pi Day

This is a good time for *any* mathematically inclined person to be home celebrating with family all around. If you were lucky enough to be born on this holiest of high holidays, you get the entire week off.

When he's not dreaming up holidays, Michael Ersevim, ACAS, is AVP-Actuary for AmTrust Underwriters, Inc. in Rocky Hill, Connecticut.

Kate Niswander, Marketing and Communications Manager

Welcome to the CAS Staff Spotlight, a column featuring members of the CAS staff. For this spotlight, we are proud to introduce you to Kate Niswander.

- **What do you do at the CAS?**
  As marketing and communications manager, I work on initiatives designed to promote the CAS and the work of our members to external audiences. I help to produce press releases, communication plans and other vehicles to promote CAS initiatives, research and publications. My job is to help nonactuarial audiences make the connection between our members' skill sets and the public issues in which actuaries can contribute valuable insight, such as climate change, automated vehicles and cyber risk.
- **What do you enjoy most about your job?**
  I enjoy the challenge of translating actuarial concepts and research into more universal terms. I like helping to educate people about the role that actuaries play in many of today's most important business functions. I also love working with the CAS volunteers who serve on my marketing committees; they continually amaze me because they seem to have the best of both worlds — left-brain analytical skills with a right-brain eye for creativity. It's truly a rare combination.
- **Hometown:**
  Buffalo, New York
- **College and degree:**
  The George Washington University, B.A. in French Language and Literature; and American University, M.A. in Strategic Communication.
- **First job out of college:**
  I was a coordinator at a media non-profit that worked to advance women in television and radio.
- **Describe yourself in three words:**
  inventive, personable, authentic.

Kate Niswander

- **Favorite weekend activity:**
  I recently completed a two-year graduate program that held classes on Saturdays from 9 a.m.-5 p.m. Now I'm trying to remember what I used to do on weekends!
- **Favorite travel destination:**
  France. I was a French major in college and I love everything about the language and culture. I wouldn't turn down freshly baked croissants, either.
- **One interesting or fun fact about you:** I used to be a competitive tap dancer.

New Regional Affiliate Named; Holds First Seminar

The newest CAS Regional Affiliate unveiled its new name at its first meeting held June 12 at the China Re Building in Beijing. ARECA, which stands for Asia REgion Casualty Actuaries, was host to around 90 international CAS members and insurance industry professionals. The one-day seminar included presentations on as catastrophe risk modeling, motor detariffication and automated vehicles.

"Our inaugural meeting was a huge success," said Delvin Cai, FCAS, ARECA president. "We look forward to harnessing this energy and bringing the same level of programming to future ARECA events across Asia." Other ARECA officers for 2015 are Tony Gu, FCAS, president-elect; Yu Shan (Cathy) Hwang, FCAS, secretary/treasurer; Bo Huang, FCAS, VP East Asia; Herb Desson, ACAS, VP Southeast Asia; Waswate Ayana, FCAS, international advisor.

The new Regional Affiliate conducted a "Name That Affiliate!" contest earlier this year. James Sandor, FCAS, came up with the winning submission and won his choice of an Apple Watch Sport or iPad Air 2.

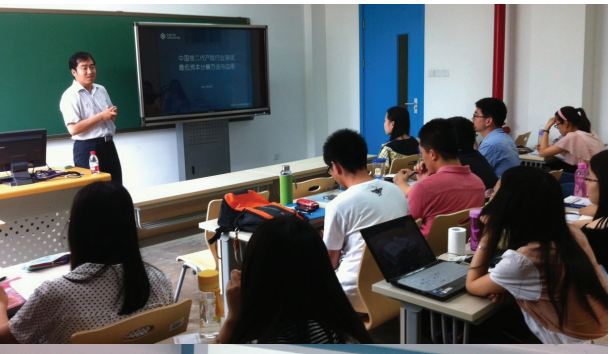
For more on ARECA and its upcoming events, contact CAS International Relations Manager Michael Chou at mchou@casact.org.

Engaging Universities and Attracting Young Talent BY XIAOXUAN (SHERWIN) LI

Attracting more young people to become actuaries is a necessary approach to maintaining the vitality of the profession. CAS members in China have made this a priority through a cooperative program that has been in place for three consecutive years between the CAS and Peking University, one of the most prestigious universities in China.

In September 2012, Dr. Kai Chen, an associate professor in Peking University's risk management and insurance department, got in touch with CAS members in China and pitched a worthy idea. His wish was to have these CAS members visit the campus and give presentations to the students about the different aspects of casualty actuarial science. Ms. Xuelian Wan and Ms. Sheen Allen, coordinators of the CAS University Liaison program in China, forwarded Dr. Chen's idea to me and appointed me the main contact to drive the program.

The author lectures students at Peking University.



During the fall 2012 semester, three CAS members volunteered to contribute to the cooperation program. Mr. Yao Wang from Towers Watson began with a presentation on non-life insurance ratemaking. Then Mr. Qinnan Zhang from China Export & Credit Insurance Corporation joined with a presentation on non-life insurance reserving. I gave the final presentation on non-life reinsurance. Feedback from the students and teachers in Peking University on these interactions was very positive; both parties were even more confident to continue the program in the future.

In 2013 three more CAS members volunteered for the cooperative program with Peking University; Ms. Sheen Allen from Deloitte, Mr. Long Li from China Life P&C and Dr. Li Zhang from China Re P&C visited the university, making presentations on non-life insurance ratemaking, non-life insurance reserving and non-life reinsurance, respectively. The cooperative program continued in fall 2014, with the presentations from Dr. Ting Yu from Ernst & Young on non-life ratemaking, Mr. Qinnan Zhang from China Export & Credit Insurance Corporation on non-life reserving and from me on non-life reinsurance.

Time flies quickly and three years have passed. All the volunteers who made contributions to the program are greatly appreciated. In 2015 we are going to push forward the Peking University program with even more energy, recognizing its benefits for both the profession and the university. We are also looking for opportunities to expand this kind of cooperative program to other universities in China in the hope that more and more talented youth will be attracted to the promising profession and will keep it vibrant.

The Chinese insurance market has been growing very rapidly during the past decade, with an annual average growth rate of around 20 percent in premium income. According to public statistics, the Chinese insurance market became the fourth largest in the world at the end of 2013.

Nevertheless, the actuarial profession in China is very young, especially for the property-casualty business. The CAS members practicing in the Chinese market are making great efforts to enhance our profession's contributions to the public. We also hope to gain more recognition in society.

Xiaoxuan (Sherwin) Li, FCAS, FIA, FCAA, CCRA, ARA, MCSE, is the assistant general manager of the actuarial and risk management department for China P&C Reinsurance Company Ltd. in Beijing. He has served as a CAS University Liaison as well as a member of the CAS Syllabus Committee.

CAS Student Central Recognized for Excellence BY KATE NISWANDER, CAS MARKETING AND COMMUNICATION MANAGER

The CAS has been recognized by the American Society of Association Executives (ASAE) for the successful launch of CAS Student Central in 2014. ASAE's annual awards competition, the Gold Circle Awards, honors excellence, innovation and achievement in association/nonprofit marketing, membership and communications programs. This year's competition received 193 submissions in 16 different categories. The CAS earned a Merit Award in the Membership Recruitment Campaign category for its innovative tactics and initiatives to launch its new university student program.

CAS Student Central is a free membership program that offers university students access to the latest news, information and advice as they make the transition from college to credentialed actuary. Launched in January 2014, the multicomponent marketing campaign that garnered the award included a dedicated CAS Student Central website and online community, videos highlighting CAS members in the early stages of their careers, social media pages across LinkedIn, Facebook and Twitter, and an infographic showcasing the CAS's credentialing benefits and resources for students.

The CAS also leveraged collaborative partnerships with other organizations that serve university actuarial students, such as Gamma Iota Sigma and the Actuarial Students' National Association, to help promote and grow CAS Student Central.

The program has experienced enormous success in its first year, gaining over 2,400 student members from over 350 different universities. At the same time, the CAS has enhanced its partnerships with the academic community by introducing CAS Academic Central, a free membership program for professors teaching actuarial science, mathematics, economics, business or related topics. Academic Central includes 280 members at over 175 universities.

CAS Student Central offers numerous benefits to its student members, including resources such as skill-building tips, free webinars on topics designed specifically for the university student audience, and invitations to networking events to help connect students with casualty actuarial professionals. The program exemplifies the CAS's deep commitment to the next generation of casualty actuaries, helping to guide students through the maze of curricula, rigorous exams, and promising internships that lead, ultimately, to a challenging and rewarding career.

"The success of CAS Student Central surpassed our expectations," said Melissa Tomita, chair of the CAS University Engagement Committee and senior actuary at Nationwide Insurance Company. "As the program continues to grow, Student Central members will see increasing benefit and value in connecting with the CAS."

"It is an honor to be recognized by ASAE for the CAS Student Central membership recruitment campaign," said Mike Boa, chief communications officer for the CAS. "A marketing campaign aimed at university students required us to explore innovative ways to reach this younger demographic. Our consulting firm, The Yu Crew, was instrumental in helping us design and execute a campaign that engaged students and encouraged them to join the program and learn about the CAS. The staff and volunteer members who brought the campaign to life should be justly proud of this recognition."

ASAE is a membership organization of more than 21,000 association executives and industry partners representing 9,300 organizations. Its members manage leading trade associations, individual membership societies and voluntary organizations across the United States and in nearly 50 countries around the world.

Winners in the Gold Circle Award competition were recognized in June at ASAE's 2015 Marketing, Membership & Communications Conference in Washington, D.C.

The Many Benefits of the CAS Student Programs BY TAMAR GERTNER, CAS

UNIVERSITY ENGAGEMENT MANAGER

If you were at a CAS meeting or seminar in the last year and overheard screams, laughter and cheers from one of the rooms, you were likely passing by a CAS Student Program interactive session.

The shrieks come courtesy of Eric Schmidt of Allstate Insurance, who has introduced a fun activity that breaks the ice with students while teaching the basics of ratemaking. (For more on how to play the game, see the sidebar.)

Today, the CAS incorporates its one-day student programs into all national CAS meetings and seminars. The student programs offer a full-day of learning and networking. Sometimes a Career Session is added that includes conducting mock interviews and taking professional headshot photos.

To participate, students must be members of CAS Student Central, and with more than 3,000 members, the student programs fill up fast! Each program hosts up to 30 students per event, consisting of both local students and those who fly in from other cities. More than 230 students from over 50 schools throughout North America have attended CAS Student Programs since they were first introduced in 2013.

The response to CAS Student Programs has been overwhelmingly positive. Students appreciate the opportunity to learn more about the CAS and the property-casualty field. One student stated, "I'm walking away from this program having learned a great deal about what a P&C actuary does." Another student enjoyed meeting practicing actuaries and "getting a sense of the environment and energy of the actuarial field."

Mentoring is a key feature of the program. Students are paired with CAS members who act as mentors throughout the event day. They network and attend sessions together. Nearly every evaluation submitted by students identified the time spent with a mentor as a highlight of the day. As one student shared, "The pairing with a mentor was incredibly valuable and an excellent experience to learn about the daily life and responsibilities of an actuary."

The value that students receive from participating in CAS student programs extends beyond the one-day event. "The opportunity we provide students to network with practicing actuaries and to make connections has been leading to interviews and jobs," said Melissa Tomita, chair of the University Engagement Committee.

Yuval Halperin, president of the Actuarial Student Association at the University of California at Santa Barbara, was so intrigued by one of the CLRS sessions he attended that he approached the presenter with questions. "My further interest led to an internship opportunity with the presenter's firm, Oliver Wyman, this summer," said Yuval.

For Railya Ismailova, a 2014 graduate of Virginia Commonwealth University, connecting with one of the mentors would have a significant impact upon her career after graduation. While attending a program at the Ratemaking and Product Management Seminar during the spring semester of her senior year, Ismailova met her mentor, Kelly Sullivan of Markel Corporation. It just so happened that Markel had an opening that summer for an internship in the ac-

Students play a basic ratemaking game at a CAS Student Program interactive session.

Basic Ratemaking: The Rules of the Game

The Basic Ratemaking activity has been extremely well received, and students have been so impressed that they have been replicating the activity in their own student clubs. Here's how to play:

The game creates an insurance marketplace with dedicated insurance companies and consumers. The students divide up with a small group playing the part of insurance company employees and the remainder participating as consumers. A CAS member acts as the regulator, and through a series of rounds, the consumers attempt to throw a ball into a basket. Each missed toss simulates an accident. Over the course of 4-5 rounds, the regulator places restrictions on the marketplace, changing the dynamics of the loss trigger in real time. The Students have to adapt on the fly. After each round, the insurance companies evaluate their rates and then sell insurance to the consumers.

tuarial department. "Railya was already one of our top choices," said Markel. "She was then such a good fit that we ended up hiring her full time. The Student Program was a great opportunity for everyone."

The University Engagement Committee continues to infuse new and exciting ideas to enhance the student experience. Two programs remain in 2015 — the Casualty Loss Reserve Seminar in Atlanta and the Annual Meeting in Philadelphia. To volunteer as a mentor or to assist with other aspects of the program (planning, speaking, etc.) please contact Melissa Tomita, University Engagement Committee Chair at TOMITAM1@nationwide.com or Tamar Gertner, CAS University Engagement Manager at tgertner@casact.org.

A typical CAS student program schedule.

NEW FELLOWS ADMITTED IN MAY 2015

Row 1, left to right: *Siew Gee Lim, Yiying Xie, Andrew Bond Thompson, Ran Guo,* **CAS President Bob Miccolis**, *Daniel R. Donahue, Jamie Shooks, Steven Joseph Walsh, Jose Antonio Ramos.*
Row 2, left to right: *Michael Mendel, Jing Meng, Yang Angela Cao, Qiong Wei, Benjamin James Villnow, Yan Miao, Laura Cremerius, David F. Lee, Brock A. Seim.*
Row 3, left to right: *David Markowitz, Jun Zhou, Ashley Persson, Jill M Rosenblum, Nihar M. Shah, David Adam Ring, Debdatta Bose, Naheed Z. Jaffer, Wei Pan.*

Row 1, left to right: *Laura Anne Allen, Andrea Lucchesi, Warren Pagsanjan San Luis, Ika Marissa Irsan,* **CAS President Bob Miccolis**, *Nathan Andrew Miller, Nicolas Nadeau, Mariel Capco, Sabrina Yuen-Ming Yip.*
Row 2, left to right: *Allison T. Nelson, Michael L. Krakoff, Lon Chang, Sarah Louise Hunter, Ashley Jean Kramer, Stewart Brent Guerard, Jennifer Robin Fucile, Carrie H. Kuczak.*
Row 3, left to right: *Charles Lindberg, Stanislav I. Gotchev, Paul M. Grammens, Patrick Santala, Olivier Bernier, Mauro Garcia II, Jianhui Yu, Theodore S. Ori, Jonathan Russell Taccone.*

Row 1, left to right: *Laura M. Thomas, Anna Baryshnikova, Jaris B. Wicklund, Christine A. Doyle,* **CAS President Bob Miccolis**, *Madeleine Lavery, Joelle Saba, Veronique Ouellet, Amanda Christine Leesman.*
Row 2, left to right: *Bryan Clark, Ling Feng Tan, Christopher George Turner, Kristen Dardia Turner, Cindy Pui Man Lee, Bridget L. Hollenbeck, Patricia Conway, Robert C. Swiatek, Tyler John Birkel.*
Row 3, left to right: *Christine H. Chou, Zhihui Bian, Daryl Atkinson, Andrew William Hoffman, Sean Robert Davis, Michael Anthony McComis Jr., Clifford Dean Mefford, Landon Kimball Mortensen, Allan M. Cohen.*

Row 1, left to right: *Danielle Nicole Trinkner, James O. Boss, Amélie McDonald, Lu Wang,* **CAS President Bob Miccolis**, *Cong Tan To, Eric L. Greenberg, Timothy Y. Wang, Kara Marie Clancy.*
Row 2, left to right: *Hsiang Wen Huang, David N. Martindale, Jonathan E. Swartz, Kai Chen, Chao Tan, Minlei Chen, Francis McKinnon, Gregory Murphy Sollenberger.*
Row 3, left to right: *Bradford S. Nichols, Jonathan G. Eshelman, Christopher J. Reynolds, David Allen Prevo, Anson Ming Hin Lo, Brian Yung Man Choi, John Wilson Orr, Gary Joseph Wierzbicki.*

New Fellows not shown: *Tarek Saeid Alameh, Karen Kam On Chang, Ji Chi, Kudakwashe F. Chibanda, Andrew August Coleman, Lei (Justin) Feng, Ivan M. Fernandez, Matthew R. Jahnke, Rongfang Ji, Matthew Charles King, Christopher S. Kwon, Lili Peng, Susan M. Poole, Katrina Andrea Redelsheimer, Abigail G. Shahriyar, Wonsop Sim, Mark Sturm, Whitney Lenae Sykora, Qian Tao, Hemanth Kumar Thota, Mitchell Waldner, Cody Webb, Lai Yii Wong, Ce Xiong, Wenchao Zong*.

NEW ASSOCIATES ADMITTED IN MAY 2015

Row 1, left to right: *David Andrew Ellis, Danielle Balser, Abby Lee Popejoy, Jeremiah N. Reinkoester,* **CAS President Bob Miccolis**, *Shelley M. Schad, David Andrew Hibbard, Daniel C. Watt, Paul Charles Favale.*
Row 2, left to right: *Spencer Harrison Sadkin, Daniel Jay Falkson, Anthony Thomas Salis, Jeffrey W. Stoiber, Kyle M. Ryan, Michael A. Mazzonna, Nicholas O. Irwin, Jonathan Lim.*
Row 3, left to right: *James Frank Kaufmann, Ivanna Olga Johnson, Hao Ding, Ryan Uhlenberg, Daniel DiMugno, Elizabeth Mae Wiebke, Zhe-Hao Chan, Cale Andrew Nelson, Sanat Devendra Joshi.*

Row 1, left to right: *Donte L. Riddick, Yanqi Liu, Bihling Wu, Marc Andre Fournier,* **CAS President Bob Miccolis**, *Samantha Amy Ugol, Eric Chao, Michelle Lam, Kevin Puzzele*
Row 2, left to right: *Dmitriy Guller, Nicholas S. Foore, Jacob Sasson, Lawrence Edward Hubbard, Brian G. Garfield, Daniel Moskala, Fawn Melissa Racicot, Scott Bell Lombardo, Jeffrey S. Mond, Matthew John Engelbert.*
Row 3, left to right: *Roni Y. Schwartz, Matthew Flanagan, Marc E. Liebman, Mwiti Mark Kalothi, Alex B. Lubbers, Andrew D. Moriarty, Patrick Joseph Curley, Matthew C. Moran, Kenneth Lee.*

Row 1, left to right: *Xiaoxia Zhou, Kristen Caitlin Behling, Yulia Rozenberg, Dana Signe Ryan,* **CAS President Bob Miccolis**, *Qian Zhang, Jie Zhang, Jimisha Harish Hooda, Rebecca Elizabeth Saroki.*
Row 2, left to right: *Michael Shapiro, Kunshan Yin, Nicholas Gullo, Saurabh Khurana, Blake Stein, Patrick Ryan Knepler, Vincent Chi Yau Luk, William George Yocius, Melvyn Ray Windham Jr., Steven James Hunke, Penny Dee Barker.*
Row 3, left to right: *Graham Scott Tibbets, Brian Robert Joseph, Michael J. Schleis, Joseph Seung Lee, Peter Ott, Ming Chao Lu, Andrew M. Dryden, Christopher Ryan Cahill, Jieqing Zhu, Yi Zhuang, Faizan Amlani, Adam Christopher Fleming.*

Row 1, left to right: *Julie E. Melnick, Marla E. Strykowski, Allison Frayer Kellogg, Erica Helinek,* **CAS President Bob Miccolis**, *Buu M. Huynh, Chuan-Wei Wu, Nang Vilay Homphomsiltham, Jamie Lynn Stock.*
Row 2, left to right: *James Patrick King, Stewart M. Trego, Emily D. Angyal, Alyssa M. Potter, Spencer Thomson Hall, Britton Stewart, Robert John Furia, Anthony Salvatore Giangreco-Marotta, Tatenda M. Biti, Luc Theberge, Jean-Michel Belanger.*
Row 3, left to right: *Bryan Donkersgoed, Brandon T. Wen, David Scott Quaid, Nicholas M. Stanford, Sheridan Bernie Buckland, Max Kravitz, Jeffrey Paul (Yosef) Katzman, Nicholas Leofsky, Daniel S. Latinsky, John N. Wright.*

NEW ASSOCIATES ADMITTED IN MAY 2015

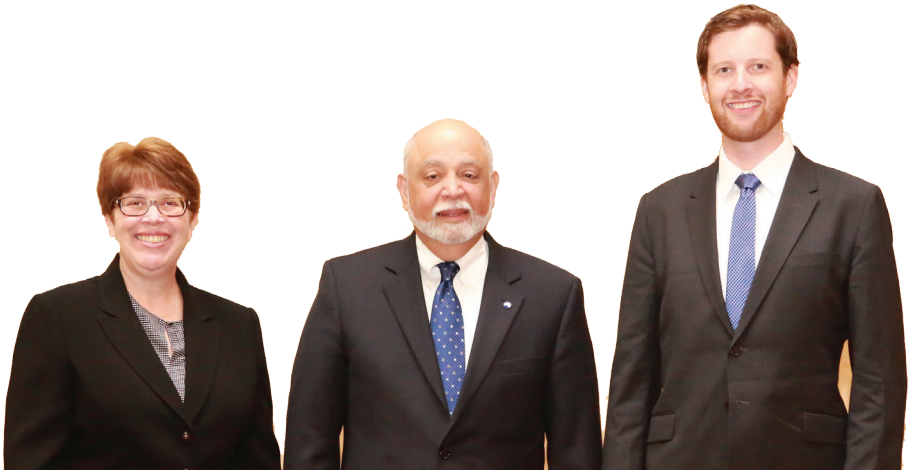
Row 1, left to right: *Lijiao Liu, Choon Hong Ang, Jiejing Liu, Diana Tsz Yan Tse,* **CAS President Bob Miccolis**, *Yue Liu, Wanyue Zhang, Priyanka Gulati, Paige Albee Roland.*
Row 2, left to right: *Mark A. Davenport, Dev Shukla, Jacob F. Orlofsky, Wenyuan Shi, Johnny David McHone, Francis Paul Gorg III, Daniel C. Mikos, Brian Christopher Ruberti, Joseph W. Falandays.*
Row 3, left to right: *Brian Michael DeGeorge, John Russell Rose, Jason Bradford Hermanson, Eric J. Xu, Xiao Xu, Robert T. Bell, Derek Anthony Chin, Lester Jongha Lim, John Nicholas Massari.*

Row 1, left to right: *Emily Helen Turek, Jessica Yeh, Amanda Marian Perrotti, Janet E. Rush,* **CAS President Bob Miccolis**, *Kathlyn F. Herrick, Jacqueline Elizabeth Muschett, Laura G. Roth, Sukaina Abbasnisar Visram.*
Row 2, left to right: *Adam Mychal Vachon, Collin Frederick Walter, Jerod Wayne Hartley, George Colby Tacquard, David E. Colón, J Daniel Stanford Benzshawel, Daniel King Clayman, Brad Joseph Rosin.*
Row 3, left to right: *Robert Edwin Balmer, Guoqing Sun, Mingwei Lei, Charles Kitson Hagedorn, Ming Keen Tran, Matthew Varughese Samuel, Joshua Parvin, Wilnex Paul, Lai-yue Sam Luo.*

Row 1, left to right: *Danielle Donnelly, Heidi Jennifer Miles, Ghizlane Benbrahim, Xiang Wu,* **CAS President Bob Miccolis**, *Min Xu, Genevieve Baril, Fanny Duquette Murphy, Weiwei Cao.*
Row 2, left to right: *Caleb Michael Wetherell, John Avitabile, Thomas JR Lapinski, Patrick Allen, Nicholas Caramagno, Marion Gregoire-Duclos, Francois Bellavance, Alex Prajescu, Jean-François Vallée, Mark Naccache, Michael Daniel Wallace.*

New Associates not shown: *Nedzad Arnautovic, Stephanie A. Aube, Kyle Babirad, Julia Emily Blyumin, Ashley Lynne Borchardt, Dana Feldman Bradley, Ja-Lin Chen, Kelley Ann Christensen, Daniel L. Dillon, Joshua S. Doll, Jonathan Mark Ellingson, Brian Faber, Hang Fan, Jun Fang, James Finucane, Yuet Ying Dorothy Fong, Jigar Sunil Gada, Andres Ruediger Gentzen, Fruma Gewirtz, Jing Gong, Joshua Gopin, Joseph Homer Gravelle, Michael Andrew Hartke, Christopher James Hedenberg, Thomas C. Heggen, Katrin Henderson, Michelle Stutey Henderson, Shimshon Herz, Leigh Gilbert Heymann, Jeana Holewinski, De-Chuan Hong, Robert Edward Hooley, Jiayue Hu, Olivia Anne Keefer, Hao Li, Zhouliang Li, Li Li Lin, Jun Liu, Kevin R. Magley, Mark C. Maxwell, Stephanie Mielke, Brad Thomas Neilson, Khiem Dinh Ngo, David Paul Ochodnicky, Christine Morgan O'Connell, William Francis O'Connor, Wei Wen Stella Ong, John E. Osteen, Jonathan Park, Christian M. Posadas, Radul Nikolaev Radulov, Frank S. Rau, Daniel David Reed, Ira Robbin, Jamie Coleen Roderick, Brian C. Ruberti, Quinn Bradley Saner, Jean-Christophe Sauriol, Ryan Daniel Scheetz, Christopher John Schubert, Gaurav Sharma, David Evan Sidney, Courtney Gerard Sims, Alison Stocks, Michael David Suess, Zongwen Tan, Samanvitha Vangala, Corey Jacob Vaughan, Yulia (Julia) Vul, David Jeremiah Whalen, Zilu Peter Xia, Yaoxi Xiong, Youjia Xiong, Soojin Yang, Li (Ellie) Zhou.*

NEW CHARTERED ENTERPRISE RISK ANALYSTS



New CERAs acknowledged at the 2015 CAS Spring Meeting are, from left to right, Mary Jean King, FCAS; **CAS President Bob Miccolis***; and David R. Payne, FCAS. Not pictured is Mario E. DiCaro, FCAS.*

2015 Spring Meeting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Background: The Broodmoor in Colorado Springs, Colorado, was the site of the 2015 CAS Spring Meeting. Photo credit: Matt Caruso. All other photos by Craig Hughey.

1. *New Associate Tatenda Biti (foreground, left) takes a tablet photo of friends and family. From left to right are Bryan Donkersgoed, Biti's mother Farai Gonzo and Yi Zhuang. Biti, Donkersgoed and Zhuang are is among 238 new Associates who were recognized at the 2015 CAS Spring Meeting.*
2. *The general session "Competition and Consolidation of the Reinsurance Market" kicked off the educational programs at the 2015 CAS Spring Meeting at the Broadmoor in Colorado Springs. Left to right are Sean McDermott (moderator), and panelists David Flandro, Bradley Kading, Tim Tetlow and Michael Pedraja.*
3. *"Grip and grin" photos of new CAS Fellows with CAS President Bob Miccolis are displayed and waiting to be picked up.*
4. *Emily Turek (right) and chats with past CAS President Bob Conger during the reception for new Associates.*
5. *Celebrating at the reception for new CAS Associates.*
6. *Congratulations New Associates!*
7. *"What Makes You Necessary?" — Slide from "Absolutely Necessary: Bulletproof Tactics That Will Put You in High Demand," presented by Ross Shafer at the 2015 CAS Spring Meeting.*
8. *New Fellow Yang Angela Cao (left) receives her diploma from CAS President Bob Miccolis.*
9. *Paul Grammens (at the podium) addresses the audience during the concurrent session "CAS & You for New Fellows." Seated left to right are Matt Caruso (moderator and CAS staffer), Shane Barnes, Katey Walker and Kimberly Walker.*
10. *CAS VP-Marketing & Communication Roosevelt Mosely (left) chats with new Associate Johnny McHone.*

CAREER CENTER

The Casualty Actuarial Society is pleased to announce the launch of the new CAS Career Center!

JOB SEEKERS:

- **FREE and confidential resume posting** — Make your resume available to employers in the industry, confidentially if you choose.
- **Job search control** — Quickly and easily find relevant job listings and sign up for automatic email notification of new jobs that match your criteria.
- **Easy job application** — Apply online and create a password-protected account for managing your job search.
- **Saved jobs capability** — Save up to 100 jobs to a folder in your account so you can come back to apply when you are ready.

EMPLOYERS:

- **Unmatched exposure for job listings** — The CAS represents the largest audience of qualified property and casualty actuaries.
- **Easy online job management** — You can enter job descriptions, check the status of postings, renew or discontinue postings, and make payments online.
- **Resume searching access** — With a paid job listing, you can search the resume database and use an automatic notification system to receive emails when new resumes match your criteria.
- **Job Posting Solutions** — Save time and money by choosing a job listing package that best fits your company's needs. **Post internship positions for FREE!**
- **Marketing Enhancements** — Get maximum exposure for specific positions or your company through a variety of enhancement packages, such as the Featured Employers Package.

CAS Releases

STATEMENT OF PRINCIPLES REGARDING PROPERTY AND CASUALTY UNPAID CLAIMS ESTIMATES

The CAS Board of Directors adopted the Statement of Principles Regarding Property and Casualty Unpaid Claims Estimates, which is a revised and renamed version of the now-rescinded Statement of Principles Regarding Property and Casualty Loss and Loss Adjustment Expense Reserves that was adopted in 1988.

The new Statement contains many changes from the original Statement. Most notably, because the original Principles were created before any standards of practice were developed or promulgated by the U.S. Actuarial Standards Board,the original Statement contained several instances of standards-type concepts and language. The principal objective of the CAS Task Force for the Review and Update of the Statements of Principles, which worked on revising the original Principles, was to update them to contain principles only, not standards of practice.

The new Statement is not intended to provide prescriptive practice guidance to actuaries. Such practice guidance for actuaries has been developed in the U.S., for example, by the U.S. Actuarial Standards Board in the form of Actuarial Standards of Practice. The newly adopted Statement has been worded to more clearly address principles in terms of definitions and concepts. Most of the items included in the Considerations sections of the original Statement have been eliminated because they were deemed to be more properly incorporated into standards of practice.

Practicing actuaries should ensure that they comply with relevant laws, regulations, standards or other requirements, which may refer to, or include content from, this revised Statement or the original CAS Principles. In addition, CAS members are subject to our Code of Professional Conduct, which refers to "professional judgment, taking into account generally accepted actuarial principles and practices," where there is not an applicable standard of practice.

The Professionalism section of the CAS website includes additional details on the role of principles and standards, and additional background on the development of the revised Statement.

STATEMENT OF PRINCIPLES REGARDING PROPERTY AND CASUALTY UNPAID CLAIMS ESTIMATES

Adopted by the CAS Board of Directors, November 2014

The purpose of this statement is to identify and describe principles for the evaluation, review, and estimation of property and casualty related unpaid claims. This Statement addresses property and casualty insurance liabilities within insurance, reinsurance, self-insurance and other risk transfer or funding mechanisms. In addition to financial reporting, Principles for estimating unpaid claims are pertinent in a variety of situations including but not limited to valuation, commutation, ratemaking, capital adequacy, solvency assessment and asset management.

This statement consists of three parts:

I. DEFINITIONS
II. PRINCIPLES
III. CONCLUSION

I. DEFINITIONS

Accounting Date: The stated cutoff date for reflecting events and recording amounts as paid or unpaid in a financial statement or accounting system. The accounting date is sometimes referred to as the "as of" date.

Claim: A demand for payment under the coverage provided by a plan or contract or the requirements of applicable law.

Coverage: The terms and conditions of a plan or contract, or the requirements of applicable law, that create an obligation for claim payment associated with contingent events.

Event: The incident or activity that triggers potential for claim or claim adjustment expense payment.

Intended Measure: The basis for the Unpaid Claim Estimate. Various types of Intended Measures include, but are not limited to, high estimate, low estimate, median, mean, mode, actuarial central estimate, mean plus risk margin, actuarial central estimate plus risk margin, or specified percentile. Any of these or other Intended Measures can be further described as a nominal estimate or an estimate discounted for the time value of money, commonly referred to a "present value".

Loss: The cost that is associated with an event that has taken place and that is subject to coverage. It is also known as a "claim amount." The term "loss" may include loss adjustment expense as appropriate.

Loss Adjustment Expense: The costs of administering, determining coverage for, settling, or defending claims even if it is ultimately determined that the claim is invalid. It is also known as "claim adjustment expense."

Review Date: The date (subsequent to the valuation date) through which material information known to the actuary is included in the unpaid claim estimate analysis.

Unpaid Claims Estimate: An actuary's estimate of the unpaid amount required to make the future loss and/or loss adjustment expense payments related to a defined group of claims.

Valuation Date: The date through which transactions are included in the data used in the unpaid claim estimate analysis.

II. PRINCIPLES

Principle 1. An unpaid claims estimate for a defined group of claims is reasonable if it is derived from reasonable assumptions and appropriate methods or models and the reasonableness of the estimate has been validated by appropriate indicators or tests, all evaluated consistent with the review date and valuation date in the context of the intended measure.

Principle 2. An unpaid claims estimate for a defined group of claims relative to a particular accounting date is inherently uncertain. This uncertainty stems from a dependence of the amount of future claims payments on facts and circumstances that are unknown when the estimate is made. The predictability of future claims payments may be subject to additional limitations, such as the availability and usefulness of data for making an unpaid claim estimate. The uncertainty inherent in the unpaid claims estimate implies that a range of estimates can be reasonable.

Principle 3. The actual amounts that will be paid for the defined group of claims likely will differ from the estimated future payments implied by a reasonable unpaid claims estimate. The actual future payments can be known with certainty only when all payments for such claims have been made.

III. CONCLUSION

Unpaid claims estimates are important to the financial soundness of the various entities that rely upon them. This Statement provides principles for estimating unpaid claims. The Principles contained in this Statement provide the foundation for the development of actuarial procedures and standards of practice.

IN FOCUS:

Expanding the Toolset — Underwriting Collaboration

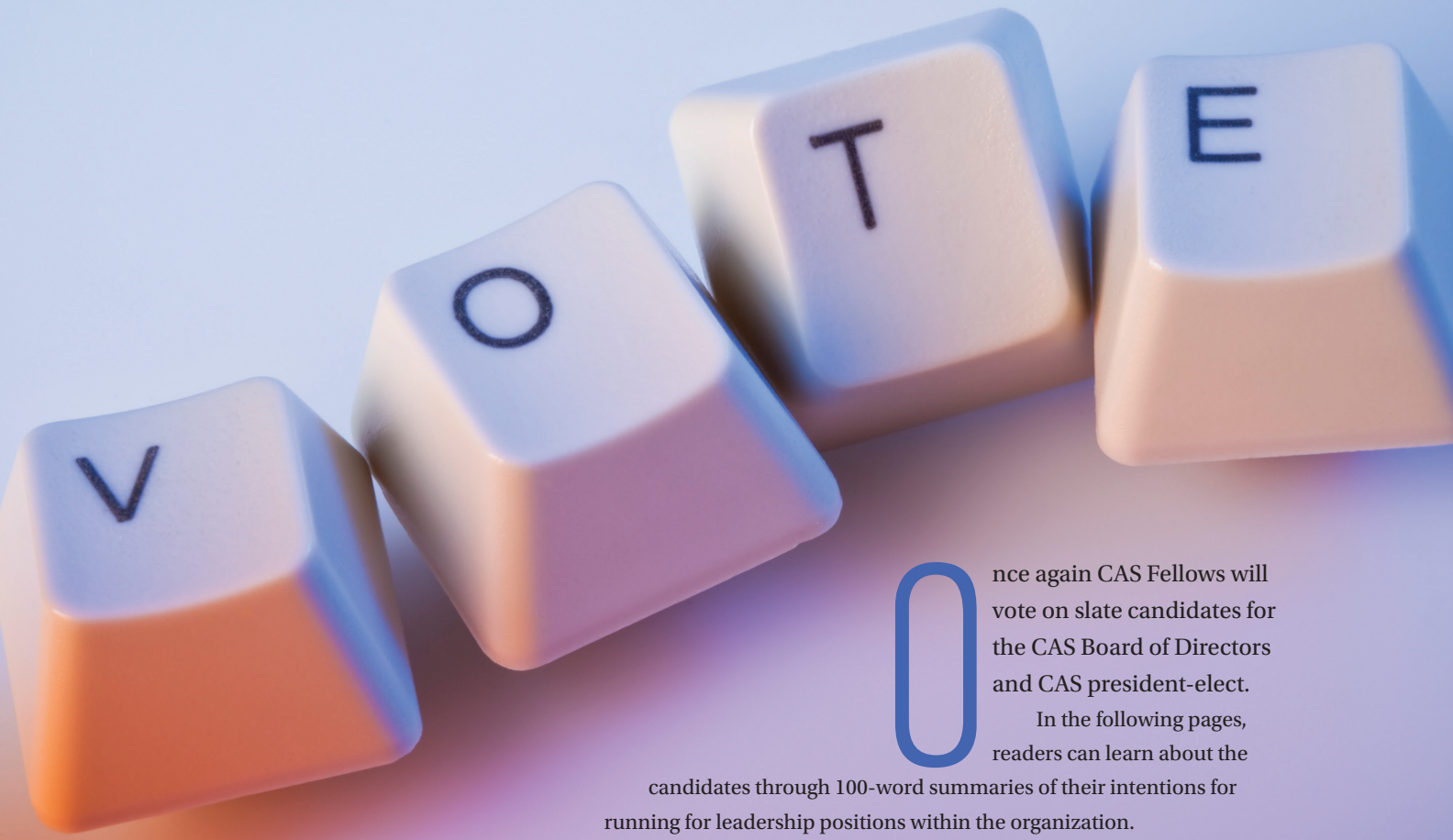
October 22-23, 2015

Hyatt Regency Cambridge

Boston, MA

www.casact.org/infocus

CAS ELECTION 2015



Once again CAS Fellows will vote on slate candidates for the CAS Board of Directors and CAS president-elect.

In the following pages, readers can learn about the candidates through 100-word summaries of their intentions for running for leadership positions within the organization.

Online voting is the default method of voting in the CAS elections. On August 7, 2015, the CAS will email Fellows a link to online voting booths that are password protected.

Paper ballots will be mailed August 7, 2015, to those Fellows who do not have an email address on file with the CAS Office or who have requested a paper ballot. Completed ballots must be submitted online or returned to the CAS office by September 4, 2015.

Please contact Mike Boa (mboa@casact.org) with any questions or comments.

Meet the Candidates

President-Elect Nominee

Nancy Braithwaite

FCAS 1989

I am truly honored and excited to be considered! We have a strong professional organization that is in an enviable position in terms of a culture of volunteerism and future job opportunities for members. But of course we need to keep an eye on the future and communicate with our constituencies to keep the CAS strong. I hope my decades of volunteer experience, positions at leading insurance organizations, and openness and respect for the input of others will contribute to my ability to add valuable perspective to the CAS leadership team.

Board Director Nominees

Kevin M. Dyke

FCAS 2000

The CAS needs a strong, effective and nimble board to address the competitive threats by focusing on its strengths as the only non-nation-specific actuarial organization focused on property-casualty risks. We need to continue to support leading research, grow responsibly, improve member engagement, foster innovation and strengthen our relationships with regulators as we have done with academics, students and employers. The perspective of a current regulator on the board would help position the CAS for success in the next 100 years.

Jim Guszcza

FCAS 2003

As the CAS turns 100, a series of business, methodological and technological innovations — evidence-based management, statistical and machine learning, the behavioral insights movement, open source, the Internet of Things — is shifting business and societal landscapes. This presents the actuarial profession with threats as well as considerable opportunities. As an actuary who has worked in a variety of roles — home office regulatory support, research center predictive modeler, consultant, university professor and chief data scientist — I wish to help the CAS formulate a vision for growth in its second century — the era of data science.

Serhat Guven

FCAS 2003

I am dedicated to upholding the mission to achieve the CAS Vision Statement. As a CAS Board member, I will be committed to build upon our long tradition of success by fostering an environment that inspires innovation. This would include continuing to

support and enhance our educational offerings to the entire membership and promoting awareness of the profession. In addition, by encouraging a more innovative culture, we can ensure our relevancy for the future.

Larry Haefner, CPCU, MAAA

FCAS 1988

I have been a member of the CAS for 27 years and have volunteered to serve on one or more committees during each of those years. The breadth of my service, which includes the Exam Committee, the Strategic Planning Committee and the Nominating Committee, has provided me opportunities to understand and address issues the CAS faces. My career experiences include leading large actuarial organizations, building predictive analytics capabilities, strategic planning and M&A activities. This has enabled me to have a robust yet nuanced understanding of the value casualty actuaries provide and the skills make them most successful.

Mary Hosford

FCAS 1986

My professional career has run the gamut from my start as a lowly loss reserving actuarial analyst for a property-casualty carrier to regulating personal and commercial lines, to working for a number of "standard" property-casualty carriers, to providing actuarial insights to a Lloyd's excess/surplus lines writer, and finally back to regulation in a health insurance role. During most of this time, I have served on or chaired a number of CAS committees and task forces. Given this background, I am ready, willing and absolutely able to take the logical next step and fulfill an elected leadership role with the CAS.

Chris Nyce

FCAS 1991

A consistent CAS volunteer for 24 years, serving the last three on the Executive Council, I have extensive experience in both company and consulting roles, working with regulators as well. Not a single issue candidate, I believe the CAS needs to be on top of all areas to succeed. While continuing to focus on areas of past accomplishment, including quality literature, healthy finances and professionalism, I also support acceleration of research and expansion of in-person and electronic meetings and training. I am excited to help the CAS continue thriving as an independent global organization advancing actuarial science in P&C insurance.

Marc F. Oberholtzer

FCAS 1996

My interest in serving on the CAS Board of Directors is to lead our profession to operate more effective globally, in maintaining our independence while improving relations with our fellow actuarial societies in the U.S., and in enhancing the education and training of actuaries to better address the millennial generation and those beyond. In doing so, I will leverage my perspectives gained over my career operating globally as a consulting actuary and as a volunteer in CAS and American Academy of Actuaries committees.

David Michael Terné

FCAS 2002

The CAS has provided me immense opportunities throughout my 25-year career working for various insurance companies and it is only right that I try to give back. The educational training has enabled my career and the leadership opportunities given through volunteering have helped me grow personally. I hope to enable and enhance those same opportunities for the membership going forward. Nothing is more satisfying than seeing candidates and members achieve their goals. I hope to help the CAS meet the challenges ahead and allow members to achieve their fullest potential.

CYBER INSURANCE:

THE ACTUARIAL CONUNDRUM

By ANNMARIE GEDDES BARIBEAU

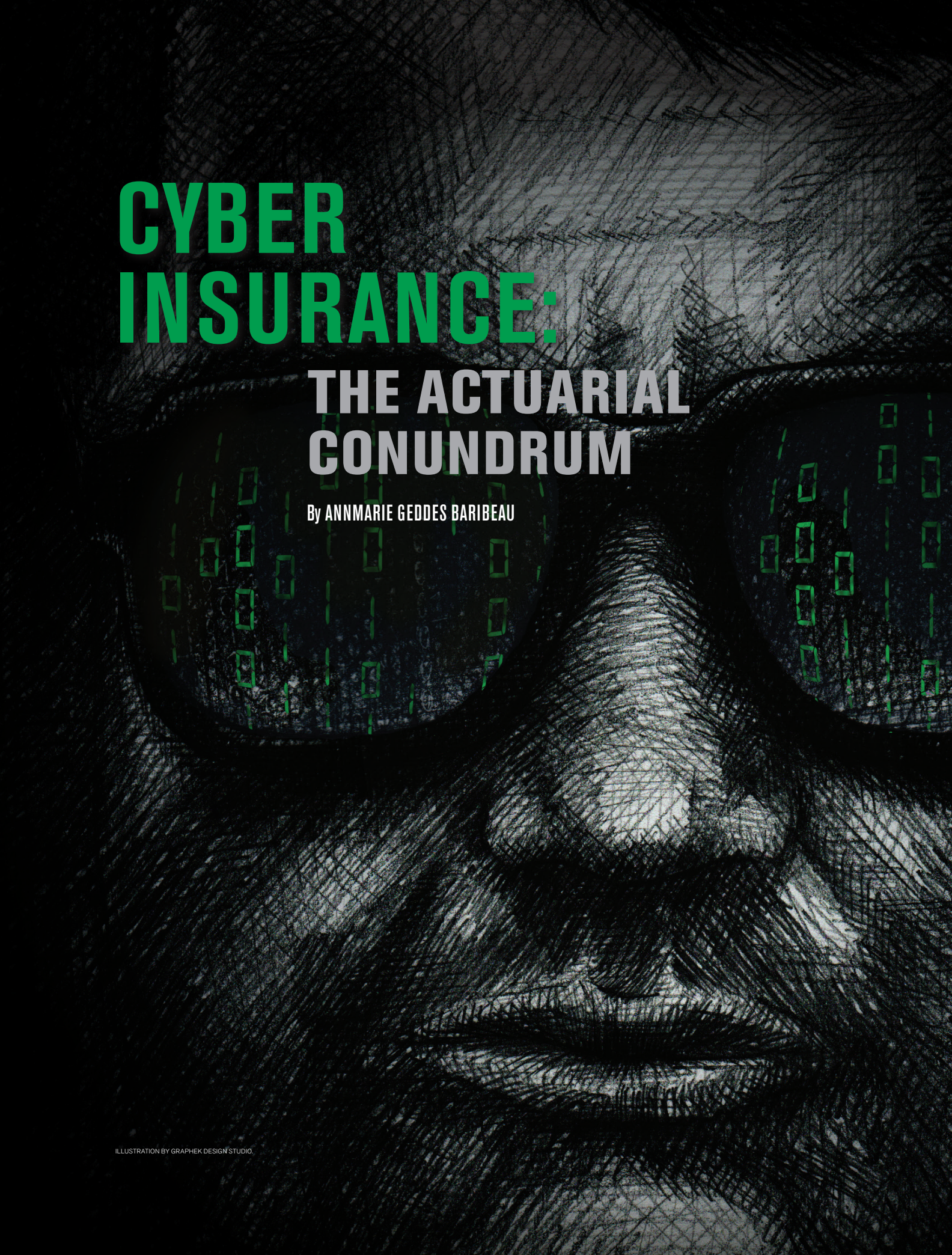


ILLUSTRATION BY GRAPHEK DESIGN STUDIO.

With scarce data and its ever-evolving risks, cyber coverage poses vast challenges for actuaries working in this emerging line of business.

With cyber incidents making headlines, it is no surprise that cyber coverage is the fastest growing insurance line.

As it evolves, cyber coverage has all the problems of an emerging line, including lack of data, little policy standardization and plenty of market experimentation.

Broadly defined, cyber security incidents are events that violate organizations' electronic information. Cyber coverage is generally customized to meet the unique needs of an organization. Depending on the policy, cyber insurance can include anything from covering the costs of notifying customers and providing them identity theft protection to expenses associated with business interruption and reputation and system damage.

From 2013 to 2014, collected premiums for cyber coverage nearly doubled to $2 billion, said Robert Parisi, managing director and cyber product leader for Marsh USA, the nation's largest cyber insurance broker. "I would not be surprised if it grows to $4 billion at the end of this year," Parisi said. In 10 years, he sees the market reaching $25 billion.

Currently, there is about 35 percent market penetration in the economy, according to Parisi. In the next year, he expects it to grow between 40 and 50 percent, with different levels of coverage adoption based upon an organization's size and industry.

While the burgeoning cyber insurance market is exciting, it is taking place with limited actuarial influence. This points to a pressing actuarial conundrum: How can actuaries appropriately price ever-changing cyber risk when data is scarce and models remain under development?

Further, asks Lloyd Foster, an adjunct actuarial instructor at Columbia University, "How can actuaries keep themselves relevant while they are trying to build the necessary models?"

For actuaries to gain their rightful place at the pricing and underwriting table, they must solve the conundrum. It will require them to look beyond the past-is-predictor-of-future assumptions to keep up with ever-changing risk. Until there is enough reliable insurance loss data, they will need the vision and temerity to scour for as much alternative relevant data as possible to develop effective models.

One Hot Market

Not since the genesis of employment liability coverage has the insurance industry experienced such a growing insurance segment. Cyber insurance was first offered in the late 1990s when AIG developed coverage for data privacy during the dot-com boom, said Parisi, who helped develop that first product for AIG.

Demand for coverage gradually grew, accelerating when headline-making cyber incidents affected household-name companies — including Target, Chase Bank and Sony — and made the C-suite realize their companies' need for cyber insurance. The percentage of Marsh USA clients that bought stand-alone cyber insurance policies rose to 32 percent in 2014 from about 20 percent in 2013, according to "Benchmarking Trends: As Cyber Concerns Broaden, Insurance Purchases Rise,"[1] a Marsh USA report released in March 2015.

More customers are buying coverage and seeking policies with higher limits, according to the Marsh USA report. Among clients with $1 billion or more in revenues, the average limit purchased rose to $34.1 million in 2014 compared to $27.8 million in 2013. The highest amount of insurance a company can buy is about $500 million to $600 million from a combination of insurers, Parisi said.

The three industries purchasing higher limits are not surprising. Financial institutions bought the highest average limit per company at $23.5 million, up from $19.7 million in 2013, while the power and utilities industry limit averaged $21 million in 2014, up from $13.2 million the year before. The retail industry bought higher average limits at $14.9 million in 2014, up from $10.2 million the previous year.

Sectors that do not traditionally purchase cyber insurance, such as manufacturing, are also seeking coverage, Parisi said. "The industrial side of the economy is purchasing coverage focusing on operational losses from cyber incidents, which differs from the data privacy focus of traditional buyers including the financial industries," he added. There is also market potential from small- to medium-sized companies.

At least four dozen insurers assert they offer cyber insurance, said Parisi, who believes the amount of participation is reaching a saturation point.

A report prepared for the Verisk Analytics subsidiary Insurance Services Office, Ltd. (ISO), "Cyber Insurance Survey,"[2] states that 80 percent of insurer respondents that offered cyber insurance in 2014 report direct written premiums at less than $10 million. Approximately 75 percent of those offering coverage planned to offer more, according to the study, which was prepared by Hanover Research and released in November 2014.

Growing Risk

Despite growing awareness of security incidents, studies generally agree that these occurrences are on the rise. It seems that as information technology experts address a particular threat, innovative cyber hackers identify more vulnerabilities.

Various organizations offer cyber incident data that can provide a window into the state of cyber risk. The challenge is that just as cyber events and responsive insurance are evolving, so are the terms and categories used to describe cyber incidents and their causes.

For example, Verizon's "2015 Data Breach Investigations Report,"[3] released in April, uses the term "security incidents," which can be used interchangeably with "cyber incidents." Verizon, which defines a security incident as "any event that compromises the confidentiality, integrity or availability of an information asset," reported 79,790 security incidents worldwide for 2014 from companies that provided information.

Of these, there were 2,122 confirmed data breaches that Verizon views as incidents that result in "confirmed disclosure," not just exposure, to an unauthorized party.

Meanwhile, another often-quoted source of cyber security data, Ponemon Institute, LLC, defines data breaches

[1] http://usa.marsh.com/Portals/9/Documents/BenchmarkingTrendsCyber8094.pdf
[2] http://www.verisk.com/downloads/emerging-issues/cyber-survey.pdf
[3] http://www.verizonenterprise.com/DBIR/2015/

differently. The Institute defines a data breach as "an event in which an individual's name plus a medical record and/or a financial record or debit card is potentially put at risk — either in electronic or paper format."

The interconnectedness of technology within an industry, such as the use of common software, is a reasonable concern given that some cyber attackers go after entire industries at the same time, said Larry Ponemon, president and chairman of the Ponemon Institute. "If one bank gets hacked, then there is a high probability that other banks will get hit at the same time," he said. "We have seen some of that. When Chase Bank experienced a major cyber attack last year, other banks were also getting hit," he added.

Cyber security studies vary on how they characterize cause — whether by malware, virus, Trojan or worms — but what really matters to insurers are the costs from cyber incidents, he added.

Some lawmakers and regulators see cyber insurance as being a key part of preventing cyber attacks because insurers require it to obtain coverage. Having coverage, however, can also create an optimism bias. Some suggest that government intervention might be needed to encourage greater safety measures. Ponemon said, however, that compliance with laws and regulations can give organizations a false sense of security. "Getting from a C+ grade in security to an A requires more than regulations," he added.

Limited Actuarial Role

Traditionally, insurers rely heavily on actuarial analysis when designing and pricing coverage. But actuarial involvement in cyber insurance has been limited so far.

"I think in the rush to fill a gap, the decision makers are going ahead without sufficient actuarial involvement," added Foster, the adjunct actuarial instructor, who is also an independent actuarial and financial consultant and the chief risk officer of The Found Table, a business networking group.

Insurers are currently focused on building market share, Ponemon said. "The insurance companies see this as a profitable new line of business and want to ride the wave because their competitors are writing policies and seem to be doing well," he added.

"Insurers are trying to balance opportunity with volatility," said Parisi. "Pricing and underwriting is being driven more by corporate governance and an analysis of security controls at companies than by any actuarial data."

Actuaries should be providing advice and consent until they have enough data to provide actuarial direction, Parisi said. "I think actuaries need to be part of the process," he added. "I think carriers would be foolish not to have actuaries at the table."

One challenge of analyzing cyber risk is that "the insured loss data available is so limited that it lacks the level of credibility actuaries want to see. There are simply too few data points for traditional analysis," said Alex Krutov, president of Navigation Advisors LLC and chair of the Casualty Actuarial Society's Task Force on Cyber Risk.

Because substantial actuarial data is not available, some experts say the insurance companies may be exposed to a greater degree than commonly assumed. Foster said that the life insurance industry is facing grave financial setbacks (measured in the hundreds of millions of dollars) because of the modeling and risk management issues related to variable annuities. "We stand to face a similar problem with cyber insurance," he added.

When actuaries are not properly involved in the analysis of cyber risk, Krutov said, insurers "are not getting the benefits of the actuarial expertise, and that could lead to potential losses, increased risk of insolvency and missed opportunities." While preventing cyber attacks may be impossible, he added, neglecting proper analysis and not getting the benefits of actuarial perspective are inexcusable. "This is a risk no insurance company should take," he added.

To boost market share and remain financially healthy, "insurance companies write policies by providing coverage to a point," said Ponemon.

Since policy standardization is also evolving, selling cov-

erage and buying it can be complex and confusing. "[Insurers need] the actuarial experience and the insight of policy design because certain ideas are out of the scope of the models," Foster said.

Policies are currently being offered, but with limitations. Sometimes agents and brokers have to stack policies together to achieve customers' desired limits. What is and is not covered can be confusing.

Insurers also vary on the type of coverage they offer. At least half of the insurers in the 2014 ISO survey offered coverage for data breach expenses, data restoration and replacement, business interruption losses and public relations expenses. Coverage for cyber extortion (ransom paid for compromised customer data) and cyber reward (paid for information leading to a criminal conviction), however, was available from fewer than 20 percent of carriers.

Insurers are compensating for the lack of actuarial data "by relying on qualitative assessments of an applicant's risk management procedures and risk culture," according to the National Association of Insurance Commissioners' website.[4]

[4] http://www.naic.org/cipr_topics/topic_cyber_risk.htm. Accessed 4/23/2015.

Figure 3.6: Which information do you consider to be the most important when underwriting cyber risks? (N=73)

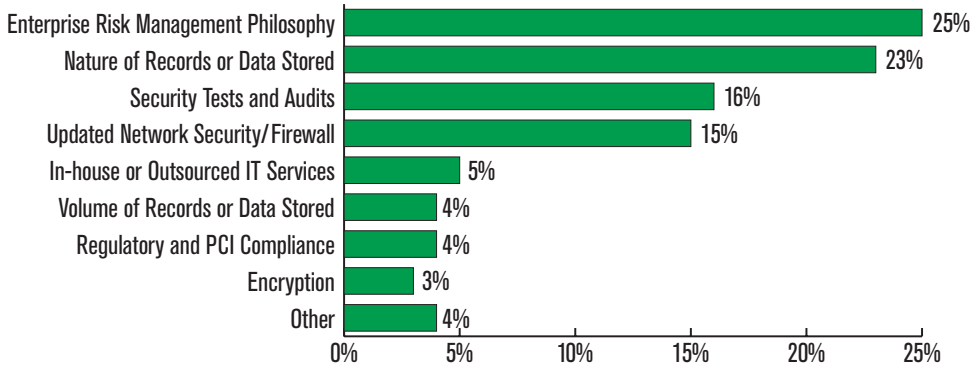
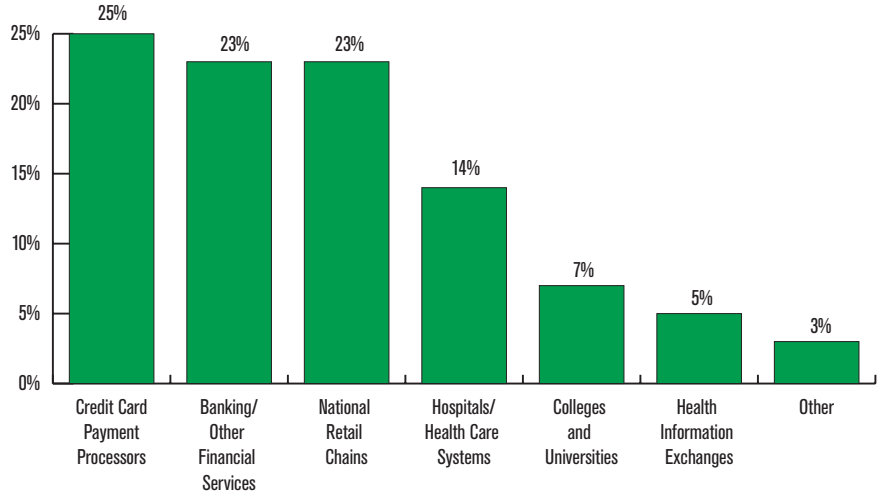


Figure 3.5: Which of the following classes do you consider to be the most hazardous to insure? (N=73)



Thus, according to NAIC, cyber risk policies "are more customized than other risk insurers take on, and, therefore, more costly."

Foster is concerned that pricing considerations are being made around the independence of a specific client company instead of looking at the potential of how a company is interconnected with others.

"Unlike other lines of coverage," Parisi said, "there is no right rate for a bad risk, so carriers are pricing and underwriting by adopting non-insurance tests, such as information security standards."

Considerations Sans Actuarial Data

How are insurers underwriting cyber coverage without actuarial data and models?

Insurers in the ISO study cited enterprise risk management philosophy, nature of records or data stored, and security tests and audit as the three most important types of information for underwriting risks.

When considering risk by industry, insurers responding to the ISO study named credit card payment processors (25 percent), banking and other financial services (23 percent), and national retail chains (23 percent) as the three industries most hazardous to insure.

In its study, Verizon reports that the average cost per breach is 58 cents per record. It also concludes that the more records affected by a breach, the lower the cost per record.

Meanwhile, the Ponemon Institute estimates that the costs of a data breach are about $200 per record, according to its "2014 Cost of Breach Study," the most recent report at press time. The conclusions vary considerably from those in the Verizon study due to the use of different data sets and definitions as well as some self-described "non-statistical samples" and sampling methods that are "not scientific." The experts who performed the two studies also disagree on the methodologies and calculation assumptions.

Solving the Conundrum

As cyber insurance evolves and matures, Parisi said that there will be more actuarially useful data and actuaries will have greater input.

In the meantime, actuaries need to find credible data wherever possible. Data on actual cyber losses is extremely limited and a large part of it is proprietary, Krutov said.

Other types of data can be found but have their limitations, Krutov said. For example, he noted that filings of publicly traded companies with the U.S. Securities and Exchange Commission contain certain useful information on some of the largest data breaches and, for the most part, this information is quite reliable.

The data, however, is very limited and the sample it comes from may be skewed. "There is a significant difference between losses in general and insured losses, which is another challenge insurance companies face in pricing cyber risk," Krutov said.

At press time, Congressional efforts were underway to allow companies to report data breaches without fear of liability.

Encouraging information sharing between industry and government is another step toward having a comprehensive risk mitigation strategy. However, Foster wonders, "What if the data bank the government creates is itself breached?"

Since Ponemon uses field-based research where they visit companies to analyze events, some insurers are including their data for underwriting decisions. "The caveat is there are probably better ways to do this," Ponemon said.

Foster suggests that reinsurers should be another data source, which would be especially useful since their information would come from several insurance companies. "The reinsurer's duty to its client is more than sharing risks, but also sharing certain helpful information."

Enlarging the Actuarial Role

Effectively pricing and underwriting cyber coverage, and reserving for cyber events, require a multidisciplinary approach that includes input from actuaries, underwriters, information technology professionals, cyber security experts and legal experts, Krutov said. "Actuaries can and should play the leading role in the cyber risk analysis and the quantification of financial impact of cyber-related events such as data breaches," he added.

At the same time, it is a mistake to believe that actuaries alone can perform this type of analysis even though they can do so for many other types of risk, he said. That is "as big a mistake as the common belief on the part of some information technology experts, risk managers or insurance underwriters that they can, on their own, properly assess cyber risk exposure or to price cyber insurance."

And while actuaries do need as much historical data as

they can get, past data is not always indicative of future events or their cost. "The challenge is much greater than not having enough historical data," Krutov said. "Because cyber risk is both growing and rapidly evolving, information about the past may be of limited direct predictive value when looking at the future," he added.

Consider the unique Sony attack last November, which included a breach of several terabytes of data, compromised operational systems and threats to employees and even theaters that would show the film, *The Interview*. Before Sony, headline-making cyber attacks focused on the loss of personal information. The Sony experience demonstrated that cyber attacks could go well beyond that.

Cyber experts see several potentially dangerous cyber incident scenarios that could make standard data breaches look inexpensive in comparison. The chance that an attack can knock out a power grid is a tremendous worry because such an attack has the potential to jeopardize human life. Then there is cyber terrorism, a term whose definition alone could affect coverage eligibility.

And a cyber hurricane — where a security incident cascades to a multitude of companies in a limited timeframe — would mean insurers would have to pay heavy losses in a short period of time.

Technological innovation also introduces new vulnerabilities. Cloud computing, employees using unprotected personal devices for work, and the Internet of Things offer new places for attackers to strike.

The need for future predictive analysis of extreme events presents an opportunity for actuaries to become more relevant to insurers, Foster said. For large incidents such as a cyber hurricane, the extreme value theory-modeling tool can be helpful because it overcomes the problem of determining the cost of future cyber incidents with limited data.

"In addition, the science and mathematics behind it have been established and described in detail for over 70 years by respected mathematical professionals," Foster said. "The downside is the model would make cyber coverage more expensive," he added, which should be counterbalanced because the cost of incidents is often underestimated. As more information becomes available, the model would be adjusted accordingly.

While actuaries do need as much historical data as they can get, past data is not always indicative of future events or their cost.

Krutov maintains that there is no agreed-upon modeling approach for analyzing cyber risk. "While it is not difficult to develop many theoretical models of cyber risk, in practice model selection is likely to be driven by the available data," Krutov said. Even as models improve, "expert judgment will continue to play an important role in model construction, parameter selection, input choices and other elements of cyber risk modeling," he added.

To get insight into the potential of future cyber incidents and their financial impact, Foster believes conducting simulations with the help of carefully selected and reformed former cyber criminals can be useful.

As more ideas surface, actuaries will overcome their actuarial conundrum with cyber insurance. After all, solving problems is what actuaries do.

Annmarie Geddes Baribeau has been writing about insurance and actuarial issues for 25 years. To read her musings, please visit annmariecommunicatesinsurance.com.

ON THE SHELF BY LAURIE MCCLELLAN

Peering Into the Murky Future of Cyber Threats

***Future Crimes* by Marc Goodman (Doubleday. 2015. 464 pp. $27.95)**

On an ordinary day in February 2013, residents of Great Falls, Montana, were surprised to hear the zombie apocalypse had begun. A news bulletin running on the official Montana Emergency Alert System on KRTV stated, "The bodies of the dead are rising from their graves and attacking the living." Eventually it became clear that hackers, not the undead, were to blame. Someone had taken control of the station's feed to broadcast the bogus alert.

This is the sort of incident that worries cybercrime specialist Marc Goodman, who recounts the incident in his new book, *Future Crimes*. While the zombie alert turned out to be a prank, it showed how easily criminals with more malicious intentions could seize control of vital infrastructure. "We've wired the world," Goodman said, "but we've failed to secure it."

Goodman began his crime-fighting career as a rookie cop in the Los Angeles Police Department. In 1995, he was selected to work on a high-tech case because of an unusual credential: He knew how to spell check in WordPerfect. Since then, Goodman has served as futurist-in-residence with the FBI and consulted with Interpol. But he's motivated to fight cyber threats by the same concerns that led him to be a cop. "I don't like when innocent people become victims of a crime," he says. "And what I see as we transform our world into one that's run by computers, [is] those that are in the know are extremely well disposed to take advantage of and to exploit those who are not."

Goodman points out that criminals have long used technology to gain a competitive edge. "Theft used to be a one-on-one affair," he says. "One person would get a gun or a knife, hide in a dark alley, and point that at somebody and say, 'Give me your wallet.'" In the 1890s, bandits like Butch Cassidy realized that a new technology, the long-distance train, created the opportunity to rob many people at once. But with networked computers, that math has spiraled out of control, as shown by the theft of data from more than 110 million accounts when Target was hacked in 2013.

Today, it's much more than credit card numbers that is at risk. The bigger challenge, says Goodman, "is that we now have a world that's run by computers. Our bridges, our tunnels, air traffic control, our electrical grid, hospitals, 911 systems: they're all run by computers. And every one of those computers is hackable." Some of the evidence Goodman cites is striking. When Dick Cheney was fitted with a pacemaker, his surgeon disabled its wireless capabilities to prevent terrorists from hacking it and sending the former vice president a lethal shock. In 2013, the police department of Swansea, Massachusetts, was forced to pay a ransom of $750 in Bitcoins to retrieve its own files, encrypted by a piece of malware known as CryptoLocker.

At least the cops in Swansea knew they had been hacked. According to Goodman, "One of the huge problems with the cyber threat is that most people don't know when they've been a victim. So if you want to count the number of cars that are stolen in the United States every year, it's a much easier problem. Because when Joe or Jane goes down to their garage in the morning and sees their car is gone, they're like, 'Hey! My car is gone!' And it's the type of thing you notice when you need to drive to work in the morning." Detecting when your data have been stolen, on the other hand, can be much more difficult. According to one study, when a company is hacked, the average time from intrusion to detection is 211 days.

While it can be difficult to detect cybercrime, researchers have some idea of how much it costs the global economy. A recent study by the Center for Strategic and International Studies and McAfee places the current cost at $400 billion U.S. annually. But how can companies and governments quantify the cost of future risk? "If any actuary wants to be a super hero," says Marc Goodman, "this is their chance."

Goodman believes that actuaries "could theoretically play a huge role" in tackling cybercrime. He explains, "The challenge is that we can't quantify this threat, because of the detection issues. So what other ways could we go about

detecting the threat? And then how could we measure and map it? Because until we can measure and map it accurately.... we can't count it. And if we can't count it, then we can't dedicate law enforcement resources to it." Goodman has come to the conclusion that, "You'll need a whole new generation of actuaries to figure out the cyber threat ... and those that come up with the killer algorithm that can help explain this are in line for some untold fortunes."

As sobering as the data on cybercrime may be, Goodman manages to make his review of the threats entertaining. Studded with references to science fiction movies and TV shows, from *Lost in Space* to *The Six Million Dollar Man* and *Minority Report*, the book also serves as an encyclopedia of computer crime anecdotes. Some of these are inventive in the extreme. In Seattle, Washington, an armored truck robber used Craigslist to crowdsource his getaway. The bandit first placed a "Help Wanted" ad promising top wages for construction workers. He then instructed applicants to show up near a certain Bank of America, dressed for work in a hard hat, safety vest, tool belt and safety goggles. Wearing an identical outfit, the thief approached an armored car guard, squirted him in the face with pepper spray and stole a bag of money. The real thief then melted into the crowd of construction workers and got away.

In a chapter on things that are now hackable, Goodman counts 338 sharks in Australia who have Twitter accounts. An acoustic tag on each fish sends a Twitter alert whenever one swims within half of a mile of a beach, attracting some 40,000 Twitter followers. Less amusing is the story of a high school student in Pennsylvania who was called into the principal's office for dealing drugs. As evidence, school officials showed Blake Robbins a photo of himself, sitting in his own bedroom, popping red pills in his mouth. The pills, it turned out, were Mike and Ike candies, and the photos had come from his laptop's own camera. The school had supplied its students with laptops but failed to tell them it was using software to spy on them. Reading about this incident caused one reader (the one writing this review) to immediately stick duct tape over her laptop's camera, one of the commonsense precautions that Goodman recommends in the appendix.

One bank robber, tweeting shark or student busted for candy consumption may not seem too menacing, but Goodman contends that cybercrime is about to achieve liftoff, thanks to the exponential growth of computer power. A modern smartphone, for example, contains more computing power than NASA used during the Apollo 11 moon landing. According to an axiom called Moore's law, computing power doubles roughly every two years. To illustrate the power of this kind of exponential growth, Goodman cites the example of a hypothetical water lily leaf that doubles in size every day until the 30th day of the month, when it will smother the entire pond, killing all other life. A leaf of this size grows slowly at first, covering just one-tenth of one percent of the pond by Day 20. But nine days later, when the leaf covers 50 percent of the pond and the threat is obvious, there is only one day left to act. Which raises the question: How many days, weeks or years remain to defuse the world's cyber threats?

According to Goodman, "Cyber was just the beginning... and there's this whole wave of technological awesomeness that's coming, but there's this whole new wave of technological threats that we need to be aware of." Among that next wave of possible threats, Goodman counts robotics, artificial intelligence, nanotechnology, 3-D manufacturing, and the Internet of Things. "But what I'm seeing," says Goodman, "is that awareness is growing linearly, and the threat is growing exponentially."

Goodman ends his book with some precautions that individuals can take to protect themselves from cybercrime. For solutions on a larger scale, he is currently focusing on two ideas: first, an XPRIZE for cyber security. "I think an incentive prize ... could really drive a ton of innovation," he says, "to look at building much more resilient systems or less hackable software. People forget that when Charles Lindbergh crossed the Atlantic, it was [motivated by] an incentive prize ... and it got the very nascent field of aviation off the ground." Second, Goodman advocates a Manhattan Project for cybersecurity, "bringing together 10 times or 100 times more people than we currently have thinking about this problem from all backgrounds. And actuaries could be right there at the table, trying to contribute their skill set to solving the problem."

Asked why he wrote *Future Crimes*, Goodman says, "I think that this is a kind of a clarion call to let people know about this risk that we face." In his conclusion, he notes, "The proverbial twenty-ninth day of the lily pond is fast approaching." However, the book and its title do sound one hopeful note: There is still time available in the present to prevent the crimes of the future. ●

Laurie McClellan is a freelance writer living in Arlington, Virginia.

Latest Trends in Auto Insurance Fraud BY JOE WEHRLE

No insurance company, no matter how big or small, is invulnerable to insurance fraud. The National Insurance Crime Bureau (NICB) — the property-casualty industry's not-for-profit national fraud-fighting organization — is constantly adapting its methods to battle this insidious crime, relying in large part on advances in technology, the use of big data, and advanced investigative techniques. Yet, criminals are more sophisticated than ever, making the jobs of our nearly 400 employees, member company special investigators and our law enforcement partners tougher every day.

The good news in the vehicle-theft arena is that anti-theft technology has made stealing a car quite a bit more difficult than in the days of "jimmying" door locks and hot-wiring ignitions. Keyless technology means (almost always) that the person with the fob is the only one who can open or start the car. Our analysis shows that since the advent of this technology in the late 1990s, vehicle theft fell from a peak of 1.7 million stolen vehicles per year to fewer than 700,000 in 2013, despite a significant increase in population and vehicle registrations. What this means is that if you own a vehicle, your chances of having it stolen today are significantly less than any other time since 1960.

The "Mystery Device"

As anti-theft technology advances, thieves are always looking for new ways to beat it. One of the most widely publicized new trends in vehicle-related crime is a perfect example. Recent reports tell of thieves using a "mystery device" that appears to use electromagnetic frequencies to pop open car door locks, allowing them to steal personal items left inside without ever having to break a window or jimmy a lock. NICB is working hard with vehicle manufacturers and law enforcement to "beat the technology that beat the technology."

Identity Fraud

Even when we outwit the "mystery device," industrious criminals will continue to find new ways to steal cars, having already turned the act from a blue-collar crime to a white-collar felony. Today's car thief merely needs a ballpoint pen and basic financial knowledge to walk into a car dealership, present fake identification and sign a loan or lease. By the time a dealership realizes it has been scammed, that brand-new luxury vehicle is hidden in a cargo container bound for a foreign port where it will bring in two or three times the original retail price. Unlike typical auto insurance scams, the victim isn't the policyholder or even the auto dealership, it's the bank or finance company that has to write off the loss. In fact, this type of theft is not even counted among national auto theft figures. Legally, it is considered a financial crime.

VIN Cloning

VIN-switching or "cloning" is another growing trend, requiring considerable sophistication. Thieves steal a luxury car, fabricate a new vehicle identification number or VIN plate by copying one from another vehicle of the same make and model, then sell the stolen car. Often, no one is the wiser until at least one party goes to sell the vehicle. NICB agents are experts in identifying cloned vehicles.

Keys Left Inside

One of the newest trends we're seeing may surprise you because it's at the opposite end of the "sophistication spectrum." While national auto theft figures are dropping overall, one type of auto theft is actually rising: thefts due to drivers who leave the keys inside. The sad truth is that regardless of all the anti-theft technology a car may have, it is rendered useless if the driver leaves the keys inside. A recent NICB analysis of FBI crime data shows that between 2012 and 2014, more than 126,000 vehicles were stolen with the keys left inside. That's an increase from 5.4 percent of all vehicle thefts in 2012 to 6.7 percent of all vehicle thefts in 2014. It just goes to show that we can't stop driving home the message that drivers still have to employ traditional anti-theft measures, such as locking their doors and windows, removing the keys, not leaving valuables inside and parking in well-lit areas.

The "Craigslist Scam"

NICB also recently issued a warning to used-car buyers referred to as the "Craigslist Scam." Working with law enforcement agencies across the Midwest, NICB identified nearly 100 cases where private auto sale transactions went sour when phony bank checks were used to pay for the vehicles. One Kentucky couple sold their 2010 Corvette on Craigslist, only to learn that the check that their bank initially said was valid was actually bogus. Fortunately, quick action by law enforcement agencies in Kentucky and Illinois, with assistance from NICB, led to the recovery of the Corvette after it had been picked up, driven to Chicago, and listed for sale again on Craigslist. NICB says these scams may appear legitimate since they are well organized. NICB advises anyone trying to buy or sell a vehicle on Craigslist to follow their very specific guidelines which can be found here: https://www.craigslist.org/about/scams.

"Crash-and-Buy" Schemes

The state of Maryland may be the first to officially recognize that "crash-and-buy" schemes are growing in the state. Perhaps as a result of the recent financial crisis and strain on many households, more people are opting to go without auto coverage, then buying policies after accidents and filing false claims. No hard data exists on these "crash-and-buy" scams, but the Maryland Insurance Administration says they constitute a quarter of all the fraud investigations it conducts. However, many states don't even prosecute these crimes criminally. Sometimes insurers discover the fraud before the claim is paid, so no money is lost. But there is little chance of getting the money back once the insurer pays

out a dishonest injury or collision claim, so honest policyholders take the hit in higher premiums.

Airbag Thefts

While accurate statistics on the number of airbag thefts in the U.S. are lacking, NICB agents see rashes of these thefts occurring sporadically in cities across the country. Thieves may target a particular neighborhood and steal several airbags over the course of a couple weeks. Airbags can be stolen in under a minute and the payoff can be big; thieves can sell them to unscrupulous body shop owners for between $50 and $200 and the body shops then sell them as "new" to unsuspecting customers for upwards of a thousand dollars. Insurance companies have to pay claims from customers whose airbags were stolen, but the costs of this crime can be much higher to victims who unknowingly purchase used airbags that later don't deploy in a crash.

Airbag thefts don't always occur where you park your car. They can also occur in body shops by dishonest mechanics. For example, a mechanic may pull out your perfectly intact airbag after you've had an accident, then insert a cheap knockoff (or even old rags, cardboard, etc.) and charge the insurance company full price for "replacing" the "damaged" airbag. Another scheme is to remove your intact airbag, replace it with an old deployed one to make it seem like the original inflated during the accident, then re-install your original airbag and charge the insurance company for a new one.

Car owners can avoid the above scenarios by having their cars inspected first by their insurance company estimators and insisting on receiving new airbag replacements.

Towing Scams

Certain large cities, such as Los Angeles, Houston and Chicago, have been seeing a number of tow truck "bandits." These unscrupulous operators are tantamount to ambulance chasers; they listen to police scanners for reports of accidents and then show up on the scene, usually before police have even had a chance to take a report. They tell the driver of the damaged vehicle that they have been "authorized" to give them a tow, usually pressuring the victim to sign a release form quickly. Then, off the vehicle goes — and the driver may not find out for days where it is located. At that point, the bandit tow truck company charges inflated towing fees, storage fees and other add-ons. Drivers should never allow their car to be towed by a company

that hasn't been called by their insurance company or the police. Some states have laws to this effect.

On the Horizon

One trend on the horizon has to do with the increasing length of car loan terms. While four-year loans were once standard, six-year loans are now common, and seven and eight-year loans are now becoming popular, too, according to a recent report. As the economy improves and car sales increase, it's likely that thousands of car owners will be underwater on their loans in just a few years from now.

When loan balances are greater than the value of the cars they financed, some drivers will have significant incentive to rid themselves of the financial burden. The result can be cars set on fire, sunk in ponds and lakes, or simply hidden before insurance claims are filed. Insurers may end up paying the price for these long-term loans a few years from now and should be on the lookout for this trend to develop.

In the coming years, criminals will continue finding new ways to ply their craft. NICB will continue to solidify its vast and growing partnerships with law enforcement agencies, manufacturers, legislative bodies and industry groups — and to invest in cutting-edge intelligence and data systems — to protect its member companies and the American public. ●

Joe Wehrle is president and CEO of the National Insurance Crime Bureau.

Other Insurance Fraud Trends

PIP Fraud

Unlike traditional auto theft, medical fraud has risen dramatically. This type of fraud, such as the abuse of no-fault or personal injury protection (PIP) insurance, often involves organized criminal rings who stage accidents and recruit "victims" to claim phony injuries and big insurance payouts. NICB continues to see a rise in dishonest medical clinics where much more time and expertise is spent filing false insurance claims than actually practicing any form of legitimate medicine.

Medical Billing Fraud

Fortunately, NICB's Aggregated Medical Database (AMD) has been making vast inroads in identifying potential medical fraud since its creation in 2011. With 33 property-casualty carriers submitting their medical billing data (and more joining soon), the AMD's analysis has resulted in nearly 2,000 MedAWARE℠ Alerts identifying over 3,000 providers and nearly 5,000 clinics in 41 states.

These leads reflect over $681 million of medical billing by the providers identified in the MedAWARE Alerts during the time period in which their billing practices were examined. This time period is generally one year in which the dollar value of billing exposure is calculated. The NICB has initiated and concluded cases with successful outcomes based on information contained within the Alerts. More importantly, the information has been valuable to NICB member companies in terms of better identifying providers whose billing practices fall outside the norm, therefore enabling them to successfully pay legitimate claims.

Cargo Theft

Cargo theft continues to pose a serious threat to the U.S. economy, not to mention the insurance industry. As law enforcement resources are stretched, organized criminal rings see cargo theft as a high-reward, low-risk enterprise. NICB agents, deployed in strategic locations throughout the U.S., work with law enforcement and member companies to recover stolen cargo and dismantle the crime rings.

In China, Insurance Regulation Shifts as Premiums Climb BY JIM LYNCH

China, one of the world's fastest growing insurance markets, is undergoing important changes to both its auto insurance market and its insurance solvency supervisory system, a group of casualty actuaries were told at the CAS Spring Meeting in May.

The changes signal a shift away from heavy rate regulation and toward more robust solvency regulation, a trio of actuaries from China said at a session titled "The Dynamic China P&C Market — An Update."

China's market has grown between 13 and 35 percent a year for the past decade, said Qian (Rita) Tao of China Property & Casualty Reinsurance Co, a new Fellow of the Casualty Actuarial Society. Property-casualty insurers wrote RMB 754 billion ($120 billion U.S.) of premium in 2014, 16.4 percent more than a year earlier. By contrast, U.S. property-casualty insurers wrote about $500 billion and grew just over four percent, with both figures reflecting the maturity of the U.S. market.

All the growth is creating opportunities for property-casualty actuaries, said Robert Conger, FCAS, a consultant with Towers Watson. Together, Mainland China and Hong Kong have 100 casualty Fellows, enough to create a new CAS Regional Affiliate in Asia named ARECA, which stands for Asia REgion Casualty Actuaries.

Rapid growth is not the only difference between the Chinese and U.S. markets, Tao said.

China's market is much more concentrated than in the U.S. There are 67 primary P&C insurance companies as of 2014, versus thousands in the U.S.; the 10 largest Chinese companies own 90 percent of the market, versus the just less than 50 percent share owned by the 10 largest American insurers.

China is also less litigious than the U.S., Tao noted. Only three percent of premiums pay for non-auto liability insurance. However, auto insurance, like in the United States, is the largest line of business, with more than 70 percent of premiums.

"The job market for actuaries in China is very good at the moment." — Bo Huang

China requires minimum statutory third-party liability auto insurance, said Li Zhang, FCAS, senior actuary of China Property & Casualty Reinsurance Co. However, most premium pays for voluntary coverage, which includes higher limits for liability insurance and coverage for vehicle damage and theft. There are three standard voluntary policies — the ones issued by the three largest insurers (with very minimal coverage difference); other companies simply follow those leaders.

The minimum third-party liability rates are set by the government and uniform across the country. Other coverage rates were also fixed, but insurers sometimes offered discounts and other inducements to buy, such as gas cards or online shopping coupons.

Premium for vehicle damage and theft was based on the new vehicle purchase price, a fact that upsets policyholders whose claims are settled based on the depreciated cost of their vehicles. Eligible policyholders could also receive discounts for a good driving record and for buying via the Internet or through telemarketing, which resulted in fewer overhead costs than going through an agent. There were 13 other rating factors, which all insurers use.

A new rating system, taking effect June 1, 2015, in one-fifth of the country (the six pilot provinces), creates a base rate by loading industry-wide expected losses with company-specific expenses. Insureds will still receive discounts for their driving records and ones based on the distribution channel through which they purchased. Premium for vehicle damage is now linked with actual cash value and vehicle make and model, but other underwriting factors will be allowed and can vary by insurer.

China is also overhauling its solvency regulation, said Bo Huang, FCAS, a senior manager with KPMG China, and is becoming one of many nations examining solvency in the wake of the 2008 financial crisis.

China has developed a system, known as C-ROSS (China Risk Oriented Solvency System), that its leaders believe could become a standard, particularly for emerging markets.

"It's a cross," Huang said. "We're at a crossroads of the whole industry's growth."

The new standard is expected to take full force in January 2016 (running in parallel with the current solvency regulation in 2015). They replace a system Huang said was "not very scientific," in which insurers were allowed to write $4

The Chinese Market by the Numbers

67
Primary P&C insurance companies as of 2014

+70%
Auto insurance premiums

3%
Premium for non-auto liability insurance

of net premium for every $1 of surplus held. In the United States, the same ratio is closer to 1:1.

The new standard splits "supervisable" risks that regulators are good at addressing from the ones better handled by market mechanisms.

The supervisable risks are split between quantifiable ones, like insurance risk, and unquantifiable ones, like reputation risk. Another class of supervisable risks is control risk. For emerging economies like China's, Huang said, it is even more important to watch how companies control their risks. Good risk management may result in a reduction in regulatory capital requirement; poor risk management can result in a capital add-on up to 40 percent.

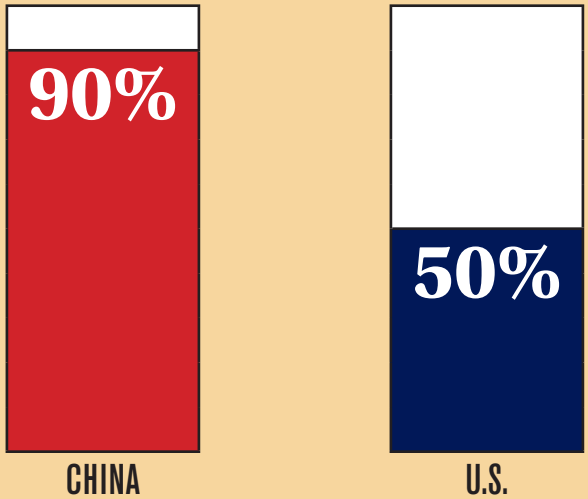
There's also a risk element that requires systemically important insurers to set aside more capital.

The solvency and rate regulation changes mean most insurers are hiring risk managers, accountants and actuaries, Huang said. "The job market for actuaries in China is very good at the moment; a main reason is thanks to C-ROSS and auto rate reform."

James P. Lynch, FCAS, is chief actuary and director of research and information services for the Insurance Information Institute in New York.

Market Share of the Top 10 Insurance Companies

China vs U.S.



Actuaries Plunge Into the Big Data Pool BY JIM LYNCH

The story of big data — the oceans of data that modern technology generates — in some ways presents a modern cliffhanger. Now that we have access to all of that data, what can we do with it? Actuaries heard a variety of answers at the 2015 CAS Spring Meeting in Colorado Springs, where a trio of experts shared how to glean useful information from a world awash in selfies, tweets and status updates. Casualty actuaries now have the ability to tap into data and stretch beyond their traditional roles of pricing and reserving to help claims adjusters and marketers to do their jobs more effectively.

Philip Borba, a senior consultant at the consulting firm Milliman, showed how to find gems of insight in the standard claims report. Adjusters' notes, he said, contain useful information that actuaries can use in predictive models to pick out which claims are most likely to turn contentious.

Borba, like most researchers in this area, breaks a standard narrative report into "*n*-grams." *N*-grams are a single word or a short series of words. For example, the phrase "tested positive for amphetimines and marijuana" would yield several *n*-grams, including "tested," "positive," "tested positive" and so on.

Borba looked at 6,949 accident reports from the National Motor Vehicle Crash Causation Survey, a National Highway Traffic Safety Administration project that analyzed crashes. In the study, researchers wrote reports after visiting accident sites just after the crash occurred.

The 6,949 reports generated 13.3 million *n*-grams. Harnessing computer power to build a model, Borba looked for information on the use of cell phones and driving under the influence of medications. He found that narratives held important information on how often these two were linked to traffic accidents.

A separate study created a predictive model for workers' compensation claims files, in which *n*-grams held clues to find "jumper" claims — ones likely to blow up. For example, an adjuster's note 14 days after injury might note the claimant is "scheduled for an arthroscopic surgery," Borba said.

The insurer "might not get that bill for eight weeks," he said. Plucking that information from an adjuster's narrative could help set a claims reserve more accurately and faster. Textual data like *n*-grams influenced almost a quarter of the model Borba built.

A second researcher, Douglas Wing, FCAS, an assistant vice president at Insurance Services Office, showed how insurers use computers to study visual information.

Computers see photos differently than we do. For people, a picture is a signal that helps them remember what an object is, Wing said. To a computer, it's a large number of pixels or a unique jigsaw of colored polygons.

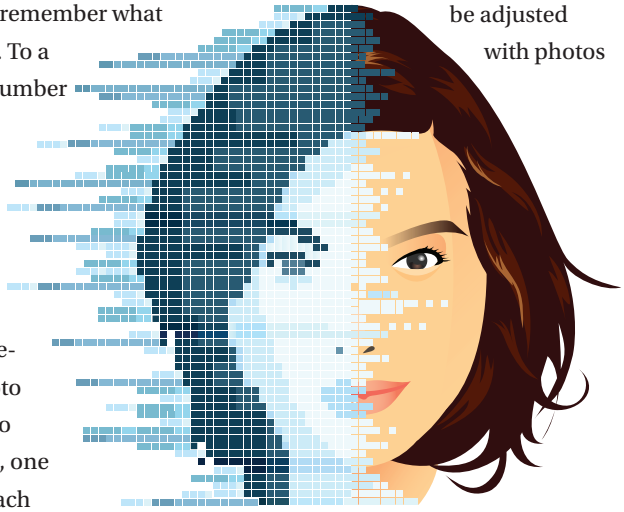
In a process called image segmentation, the computer turns a picture into a series of polygons. A photo of a tree is changed into thousands of polygons, one for each leaf, one for each branch. Another process, feature extraction, lets the computer find common shapes — eyes or ears, for example.

The process in essence turns the computer into a super-sophisticated set of eyes, which Wing says insurers are beginning to take advantage of.

In homeowners insurance, for example, photographs can show the area of a home's roof, along with its pitch and type of roof — all helpful in underwriting a policy or settling a claim. It's expensive and dangerous to measure a roof by hand, Wing said, particularly in winter.

"You don't have a lot of people volunteering to go on the roof in the cold and in the snow," he remarked. But a computer can read a flyover photograph, identifying roof lines, chimneys and vents, all of which underwriters are interested in. After a disaster, Wing said, a computer can compare before-and-after photos to see which homes are damaged and what the insurers' overall exposure is likely to be.

Auto insurers can use the technology as well, Wing said. Claims on many damaged cars can be adjusted with photos



alone. A computer analyzing a damaged vehicle could settle about 40 percent of claims within a day, Wing said. Often the insured could take the picture, reducing the time and cost of settling a claim.

Computers already store millions of license plates, as vehicles scour parking lots, photographing every plate. The practice began as a way for repossession dealers to find cars. Insurers could use the same information, Wing said, to recover stolen autos or validate that a car is garaged where the insurance policy says it should be.

"This is already starting to happen," Wing said. "We need to start leveraging it."

Roosevelt Mosley, FCAS, a principal at Pinnacle Actuarial Resources, described how Twitter yields valuable information on insurance marketing. Social media outlets like Twitter, Facebook and LinkedIn provide a candid window into the conversations and opinions of millions of people, he said. "Current and potential customers are sharing sometimes intimate details of their life with the world," Mosley said. Insurers have the opportunity to observe and react.

Companies can respond to online *cris de coeur* or passionate public protests as part of their customer service practice. They can listen, tapping into customer sentiments. They can monitor and pick up on broad market trends.

Data mining, Mosley said, is a "virtual focus group." A company can put an ad online and then see how consumers like it.

Mosley contrasts two GEICO ad campaigns centered on visual puns: a camel proclaiming Wednesday as "Hump Day" and a pig that does strange and yet not strange things like riding in a car shrieking "whee!" or draping itself in a blanket at a football game. The camel ad campaign garnered a tremendous social response when it was launched, Mosley said, but interest leveled off quickly, even as the company tried to reignite it. The ads with the pig "had a much longer run," he said, even though the ad provoked extreme responses. In fact, Mosley believes the pig ads have endured because they are divisive.

Mosley has also used social research to understand usage-based auto insurance, in which companies use a telematics device to monitor driving patterns. The question: How much of a discount do customers want before they think installing a device is worthwhile? It was no surprise, he said, to learn that people with higher discounts were more satisfied with the program. More surprising, however, was that the size of the discount was not as important as the size of the actual discount compared with the discount customers thought they should get.

Monitoring social media has the advantage of being unfiltered, Mosley said. "People are sharing raw emotional responses on both the good and the bad side," he said.

On the other hand, that means insurers have to take care to understand what is driving the strong feelings; this is a process that "can get really tricky," he said, but one that is worthwhile.

"Instead of having to guess what your policyholders want or what your customers are thinking," he said, "sometimes you just have to do a little digging and you can find out." ●

James P. Lynch, FCAS, is chief actuary and director of research and information services for the Insurance Information Institute in New York.

Actuaries to Roll Out Index Monitoring Climate Change BY JIM LYNCH

An actuarial climate index that will measure weather extremes will be launched within the next few months, actuaries were told at the 2015 CAS Spring Meeting in Colorado Springs in May.

The index will help to combine a practical actuarial need to account for climatological trends in models with a public need to show what effect long-term climate changes have on extreme weather, said Stuart Mathewson, FCAS, a member of the CAS Climate Change Committee.

"We would really like people to understand the difference between weather and climate," Mathewson told about 150 attendees in a session titled "Climate Change: What Can We Do About It?"

The Actuaries Climate Index (ACI), a joint effort between the CAS, the American Academy of Actuaries, the Canadian Institute of Actuaries and the Society of Actuaries, will measure the frequency of extreme events in order to educate the public about climate change. Insurance claims are often driven by extreme events: hurricane-force winds, torrential rains and soaring temperatures, to name a few. The index is an educational tool that could help pricing actuaries incorporate long-term trends into their mathematical models; it could also help actuaries and others working in enterprise risk management by quantifying the risk as a subtle, long-term trend.

The index is an example of casualty actuaries using their quantitative skills to tackle a difficult problem, said CAS Climate Change Committee Chair Doug Collins, the program moderator.

"I like to think of actuaries as the scientists of the insurance industry," Collins said.

The index could ultimately be an example of "usable science," said panelist Lisa Dilling, an assistant professor of environmental studies at the University of Colorado-Boulder. Usable science is a term that refers to scientific information being generated by a deliberate process so that it can be understood and used by decision makers more effectively. The key, she said, will be to adapt the index to help decision makers understand what is being measured and how to use it effectively.

The first version of the ACI will cover the United States and Canada, splitting the nations into 12 zones, each of which will have its own set of indices, Mathewson said. Measurements will be taken by grid, with each grid approximately 170 square miles.

The index will have six components: high temperatures, low temperatures, heavy precipitations, lengthy drought, high winds and elevated sea levels.

Each quarter, the ACI will measure how many extreme events occurred in each zone, with extreme defined as being in the highest 10 percent or the lowest 10 percent of events across a baseline period of 1961 to 1990.

The six components will be combined into one ACI for each region, and those will be rolled up into a single number for all of North America.

The ACI will be rolled out after the

launch of a website to host the data a few months from now. So far the index, working from historical data, has shown that extreme weather has become more frequent. T90, the index for hot days, has been growing since the mid-1980s. The cold-day index, T10, has been declining. In other words, while we have seen an increase in notably hot days, we are experiencing fewer notably cold days.

The overall ACI took a big jump in the 1990s, Mathewson said, though the last few years show a leveling off.

Work on the index started within the CAS Climate Change Committee. Property-casualty is the branch of insurance most obviously affected by climate extremes, Mathewson said.

Some extreme events, particularly heat and cold, can affect mortality and health. So the CAS joined with other North American actuarial associations to create a Climate Index Working Group, Mathewson said.

That group worked with a private company, Solterra Solutions, to develop the index. The index will be calculated on quarterly basis. Members of the Climate Index Working Group will develop commentary to explain each quarter's activity.

Right now the index will only monitor North America, but there are discussions with the actuaries in the United Kingdom to expand. The working group is also reaching out to other actuarial organizations worldwide.

In addition, the group is developing a separate Actuaries Climate Risk Index that combines the effects of extreme weather with the effects of changing exposures. The second index will aim to capture more precisely the insurance risk within extreme weather. If more people move into a vulnerable area, for example, the insurance industry is more likely to be exposed to an event. ●

James P. Lynch, FCAS, is chief actuary and director of research and information services for the Insurance Information Institute in New York.

CAS Innovation Accelerated BY KEVIN BINGHAM AND AARON HALPERT, CAS INNOVATION COUNCIL CO-CHAIRS

Having recently attended the CAS Spring Meeting and the CAS Seminar on Reinsurance, we could not help but feel the undercurrent of innovation seeping through most of the program and presentations. From innovations in the insurance shared economy, to new ideas in reinsurance and alternative capital management products, to effective use of unstructured big data, we are clearly on a path to fully embracing innovation as a core property-casualty actuarial competency.

In this spirit, the Innovation Council has continued to roll out programs and processes to accelerate our travel along this path. Here is a sampling of what we've been up to since our last update.

The CAS Innovation Process

As many of you have heard by now, we conducted a very successful innovation workshop in February 2015. As Bob Miccolis noted in his President's Message (March-April 2015 *Actuarial Review*), a group of approximately 30 people including both volunteers and staff overcame scheduling challenges during the busiest time of the year for many actuaries to participate in a highly interactive and productive workshop. With input from all attending, we successfully developed a common point of view of the objectives and principles that will guide CAS innovation as well as a prototype of the CAS innovation process called the CAS "Accelerator."

CAS staff member Dave Core and a team of CAS innovators are already testing the Accelerator by applying the process towards the development of a new program, "Business Storytelling for

Innovation Workshop attendees ponder their choices in a collaboration exercise.

Actuaries." Feedback from this and other testing will strengthen the Accelerator and help us integrate it into CAS operations later this year. One of the keys to success will be how well the process connects with the current CAS volunteer and committee infrastructure. By studying innovation models developed by insurers and others, we plan to create an innovation virtual environment in which dedicated innovation teams reach out to collaborate with CAS Committees as they test and validate idea prototypes.

Innovation Class at the CAS Spring Meeting

Twelve CAS members attended an Innovation Class at the CAS Spring meeting. Facilitated by Jeff De Cagna, chief strategist and founder of Principles Innovation, the class focused on why innovation matters to P&C actuaries, identifying and challenging CAS and actuarial orthodoxies, and understanding the importance of collaboration as a key to achieving innovative results. Members worked through real-life case studies that highlighted the power of collaborating with other professionals outside of the actuarial profession. Similar innovation class offerings are planned for future meetings.

Innovation Profile Series on Catastrophe Management

The third innovation profile series webinar was presented in May and featured Jason Hager of Willis Re. Hager demonstrated how applying the principles of innovation enabled him to significantly expand the actuarial footprint at Willis Re. Hager also shared how the lessons we've learned from property catastrophe modeling can be applied to modeling casualty exposures, including cyber and other terrorism exposures.

The Innovation Profile Webinar Series focuses on CAS members who have embraced the principles of innovation to accelerate the growth of their actuarial practices. Future webinars will focus on other emerging actuarial practice areas and highlight the role of the CEO in driving innovation at insurance organizations.

Innovation Community

The CAS Innovation Community is now up and running. The Innovation Community resides on the CAS website and is an excellent repository for all innovation activities at the CAS. The Innovation Community site is currently populated with several innovation articles, replays of the Innovation Profile Webinar Series, news items and other items of interest for innovators. It is an excellent portal for CAS innovators to exchange ideas and keep up with the growing innovation activity at the CAS.

As the American cultural anthropologist Margaret Mead once said: "Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has." As we hope you will learn from the CAS' innovation journey, overcoming orthodoxies and "changing how we do things around here" starts with a small group of actuaries committed to making our profession better. ●

Kevin Michael Bingham, ACAS, is a principal for Deloitte Consulting, LLP in Hartford, Connecticut. Aaron M. Halpert, ACAS, is a principal with AMH Advisory LLC in New York.

Be a part of the CAS Innovation Community! Visit community.casact.org/p/co/ly/gid=198%3E

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EXPLORATIONS BY GLENN MEYERS

Dependencies in Stochastic Loss Reserve Models

My approach to the problem of correlations, or more generally, "dependencies," has usually appealed to some kind of causal modeling such as a common shock model. That changed at last November's CAS Centennial meeting when I attended a presentation by Yanwei (Wayne) Zhang about his paper, "Predicting Multivariate Insurance Loss Payments Using a Bayesian Copula Framework,"[1] written jointly with Vanja Dukic. The CAS awarded this paper the ARIA Prize. This annual prize, established in 1997 by the American Risk and Insurance Association, is made to the author or authors of a paper published by the *Journal of Risk and Insurance* that provides the most valuable contribution to casualty actuarial science.

The idea behind the Zhang-Dukic paper has a very simple high-level description. Suppose we have two Bayesian Markov chain Monte Carlo (MCMC) models, say Model 1 and Model 2. We can then use Bayesian MCMC to fit a joint (Model 1, Model 2) distribution. Zhang and Dukic expressed their bivariate distribution in its most general formulation as a copula, but any kind of bivariate distribution will work. Having just written a monograph for the CAS on Bayesian MCMC stochastic loss reserve models,[2] I thought I would give their approach a try on one of the models in my monograph.

I chose a changing settlement rate (CSR) model and applied it to paid 10 x 10 triangles taken from the commercial auto, and personal auto lines in the CAS Loss Reserve Database.[3] Following is a high-level description of this model.

Let w and d be subscripts for the accident year and development year, respectively. Let C^X_{wd} denote the cumulative paid loss for line X; $X = 1$ for commercial auto and $X = 2$ for personal auto. The univariate version of the model takes the following form:

$$\log(C^X_{wd}) \sim \text{normal}(\mu^X_{wd}, \sigma^X_{wd}),$$

where each μ^X_{wd} is a function of accident year and development year parameters. In all, there are 30 parameters in this model. There is a link to the full description of this model, along with the R/JAGS script, in the web version of this article.

The bivariate version of this model takes the following form.

$$\begin{pmatrix} \log(C^1_{wd}) \\ \log(C^2_{wd}) \end{pmatrix} \sim \text{normal}\left(\begin{pmatrix} (\mu^1_{wd}) \\ (\mu^2_{wd}) \end{pmatrix}, \begin{pmatrix} (\sigma^1_d)^2 & \rho\sigma^1_d\sigma^2_d \\ \rho\sigma^1_d\sigma^2_d & (\sigma^2_d)^2 \end{pmatrix} \right).$$

This model has 30 parameters for each line of insurance, plus a correlation parameter ρ, for a total of 61 parameters. Fitting a Bayesian MCMC model yields a sample of 10,000 parameter sets from the posterior distribution. I ran this model on two insurers in the CAS Loss Reserve Database. Of particular interest is the correlation parameter, ρ. Figures 1 and 2 describe the posterior distribution of ρ for each insurer. Table 1 below gives some summary statistics of the predictive distribution of outcomes for the marginal distributions and the sum of losses in each line of insurance.

Table 1

Insurer #353	Net Premium	Expected Loss	S.D. Loss
Line 1 Marginal	52,429	37,845	1,824
Line 2 Marginal	155,061	126,439	2,018
Line 1 + Line 2	207,490	164,285	2,523
Insurer #388			
Line 1 Marginal	1,086,150	777,078	133,916
Line 2 Marginal	1,270,861	1,040,930	75,989
Line 1 + Line 2	2,357,011	1,818,009	155,108

I have run this model on several other insurers and found that these two insurers represent fairly well what happens with other insurers.

Based on my work to date on this topic, here are some general observations.

- My biggest surprise is that it is not uncommon for insurers to have negatively correlated logarithms of losses. As a quick reality check, I calculated the standard deviations of

[1] http://www.marsinsights.com/publication/bayesianCopulaOneComp.pdf
[2] http://www.casact.org/pubs/monographs/papers/01-Meyers.PDF
[3] http://www.casact.org/research/index.cfm?fa=loss_reserves_data

Figure 1

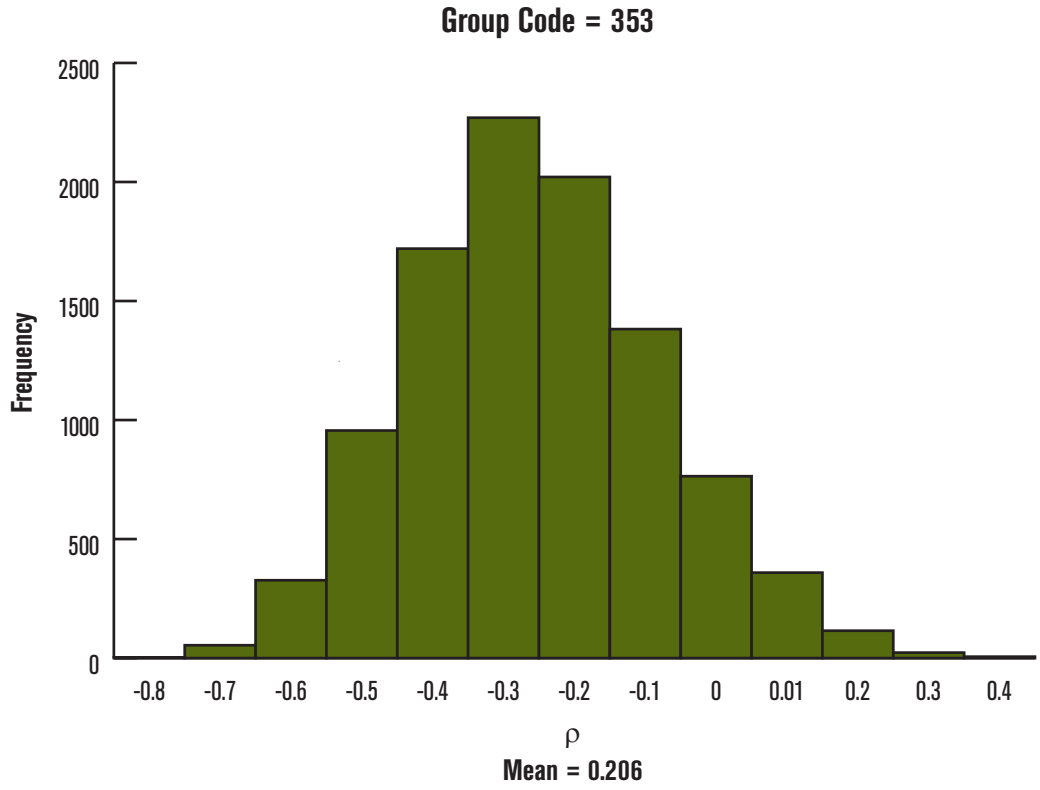
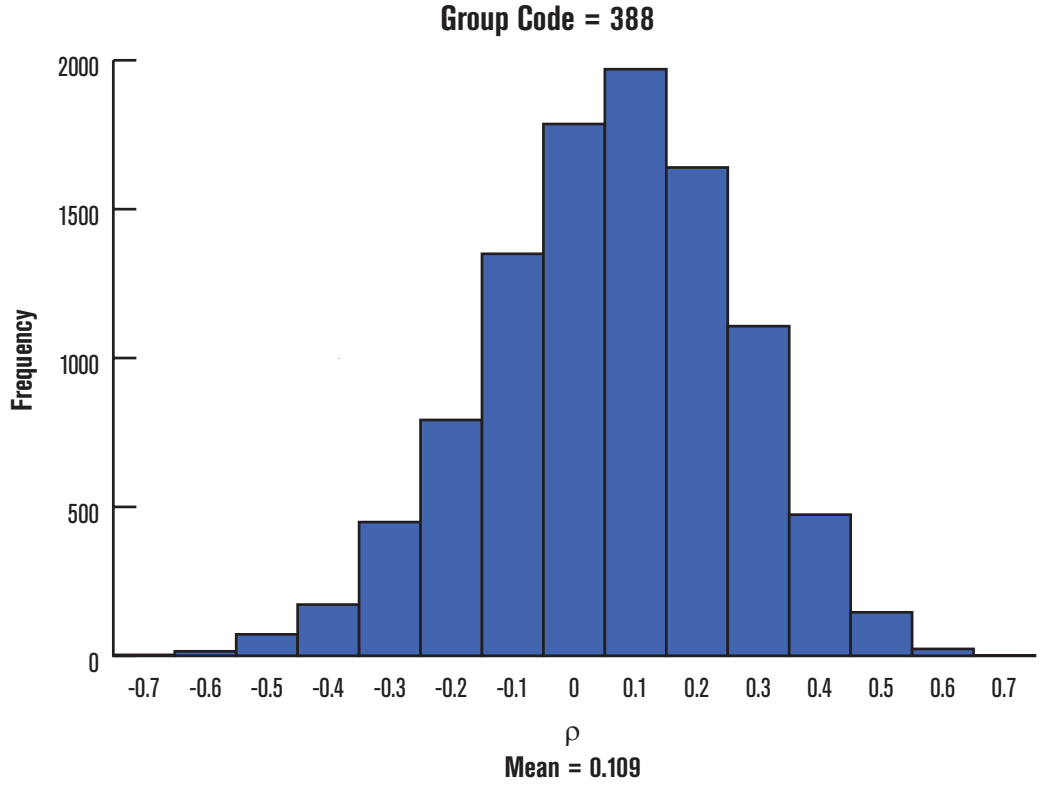


Figure 2



the total loss under the assumption of independence between lines and got following:

- 2,720 for Insurer #353. This is greater than the standard deviation obtained with the bivariate model, which is to be expected as the posterior mean coefficient of correlation is negative.
- 153,973 for insurer #388. This is less than the standard deviation obtained from the bivariate model, which is to be expected as the posterior mean coefficient of correlation is positive.
- If these results hold up under further scrutiny, it could imply that there is a sizeable diversification benefit for multiline insurers in various risk-based capital and liability risk margin regimes. For example, the liability risk margins under Solvency II are additive by line of insurance, which is tantamount to assuming that the lines of insurance are perfectly correlated.
- The prior distribution I chose for this model for each σ_d has a lighter tail than the prior distribution I used for the CSR model in my monograph. The results were unstable for the prior distribution I used there. I would very much like to have a model that worked well for all prior distributions. I am still thinking about how to handle prior distributions of σ_d with heavier tails.

As we can see, there is work that remains to be done. But nonetheless, we should all thank Zhang and Dukic for a fine piece of basic research that could have far reaching effects on solvency management for the insurance industry.

Meet the *Variance* Author: A Q&A with Joseph Boor

Joseph Boor, FCAS, Ph.D., CERA has been a member of the CAS for 30 years, and is presently employed as an actuary at the Office of Insurance Regulation of Florida. He is the author of the paper, "Interpolation Along a Curve," published in the latest issue of *Variance*.

Q: Describe your paper in three sentences or less.

A: My paper shows a better way to interpolate loss development factors, increased limits factors and other rating items. The idea is to begin with a mathematical curve fitted to the data points but then adjust it so that it exactly matches the "real" data points that you began with. The paper also offers examples that outline all the necessary steps — including the curve fitting itself — for interpolating loss development factors and increased limit factors.

Q: Why did you choose to write about this particular topic?

A: I've been using this method for over 20 years. Through my work as a regulator I've seen a lot of filers struggle with this subject. I also had a fair amount of material for the foundation of my paper, as I thought I might need the methodology to interpolate company variance and loss development factors as a function of the reinsurance retention, as part of my recent Ph.D. dissertation.

Q: Who is your intended audience?

A: Actuaries doing practical reserving and pricing work.

Q: What makes this paper unique?

A: Interpolation is a subject that has not attracted a lot of attention in recent years (although when you have to do it, it becomes very important). In addition, this paper includes a "field test" of interpolation along the curve against a number of other methods — an idea borrowed from a 2009 *Variance* paper, "Claim Reserving: Performance Testing and the Control Cycle" by Jing, Lebens and Lowe.[1]

Q: What key point does your paper convey to CAS members?

A: The major take-away here is a fairly easy-to-replicate process for interpolating loss development or increased limit factors. I wrote this paper specifically to provide that to the CAS membership.

Q: Was there anything that surprised you during the course of your research?

A: As a consequence of the testing, it became apparent that, if you are not going to use curve fitting in any way, linearly interpolating the percentage of losses developed (paid or incurred) and dividing the result into one is pretty much the most accurate interpolation method for loss development factors.

Joseph Boor

Q: What else are you working on right now?

A: I recently had another article accepted by *Variance* that gives tools for computing the "best estimate" credibility for an overall rate change. It seeks to bridge the gap between an existing theoretical model (Gerber-Jones) and what is needed to compute actual credibility values. In the continued spirit of investigating the parts of the ratemaking formulas that receive less attention, I have what I believe to be a better alternative to the flat test correction factor.

***

To read all the papers from the latest issue of *Variance*, visit www.variancejournal.org.

[1] Jing, Yi, Joseph R. Lebens, and Stephen P. Lowe, "Claim Reserving: Performance Testing and the Control Cycle," Variance 3:2, 2009, pp. 161-193.

IN MY OPINION BY GROVER EDIE

Why Hire an Actuary?

My wife and I are back from the CAS Spring Meeting in Colorado Springs. It is a beautiful place, but it was rainy, overcast and cool during our stay.

I was happy to meet with friends I have known a long time and met quite a few new ones.

So far, my wife has prevailed in stopping me from peeling potatoes with my bench grinder power tool. (I have a grinder, but we are currently out of potatoes.) If you attended Ross Shafer's presentation, you will understand what I am talking about. I'll have more on this in a future column, if I succeed in my potato-peeling endeavor.

The sessions were good and one prompted me to focus on how we, as professionals, have changed over the years. The "Actuarial Modernization" session had some thought-provoking ideas. An important "gold nugget" was provided by one of the panelists who said: "We are moving from being supporters of the business to partners in the business to leaders of the business."

I pondered the changes I have seen in the topics and the presentations over the years I have been attending the CAS meetings. I got to thinking about what the meetings will be like in 10, 20 or even 30 years from now.

Futurists claim that 50 percent or 60 percent of the jobs that will exist in the next decade do not even exist today. My experience is that either the percent is too high or the time horizon too short; think of the jobs that existed in past years that are no longer widespread today. I recall typing pools, stenographers, travel agents and more. I started my career as an underwriter trainee. I started in the file room, which took up a significant amount of floor space. Metal file cabinets held the paper copies of the declarations page, inspection reports, motor vehicle records and other items pertaining to each insurance contract we wrote. (The claims department had its own file room.) I then rotated through the rating department, which comprised individuals who rated each insurance contract using the (paper) manual, rate sheets and pencil and paper (no calculators at that time). All of those departments are now gone, replaced by the

power of the computer. Are the CAS and its members destined for the same fate?

The CAS "envisioned future," which is part of the CAS Strategic Plan, is broken down into two parts. The first is to "be globally recognized as the pre-eminent resource in educating casualty actuaries and conducting research in casualty actuarial science." The second part is that "CAS members will be recognized as the leading experts in the evaluation of hazard risk and the integration of hazard risk with strategic, financial, and operational risk."

company pay big salaries or consulting fees for a credentialed actuary when they believe they can get it better and cheaper by hiring someone they believe can do the same work, but without the cost of the credentials?

I recommend that you take some time and think about your answer.

Here is my answer:

There are professionals who are better at (pure) math than actuaries, others who are more expert in insurance coverages and possibly some who are better at understanding insurance processes.

How do we, as individuals, keep from going the way of the punch card? How do you, personally, avoid having your professional skills become irrelevant?

The first part of that goal is one for the CAS, as a society, to accomplish. CAS leadership knows it, is seeking to achieve it and, I believe, will realize that part of the goal.

The second part is for us, as members of that society, to make happen. How do we, as individuals, keep from going the way of the punch card? How do you, personally, avoid having your professional skills become irrelevant?

We tend to be comfortable with the status quo. Change is difficult, but change is also necessary for us to remain relevant. Are we watching the trees (pricing, reserving, capital and predictive modeling) and unable to see that the forest is burning? The quants, certified financial analysts, MBAs and more are seeking to take over our turf and, more importantly, the newly emerging practice areas. Why would any rational company pay big salaries or consulting fees for a credentialed actuary when they believe they can get it better and cheaper by hiring someone they believe can do the same work, but without the cost of the credentials?

I recommend that you take some time and think about your answer.

Here is my answer:

There are professionals who are better at (pure) math than actuaries, others who are more expert in insurance coverages and possibly some who are better at understanding insurance processes. The accountants and their finance cousins are likely better at accounting and finance than actuaries. There are individuals who are better at handling large volumes of data. But CAS members are the most skilled at evaluating hazard risk and integrating hazard risk with strategic, financial and operational risks.

If your company needed most or all of the skills above, you would need to assemble a whole team of people,

Or you can hire one actuary.

The actuary's advantage is that she or he has all of that training and experience in her or his head and can better see the interactions among the various disciplines. In a sense, an actuary is a "team of one."

When you think of it that way, an actuary just might be the least expensive team you can assemble.

RANDOM SAMPLER BY PAT TEUFEL

This is not an End, but a Beginning

The following address to new members was given by Pat Teufel on May 18, 2015 at the CAS Spring Meeting in Colorado Springs, Colorado.

First, let me add my personal congratulations to our new Fellows and Associates on reaching this significant milestone in your professional careers. For our new Associates: Welcome to the CAS! You've made it past the half-marathon marker, and you can see the finish line. Don't give up now! Finish the race — it's worth it. For our new Fellows, take a deep breath and enjoy the moment. You've made it; you have achieved one of the most valued actuarial credentials in the world, the FCAS! Congratulations, also to the family and friends who have supported our celebrated members on their journeys to this destination. This is your moment, too!

I am deeply honored to have been asked to address you this morning.

Pat Teufel

Be open to new opportunities. Yes, it's uncomfortable to venture into uncharted territory. "Will I be good enough?" "What if I fail?" Do it anyway! The rewards are plentiful, whether you succeed or bomb. Some of my richest learning experiences were those where I failed abysmally!

First, for most of you, this is not our first encounter. We've met before through the Course on Professionalism, and, in a small way, I like to think that I have influenced the compass for your journey. Lest you worry, I will not be using those same remarks here. While the themes may be similar, this is a celebration — of your perseverance, your commitment to a vision and of the difference that you can make — for your employers, for our profession and for society as a whole.

Even more special, at least to me, is that this is a homecoming. You see, 36 years ago, here at the Broadmoor, I was sitting where you are now at the CAS Spring Meeting, being welcomed into the CAS as a new Fellow by then-CAS president, Ruth Salzmann.

I tried to recall who gave the Address to New Members at my Fellowship meeting. My mind drew a blank. I thought, must have been a typical actuarial speech — you know, the ones you fall asleep for? But I felt somewhat guilty; after all, I remembered the Broadmoor — it was cold that year, too. I remembered Ruth Salzmann, the first female president of the CAS and a pioneer for women long before it was fashionable. Why couldn't I remember who gave the Address to New Members? And then it dawned on me. This tradition, having a past president address new members, only began in 1985. It's relatively new in the span of our 100-year history. Whew! I don't need to reserve my room in the Alzheimer's ward quite yet!

All kidding aside, why have an Address to New Members? As our organization grows larger, I think that this is a way for the CAS to impart its culture and core values, in a personal way. It is also an opportunity for an old codger like me to share some of the lessons learned along the way. Collaboration is a huge

part of who we are as a Society, and I thank the many members who posted to a recent blog "What advice would you give to yourself as a young actuary?" You'll see their thoughts interspersed throughout my comments today.

So what advice would I give to you, our newest CAS members?

First, recognize that this is not the end, but a beginning. Leroy Simon, in his 1999 Address to New Members warned, "It is easier to become an actuary than to *be* one." I've certainly found that to be true. In reaching this actuarial designation, you have demonstrated excellence in the analysis of numerical data and a mastery of the key elements of casualty actuarial science. You have a firm understanding of what it takes to be a professional. With this foundation, you're now ready to turn things on their head and see them in a different light. Actuarial science continues to advance, and we must grow too. You have embarked on a lifetime of learning — from each other, from nonactuarial business colleagues, from family and friends. Some of this learning will be technical, although in areas not currently tested on the actuarial exams — perhaps nanotechnology, nutrition, behavioral science or weather. But the majority of your learning will likely fall in the area of "soft skills" — understanding how culture influences one's view of reality, how to communicate complex actuarial concepts to non-actuaries, how to influence decisions.

Second, expand your horizons and your experiences. Most of us spend the early days of our actuarial careers talking with other actuaries. Occasionally, we'll share moments with our significant others, maybe even our children — but often just to negotiate schedules. Now is your time to expand your horizons and listen — truly listen. You'll be amazed at the perspectives you can gain from underwriters, claims adjusters, accountants, lawyers, marketing professionals — yes, even family! These new perspectives will prepare you for broader roles within your company, but also for richer lives. Be open to new opportunities. Yes, it's uncomfortable to venture into uncharted territory. "Will I be good enough?" "What if I fail?" Do it anyway! The rewards are plentiful, whether you succeed or bomb. Some of my richest learning experiences were those where I failed abysmally!

I firmly believe that life is a journey of finding ourselves — the best that we are.

Third, time — there's never enough. Learn to manage your time well, on things that are important to *you*. Focus on *all* aspects of your life — work, family, yourself. Balancing work and family commitments is an art, not a science. What works for me will not necessarily work for you. I urge you to make a conscious choice about the balance that you want in your life and what will work for you in achieving that balance.

In that balancing act, remember to "pay it forward." We are so fortunate — each and every one of us. Whatever our personal struggles, we have been blessed with keen minds, strong education, a lucrative profession, the support of families, and, for the most part, good health. As we are prioritizing our time, it's important to reach beyond ourselves and think about the many people who are in trouble and need help. We need to invest in making the world a better place. There are myriad ways to pay it forward, through direct contributions to worthy causes, through mentoring and service activities, through service on any one of over 100 CAS committees and task forces, or just by being there — fully there — at the moment someone needs a shoulder to lean on.

Lastly, have fun along the way. If you are not happy doing what you're currently doing, make a change. We spend too much of our lives at work to have it be doing something you hate! Even if it means branching out from actuarial, there are thousands of ways that you can use the skills you've gained in meaningful ways. Invest your time in something you really love! Take time to laugh with friends and colleagues. I firmly believe that life is a journey of finding ourselves — the best that we are. Many people cross our path in that journey. Treasure each and every person, each and every moment.

My wish for each of you is that you will find as much joy in this profession as I have. Who knows, 50 years from now, when the CAS returns again to the Broadmoor for its Spring Meeting, perhaps it will be one of you who is tapped to give the Address to New Members!

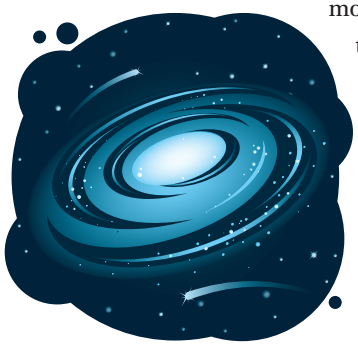
Meanwhile, celebrate! You've earned it!

Pat Teufel, FCAS, MAAA, became CAS president in November 2011, coincident with her retirement from KPMG LLP. In addition to some independent consulting, she is an adjunct professor of mathematics/actuarial science at the University of Connecticut.

IT'S A PUZZLEMENT BY JON EVANS

The Darkness Between Stars and the Size of the Universe

Olbers' paradox argues that if the universe is infinite, eternal and static then the night sky should be completely covered by stars. Suppose the universe is spherical, eternal and static. The stars are all spherical with the same radius and light does not reflect back from the edge of the universe. Also suppose the very many stars are randomly distributed; light scatters from the surface of a star but then travels in straight rays. Furthermore, assume stars take up a fraction of 1 in 10^{29} of the volume of the universe and, from the center of the universe looking out, stars appear to cover one part in a trillion of the sky. Can you estimate the radius of the universe in units of the radius of a star? Can you estimate how many stars there are? If the radius of the stars was 10 times greater but took up the same total volume, what fraction of the sky would be covered in stars?



The Shape of Melting Ice

In this puzzle a cube of ice completely melts in exactly one hour. Throughout the melting the temperature inside the entire ice cube remains uniform, just a tiny amount below the freezing point. The external environment maintains a temperature just above the freezing point. The heat transfer rate is uniform across the surface of the cube. Under the same conditions how long would the same amount of ice shaped like a regular tetrahedron take to melt? What about shaping it like a torus with a major radius twice its minor radius? Is there any specific shape that would take the longest time to melt? Is there any specific shape that would take the shortest time to melt?

Observe that for a given volume V the instantaneous melting is proportional to the surface area. For a cube the edge length $b = V^{(1/3)}$ and therefore the surface area is $S = 6\ V^{(2/3)}$. A regular tetrahedron with edge length l, has surface area $S = (l^2)\ \sqrt{3}$ and volume $V = (l^3) / (6\sqrt{2})$. So, for a tetrahedron $S = 6\ (3^{(1/6)})\ V^{(2/3)}$, or $3^{(1/6)} = 1.20094\ldots$ as much surface area as a cube with the same volume. Both the cube and the tetrahedron will shrink but maintain the same shape as they melt. So the tetrahedron melts $3^{(1/6)} = 1.20094\ldots$ times as fast for each progressively smaller volume V. Therefore from the initial volume to volume 0, the tetrahedron takes $3^{(-1/6)} = 0.832683\ldots$ hours or 49 minutes and 58 seconds to melt.

A torus has $S = 4\ \pi^2\ r\ R$ and $V = 2\ \pi^2\ r^2\ R$, where R is the major radius and r is the minor radius. However, as the torus melts uniformly, R remains the same, but r shrinks and the torus shrinks to a thin ring and then disappears. The minor radius r decreases at a uniform rate per time, since $S = dV/dr$ and dV/dt being proportional to S together imply that dr/dt is constant. In fact r will decrease at one half the rate per time as the edge b of the melting ice cube decreased. This is so because for the torus $dV/dt = S\ dr/dt$ and for the cube $dV/dt = S\ d(b/2)/dt$, and in both cases dV/dt is proportional to S. If initially $R = 2r$, then $V = 4\ \pi^2\ r^3 = b^3$ and therefore $r = (4\ \pi^2)^{(-1/3)}\ b = (0.293684\ldots)\ b$. So, the torus takes only $2\ (0.293684\ldots) = 0.587368\ldots$ hours or 35 minutes and 15 seconds to melt.

The shape with the least area per volume will take the longest time to melt. This is a sphere where $S = 4\ \pi\ r^2$ and $V = (4/3)\ \pi\ r^3$. For the sphere $S = (6^{(2/3)})\ (\pi^{(1/3)})\ V^{(2/3)}$ and therefore it melts $(\pi/6)^{1/3} = 0.805996$ times as fast as the cube. So the sphere takes $(\pi/6)^{(-1/3)} = 1.2407\ldots$ hours or 74 minutes and 27 seconds to melt.

For arbitrary shapes the surface area for a given volume can be made arbitrarily great. For example, a box with a square base with edge l and height l/k has $V = (l^3)/k$ and $S = 2\ l^2 + 4\ (l^2)/k$. So, in this case $S = (2\ k^{(2/3)} + 4\ k^{(-1/3)})\ V^{(2/3)}$. Since $S > k^{(2/3)}\ V^{(2/3)}$, S can be made as large as desired by increasing k to make $k^{(2/3)}$ as large as desired. So, the box can be made as broad and shallow as needed to melt as quickly as desired. ●

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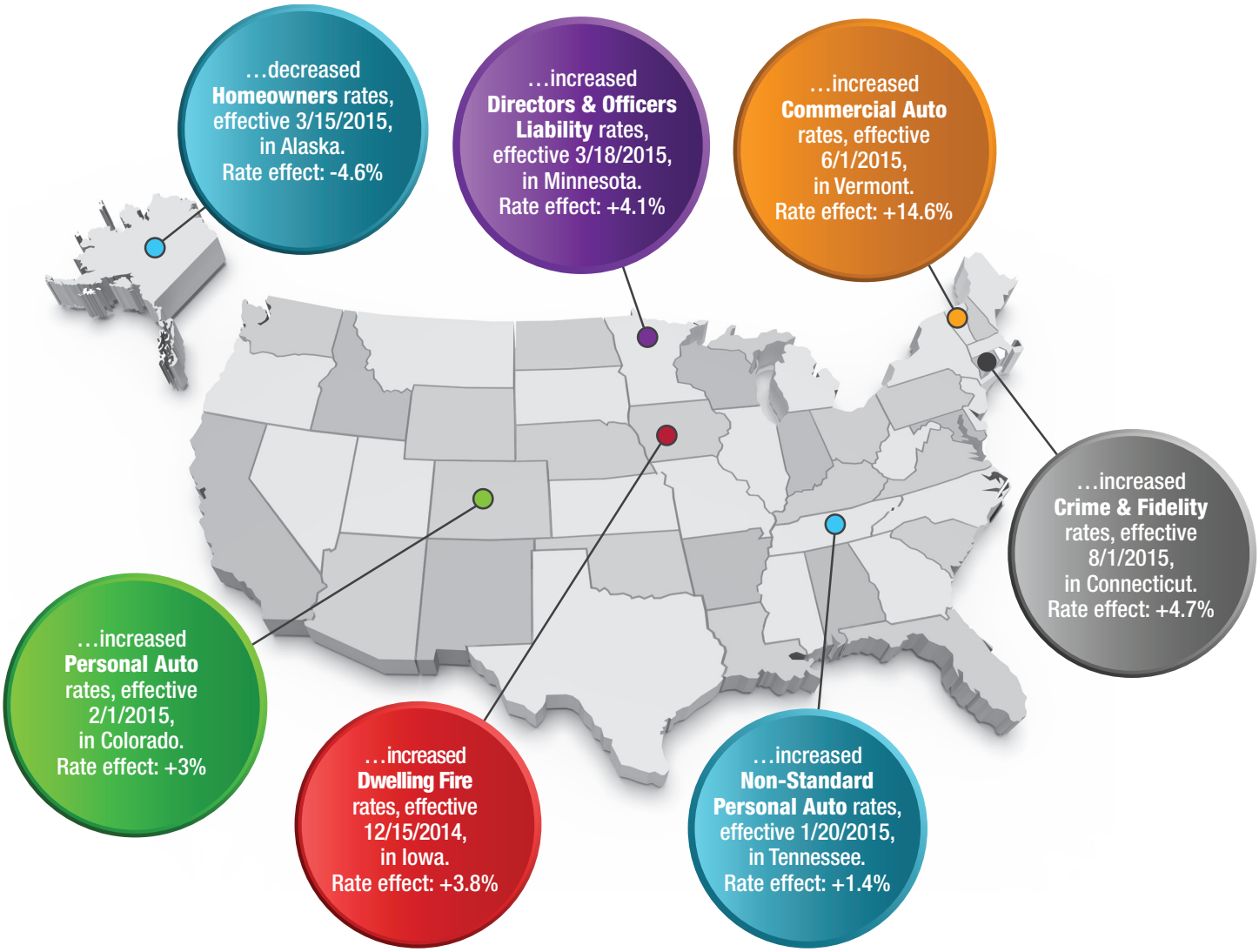

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