



Probability Management

2016 Annual Report

ProbabilityManagement.org

A letter from our Executive Director

The mission of ProbabilityManagement.org is to change the way people communicate and calculate uncertainty. The following examples, taken from this year's conference program, highlight how we are accomplishing our goals in diverse areas.

- The Environmental Protection Agency is extracting distributions of pathogen concentration on a test basis using the SIPmath™ XML standard.
- We think of data as recording past history. SIP data, on the other hand, simulates the future. Autobox forecasting software is the first time series package to offer such simulated forecasts in a standardized way.
- The San Bruno pipeline explosion of 2010 has driven interest in improved risk management at the utilities and the California Public Utilities Commission. Probability management has now become part of that discussion.
- In partnership with the Government Finance Officers Association, we have introduced probabilistic budgeting to the cities of Redmond, WA, Boulder, CO, and Sunnyvale, CA.
- Through our relationships with Chevron and Project Lead The Way, I was introduced to a STEM teacher at West Oakland Middle School. I first taught a course to the Oakland 8th graders, and a couple of days later, hooked them into my Stanford course through a web meeting, leading to one of the high points of my teaching career.
- Just as we were going to press with this report, we learned that a senior member of the Microsoft Office Analytics team will be presenting at our annual conference. We have already had lengthy discussions with Microsoft about Analytics in Excel and are delighted to welcome them to San Diego.

To our sponsors, partners, and supporters, all of us at ProbabilityManagement.org thank you for allowing us to continue this exciting journey.

Sincerely,

A handwritten signature in blue ink that reads "Sam L. Savage". The signature is written in a cursive style and is set against a light yellow rectangular background.

Sam L. Savage
Executive Director

Our Sponsors and Affiliates

Probability
Management



Thank you to our generous sponsors and affiliates! With their support, 2015 was ProbabilityManagement.org's most active and successful year yet.

Sponsors



Foundation for Creativity in Dispute Resolution

Computer Law LLC

Affiliations



Centre for
Risk Studies

Research Partner

Government Finance
Officials Association



Education Collaborator



Technology Partner



2015 Accomplishments

Your support has led to significant accomplishments in the areas of leadership, sponsorship, outreach and engagement in 2015.

Leadership

The intellectual diversity of ProbabilityManagement.org is its greatest asset. In 2015, three new thought leaders joined our team to help us change the way the world thinks about uncertainty.

- **Doug Hubbard** is the author of *How to Measure Anything*, *The Failure of Risk Management*, and *Pulse*. He is the founder of Hubbard Decision Research, which specializes in Applied Information Economics. Doug has agreed to chair an ongoing committee on Decisions and Measurements for our organization.
- **Steve Roemer** is Chairman and CEO of Lone Star Analysis, a firm that solves complex business and technical challenges through analytics. Steve is chairing a committee on Best Modeling Practices.
- **Connor McLemore** is a Lieutenant Commander in the United States Navy, and Military Assistant Professor and Program Officer at the Naval Postgraduate School, where he has introduced SIPmath in his spreadsheet course. He is participating with ProbabilityManagement.org in a personal capacity to head up a committee on National Security Applications.

Sponsorship

Our sponsors provide us with not only funding, but ideas for further growth. I am pleased to announce two new sponsors who joined us in 2015.

- **Loring Ward** is financial advisory firm in San Jose with over \$13 billion in assets under management. Both of our organizations believe that the SIPmath standard can bring increased transparency and intuition to financial decisions.
- **Hubbard Decision Research** joined as a sponsor to help us develop an open framework for networking of simulations across the enterprise and industry.

Outreach

Our mission is to promote probabilistic thinking at all levels. Here are some of our 2015 outreach highlights:

- **East Coast Conference.** In June, we held a conference in the Washington, DC area at a state

of the art conference space generously donated by Lockheed Martin.

- **West Oakland Middle School.** Through our relationships with Project Lead the Way and Brian Putt of Chevron, I was introduced to Kennan Scott, former civil engineer, now a great STEM teacher at West Oakland Middle School. The fun Kennan and I have had with both his 8th graders and my Stanford class, linked through a live web meeting, is a high point of my teaching career.
- **Towards a Simulation Network.** Marc Thibault and I co-authored a paper for the proceedings of the 2015 Winter Simulation Conference (included in the 2016 Probability Management Annual Conference program).

Engagement

- **California Public Utilities.** In the wake of the tragic San Bruno pipeline explosion of 2010, utilities and regulators have become increasingly interested in improving risk assessment across the state. On December 4, I presented a SIPmath proof of concept model to the California Public Utilities Commission at a hearing designed to provide a common understanding of both the potential benefits and challenges in creating an aggregated model of utility safety risk.
- **Probabilistic Budgeting in City Government.** With the help of Shayne Kavanagh of the Government Finance Officers Association, we introduced a simple approach to probabilistic budgeting to the cities of Redmond, WA, Boulder, CO, and Sunnyvale, CA. This project has shown how a simple Excel template can reflect reasonable estimates of the chance of budget shortfall to users with or without statistical training.
- **Advancing the Standard.** This year, we added direct support of the R statistical language and two way support for Matlab. Michael Messner, a statistician with the EPA, has been experimenting with SIP libraries created in R. In addition, three software packages are now writing to the SIPmath standard. Autobox is a time series package that now saves simulated sample paths in XML format. Davies Consulting has developed software for life cycle management of utility assets such as transformers and utility poles, which delivers SIP libraries of pertinent distributions. Analytica, a multi-dimensional modeling tool from Lumina Decision Systems, now generates SIP libraries in Excel format.

2016 Proposed Activities



In 2015, ProbabilityManagement.org expanded its sphere of influence considerably.

- We have now appeared on Microsoft's radar screen, and in March, I will be presenting at the Microsoft Data Insights Summit in Bellevue, WA along with headliner Nate Silver, author of *The Signal and the Noise*.
- Through the Government Finance Officers Association (GFOA), we have initiated pilot studies of probabilistic budgeting with the cities of Redmond, WA, Boulder, CO and Sunnyvale, CA. We are currently planning educational programs that may be made available to their full 18,000 members.
- Our relationship with Project Lead The Way (PLTW.org) continues to develop in the area of K-12 STEM education. In particular, I have started collaborating with Kennan Scott, an excellent West Oakland Middle School teacher and his remarkable class of 8th grade computer science students. I am looking forward to working with Kennan and his class to develop further lessons in probability, which can hopefully be shared with other schools in the PLTW network.
- A new edition of *The Flaw of Averages* is under way, which will include extensive coverage of SIPmath and other developments at ProbabilityManagement.org. I look forward to suggestions for new material, with attribution, of course.

To leverage our growing network of recognition, we are planning three initiatives in 2016

1. Outreach Lecture Series

I am developing a series of outreach lectures to be delivered in a number of cities to further raise our visibility. Designed along the lines of Edward Tufte's famous lectures on graphics, these in person presentations will expose managers to the benefits of probability management and educate them in the use of the tools. The first scheduled date is in the DC area in June at the Lockheed Martin facilities. This series will be coordinated with our sponsors and research partners. Among other materials, attendees will receive the latest SIPmath tools, and a draft of my book and associated SIPmath Excel calculators entitled "Flat Plus Flat Equals Up in the Middle: a Primer on the Arithmetic of Uncertainty."

2. Software Licensing

The latest version of the SIPmath Modeler Tools (now in Beta test) is powerful enough to stand on its own as a full Monte Carlo package. We are exploring approaches to licensing this software in a manner consistent with our 501(c)(3) nonprofit status.

3. Random Number Management Framework

In a recent article, Marc Thibault and I explore the potential benefits of networked simulations. In such a world, the coordination of random number generation becomes important to prevent the accidental use of the same stream of numbers across two simulations which might eventually be combined. Towards this end, Doug Hubbard and I have launched an initiative to develop a framework for coherent random number management. Papers on both these topics are included in the 2016 Probability Management Annual Conference Program.

Board of Directors

Sam L. Savage
Executive Director and
Chairman of the Board

Sam L. Savage led the development of the open SIPmath standard for storing probability distributions as auditable data. Sam is also the author of *The Flaw of Averages: Why We Underestimate Risk in the Face of Uncertainty*, and is a Consulting Professor at Stanford University.



After receiving his Ph.D. in computational complexity from Yale University in 1973, Sam spent a year in the Mathematics Department at General Motors Research Laboratory, and then joined the Management Science faculty of the University of Chicago Graduate School of Business. Here he discovered that an Algebraic Curtain separated the bulk of his management students from management science. In 1985, Dr. Savage led the development of software called What'sBest!®, which coupled Linear Programming to Lotus 1-2-3. The package won PC Magazine's Technical Excellence Award in 1986. Since then, Sam has continued working to bring analytical tools to managers in an algebra-free environment. In 1990, Sam moved to Stanford, where he teaches Management Science in the Engineering School. He has been a Visiting Professor at Northwestern University's Kellogg School of Business and the Naval Postgraduate School in Monterey, and is a Fellow of the Judge Business School at the University of Cambridge.

Dr. Savage consults and lectures extensively to business and government agencies through his consulting firm, AnalyCorp Inc., and serves as an expert witness.

Michele Hyndman
Associate Director and Board
Member

Michele Hyndman has over 15 years of public relations and communications experience. She has worked in broadcast television, at a public relations firm and was the public relations manager at Stanford University Medical School Blood Center for over 10 years. Michele works effectively and



cooperatively with people at all levels of an organization, media and industry contacts, and vendors to achieve successful branding, media, marketing, advertising and communications plans. In 2012, she launched MMH Communications to leverage her experience and industry contacts to help other nonprofits and small businesses thrive in a highly competitive landscape. Michele is inspired by organizations that help to improve the lives of others.

As Associate Director, Michele manages communication and marketing strategies, coordinates outreach to corporate sponsors and partners, and oversees Probability Management conferences and events.

Michele holds a Bachelor of Arts (BA) in Communication and Media Studies from California State University, Sacramento.

Harry Markowitz
Board Member

Dr. Markowitz has applied computer and mathematical techniques to various practical decision making areas. In finance: in an article in 1952 and a book in 1959, he presented what is now referred to as MPT, "modern portfolio theory." This has become a standard topic in college courses and texts on investments, and is widely used by institutional investors and financial advisors for asset allocation, risk control and attribution analysis. In other areas: Dr. Markowitz developed "sparse matrix" techniques for solving very large mathematical optimization problems. These techniques are now standard in production software for optimization programs. Dr. Markowitz also designed and supervised the development of the SIMSCRIPT programming language. SIMSCRIPT has been widely used for programming computer simulations of systems like factories, transportation systems and communication networks.



In 1989 Dr. Markowitz received The John von Neumann Award from the Operations Research Society of America for his work in portfolio theory, sparse matrix techniques and SIMSCRIPT. In 1990 he shared The Nobel Prize in Economics for his work on portfolio theory. Dr. Markowitz is the principal of Harry Markowitz Company. He is also an adjunct professor at the Rady School of Management, UCSD.

Our Team



Hamutal Avavi Russo
Chief Financial Officer

Ms. Hamutal Avavi Russo brings over 15 years of experience in financial planning and fundraising for both enterprise software and medical device startups.



Ms. Anavi Russo has an MBA from the Kellogg School of Management, Northwestern University, Chicago @Recanati Business school, Tel-Aviv University, Bachelor of Business Administration from the College of Management, Tel-Aviv, Israel, and a B.S. in Chemistry from Technion, Haifa, Israel.

has developed software for creating and manipulating Stochastic Information Packets (SIPs), and a compressed form of SIP representation called Distribution Strings.

Jordan Alen
Technology Coordinator

Jordan Alen is responsible for the implementation and management of the website. Jordan has worked closely with Sam on projects ranging from the DARPA proposal abstract to the events scheduled for the San Diego conference. His interests include astrophysics and Toastmasters meetings.



Melissa Kirmse
Director of Operations

Melissa Kirmse has over 20 years of project coordination, administrative, and technical writing experience. She has worked for various tech companies including Microsoft and TiVo. Together with Dr. Sam Savage, she coauthored the article “Probability Management 2.0,” which appeared in the October 2014 issue of *OR/MS Today*. Melissa was promoted to Director of Operations at ProbabilityManagement.org in 2014. She set up an accounting system for the company and manages the day-to-day accounting. She coordinates PM’s presence at various trade shows and conferences throughout the year and manages corporate communications and logistics. Melissa graduated summa cum laude from the University of Maryland with a degree in Communication Studies.



Dave Empey
Director of Software Development

Dave Empey has more than 20 years of experience with Monte Carlo simulation. He has worked with Dr. Sam Savage since the early 1990’s, and developed Monte Carlo and decision tree software for Anadarko Petroleum Corporation, the Bessemer Trust, the NSA, Royal Dutch Shell, and Lockheed Martin, among others. With Dr. Savage, Dave



Committee Chairs

John Marc Thibault Chair, Standards Committee

John Marc Thibault is an independent consultant with a twenty-year practice focused on technical analysis, design and planning. His clients have included a large fraction of the Canadian federal government's departments and a variety of high-tech companies. His earlier experience includes over a decade of marketing and technology roles at Xerox, and senior management in two high-tech startups. He has a physics degree from Loyola College in Montreal.



Author of the "Art of the Plan" blog at goodplan.ca, he is developing software and operational techniques to fix the Flaw of Averages in project planning, and to correct the systemic errors that result in high-risk plans and unattainable targets.

Doug Hubbard Chair, Decisions and Measurements

Mr. Hubbard is the inventor of the Applied Information Economics (AIE) method and founder of Hubbard Decision Research (HDR). He is the author of one of the best-selling business statistics books of all time, *How to Measure Anything: Finding the Value of Intangibles in Business*. He is also the author of *The Failure of Risk Management: Why It's Broken and How to Fix It*, and *Pulse: The New Science of Harnessing Internet Buzz to Track Threats and Opportunities*. He has sold over 100,000 copies of his books in five different languages and his books are used in courses in over a dozen major universities.



Mr. Hubbard's career has focused on the application of AIE to solve current business issues facing today's corporations. Mr. Hubbard has completed over 95 risk/return analyses of large, critical projects, investments and other management decisions in the last 20 years. AIE is the practical application of several fields of quantitative analysis including Bayesian analysis, Monte Carlo simulations, and many others. Mr. Hubbard's consulting experience and financial analysis totals over 27 years and spans many industries including pharmaceuticals, insurance, banking, utilities, cyber security, interventions in developing economies, mining, federal and state government, entertainment media, military logistics, and manufacturing.

Steve Roerman Chair, Best Modeling Practices

Steven D. Roerman is Chief Executive Officer at Lone Star Analysis. He has served on the boards of a number of corporations, authored dozens of papers on technology and management, and he holds patents in the defense, telecommunications and energy sectors. Much of his work deals with large, complex systems, whether human institutions, computer systems, networks, or systems of systems.



He holds a degree in Applied Mathematics with post graduate studies in mathematics, business, telecommunications and signal processing. He is a Senior Member of the IEEE, a Life Member of the NDIA, and a member of the SPE.

Lieutenant Commander McLemore Chair, National Security Applications

Lieutenant Commander Connor S. McLemore is a designated E-2C Naval Flight Officer. He was deployed to the Persian Gulf, flying in support of Operations Southern Watch, Iraqi Freedom and Enduring Freedom, and to the Indian Ocean and Western Pacific in support of the humanitarian Operation Unified Assistance and was the lead Navy Air Officer in the Joint Task Force Headquarters in support of Philippine Typhoon relief, Operation Damayan.



Lieutenant Commander McLemore graduated from the U.S. Naval Academy with a Bachelor of Science in Mechanical Engineering. He completed an Operations Research Masters Degree at the Naval Postgraduate School in Monterey, California. His NPS thesis was awarded the Military Operations Research Society Stephen A. Tisdale Graduate Research Award. He also completed a National Security and Strategic Studies Masters Degree, awarded with distinction, from the Naval War College in Newport, Rhode Island. He is a graduate of the Navy Fighter Weapons School (Topgun) and Naval Strike and Air Warfare Center's Advanced Mission Commander Course (AMCC).

Lieutenant Commander McLemore is a Military Assistant Professor of Operations Research and the Operations Research Program Officer at the Naval Postgraduate School.

Financials



Balance Sheet

as of December 31, 2014, December 31, 2015

	<u>Dec-15</u>	<u>Dec-14</u>
Assets		
Current Assets		
Cash	\$43,597	\$34,072
Accounts Receivable	\$0	\$1,000
Other Current Assets	\$3,878	\$3,967
Total Current Assets	<u>\$47,474</u>	<u>\$39,039</u>
Fixed Assets		
Gross Fixed Assets	\$553	\$553
Accumulated Depreciation	(\$292)	(\$108)
Net Fixed Assets	<u>\$261</u>	<u>\$446</u>
Total Assets	<u><u>\$47,736</u></u>	<u><u>\$39,484</u></u>
Liabilities		
Current Liabilities		
Accounts Payable	\$1,548	\$4,836
Other Current Liabilities	\$31,371	\$15,073
Total Current Liabilities	<u>\$32,919</u>	<u>\$19,909</u>
Total Liabilities	<u><u>\$32,919</u></u>	<u><u>\$19,909</u></u>
Net Assets		
Unrestricted Net Assets	\$19,575	\$27,066
Net Loss	(\$4,759)	(\$7,491)
Total Net Assets	<u>\$14,817</u>	<u>\$19,575</u>
Total Liabilities and Net Assets	<u><u>\$47,736</u></u>	<u><u>\$39,484</u></u>

Financials

Statement of Operations

YTD 2014, YTD 2015

	<u>Dec-15</u>	<u>Dec-14</u>
	<u>Actual</u>	<u>Actual</u>
Corporate Contributions	\$125,605	\$86,992
Individual Contributions	\$2,588	\$5,482
Matching Gifts	\$4,099	\$2,000
Program Service	\$38,233	
Income	\$170,524	\$94,474
Operating Expenses by Department		
R&D	\$19,137	\$12,538
S&M	\$102,134	\$56,360
G&A	\$53,985	\$32,963
Total Operating Expenses	\$175,256	\$101,861
Operating Income (Loss)	(\$4,732)	(\$7,388)
Interest Expense (Income)	(\$1)	(\$11)
Bank Fees	\$63	\$115
Other Expenses (Income)	(\$35)	
State and Local Taxes		
Changes in Assets	(\$4,759)	(\$7,491)



Statement of Cashflows

YTD 2014, YTD 2015

	Dec-15	Dec-14
Operating Cashflows		
Net Income	(\$4,759)	(\$7,491)
Adjustments to Net Income:		
Depreciation and Amortization	\$184	\$108
Accounts Receivable	\$1,000	(\$1,000)
Other Current Assets	\$89	(\$3,967)
Accounts Payable	(\$3,288)	\$3,363
Accrued Payables	\$16,298	\$11,406
Net Cash Provided By Operations	\$9,525	\$2,419
Investing Cashflows		
Purchase of Fixed Assets	\$0	(\$553)
Net Cash Provided by Investing Activities	\$0	(\$553)
Financing Cashflows		
Loans	\$0	
Net Cash Provided by Financing Activities	\$0	
Net Cash Increase / (Decrease)	\$9,525	\$1,866
Cash Beginning of Period	\$34,072	\$32,206
Cash - End of Period	\$43,597	\$34,072



Probability Management

Probability Management
A 501(c)(3) non-profit organization
Tax ID 46-0572110
PO Box 61045, Palo Alto, CA 94306
Visit: probabilitymanagement.org

Contact Us:

Sam Savage, Executive Director
Michele Hyndman, Associate Director
Melissa Kirmse, Director of Operations

sam@probabilitymanagement.org
michele@probabilitymanagement.org
melissa@probabilitymanagement.org