Probability Management

2020 Annual Report

ProbabilityManagement.org

A letter from our Executive Director

2019 brought important changes on four fronts: technology, applications, education, and management of the nonprofit.

Technology

- We have continued to more tightly integrate both Tom Keelin's Metalog technology and Doug Hubbard's portable, seedable random number generator into the SIPmath™ Modeler Tools.
- We have prototyped portions of the SIPmath Modeler Tools in Javascript, which will allow for a greatly expanded delivery mechanism directly through Microsoft Office in the future.

Applications

- In agriculture, we have worked with Keith Shepherd of the nonprofit World Agroforestry in an initiative to help African governments and the World Bank evaluate project options for agricultural development under climate change.
- In the area of military readiness, I have collaborated with Shaun Doheney, our Chair of Resources and Readiness Applications, and Connor McLemore, Chair of National Security Applications, in co-authoring several recent publications. These and pertinent models are posted at our website.

Education

- We are pleased to announce that in 2019, Kaiser Permanente became the latest firm supporting ProbabilityManagement.org. We began work with Kaiser's Eng-wee Ethan Yeo and Guanghong Xu to create an internal educational program with two-level certification in the discipline of probability management.
- Furthermore, we provided several educational programs to our long-standing sponsor, Lockheed Martin.

Management

- Michele Hyndman, who has done so much to grow the organization, took a position at Stanford University, but has kindly agreed to stay on our Board of Directors.
- Bridget Cash joined us as Program Director and has played a central role in the Kaiser Permanente relationship and other important activities. Her bio appears later in this report.
- Harry Markowitz, a co-founding member of our board, retired. Our success is due in large part to his energy and generosity over the past seven years.
- I am grateful to Deborah Gordon, recently retired Executive Director of the Stanford Preventive Defense Project, for joining our board to replace Harry. Her extensive experience in both computer science and government are described in her bio later in this report.

Sincerely,

Sam L. Savage
Executive Director

Our Sponsors and Affiliates

We gratefully acknowledge financial support from the following organizations.

Sponsors

Chevron

LOCKHEED MARTIN

WELLS FARGO

LONE STAR

PG&E

KAISER PERMANENTE

Hubbard Decision Research

Buckingham STRATEGIC PARTNERS

Foundation for Creativity in Dispute Resolution

Computerlaw Group LLP

Keelin Reeds Partners

Affiliations

UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

Research Partner

Government Finance Officers Association

Technology Partner

TECHNOLOGY PARTNERZ

2019 Accomplishments

In 2019, ProbabilityManagement.org continued to fulfill its mission to transform uncertainty through education, best practices, and our open SIPmath Standard. Our ongoing collaborations with key partners support the development of the SIPmath Modeler Tools and promote the widespread use of SIPmath methodologies. Below are some highlights from the year.

Technology

Integration of Metalogs and HDR into SIPmath Tools

Building on the collaboration begun the previous year with Tom Keelin and Doug Hubbard, ProbabilityManagement.org continued to integrate Keelin's Metalog distribution and Hubbard's HDR Random Number Generator capabilities into the SIPmath Tools. In 2019, development progressed through the beta test phase.

- Metalog Distributions: a Metalog matches continuous PDF and inverse CDF functions to data. It can create an analytical expression for the sums of IID random variables for a wide class of distributions, of which the Enterprise tools include lognormals and triangulars.
- Hubbard Decision Research (HDR) Random Number Generator: The advanced multi-dimensional HDR random number seed ensures statistical dependence or independence according to model requirements. One can specify separate seeds for such things as Entity (for example, corporation), Project, variable within a project, and time period. This way you can create the same template for multiple projects that differs only in Project ID seed and be guaranteed that there will not be inadvertent correlation.

Enterprise Tools Features Developed Through the Beta Test Phase

- Multi-scenario simulation: runs multiple experiments under different world scenarios and stores results in a multi-scenario library.
- Advanced sensitivity analysis: save and retrieve PMTable sheets. Move between multi-output simulations and multi-experiment without reinitializing model.
- Scatter plots of input and output cells. Learn about sensitivity and nonlinear relationships with scatter plots.
- Improved chart X axes formatting (e.g. currency, scientific).

SIPmath Standard

The open SIPmath Standard codifies the storage of an uncertainty as a SIP (Stochastic Information Packet), an unambiguous data array with provenance. In 2019, additional advances were developed through the beta test phase:

- Javascript prototype to access SIPs in the cloud.
- Virtual SIPs: coupling Metalogs to HDR (pseudo) random number generator to create virtual SIPs of miniscule size compared to traditional SIPs.
- Virtual SLURPs created through the conditional metalogs. See https://www.probabilitymanagement.org/lgw

Applications

In 2019, ProbabilityManagement.org nurtured and expanded its partnerships, democratizing the the SIPmath methodologies in various "communities of practice" including:

- Readiness - Military, Infragard
- Agriculture - World Agroforestry
- Healthcare - Kaiser Permanente
- Finance – Loring Ward, Transparency Task Force
- Government Finance Officers Association (GFOA)
- Utilities – PG&E

Government Finance Officers Association

ProbabilityManagement.org supported Shayne Kavanagh, Senior Manager of Research for the Government Finance Officers Association, in providing risk management consulting to the following cities: Tacoma, Washington; West Sacramento, California; and Mesquite, Texas. This work will continue in 2020.

Education

Kaiser Permanente Certification Pilot

This year we secured an agreement with Kaiser Permanente to provide training and pilot a certification program. Dr. Savage will collaborate with Kaiser's Eng-wee Ethan Yeo, Principal, Technology Risk Modeling & Methodology, to develop and deliver a training program targeting at three levels of modeling expertise.

Training for Lockheed Martin Aeronautics

We worked with Phil Fahringer at Lockheed Martin to provide training on the use of Metalog distributions in the reliability of aircraft parts.

K-12 Education

Developed K-12 relationships and presented to:

- Oakland Technical High School -11th graders
- Oakland Unified School District - Train the Teachers
- Palo Alto High School Investment Club

Outreach

Annual Conference

On March 25 - 27, 2019, Loring Ward hosted our Annual Conference with the theme of "Applications of Probability Management" in San Jose, CA. Our Standards and Tools Committee met during the conference to discuss the development of the Metalog Ribbon and the "Chance of Whatever" SIPmath Tools button.

Spring Webinar Series

ProbabilityManagement.org presented a series of spring webinars on a variety of topics:

- Introduction to Probability Management (Sam Savage)
- SIPmath Modeler Tools Basics (Brian Putt)
- The Metalog Distributions (Tom Keelin)
- Beyond Risk Management: How Embracing Uncertainty Helps the Whole Enterprise (Matthew Raphaelson)
- Virtual SIPs (Sam Savage)
- Risk-Aware Planning for City Finances: How Much of a Rainy Day Fund is Enough? (Shayne Kavanagh & Dan Matusiewicz)

Speaking Engagements

Dr. Savage was a featured speaker at over 20 events with stakeholders in military readiness, finance, decision analysis, risk, and climate change:

- January 8 - Dr. Sam Savage presented to the Investment Strategy Team at Loring Ward (now Buckingham Strategic Partners).
- January 23 - Savage presented at the George Shultz Roundtable at Stanford's Hoover Institution.
- February 21 - Savage and Matthew Raphaelson presented "Probability Management: A Cure for the Flaw of Averages," a free lecture and networking reception hosted by PG&E in San Francisco.
- March 15 - Savage delivered a guest webinar for Hubbard Decision Research.
- March 7-8 - Savage sat on panel for the 2019 Decision Analysis Affinity Group (DAAG) Annual Conference in Denver, CO.
- April 14-16 - Savage presented with Shaun Doheney at the INFORMS Business Analytics Conference in Austin, TX.
- April 10 & May 8 - Savage and Doug Hubbard delivered webinars for the Military Operations Research Society (MORS) Readiness Initiative.
- June 17-19 - MORS 87th Symposium in Colorado Springs, CO. Savage, Shaun Doheney, and Connor MacLemore presented four papers and tutorials on military readiness. One of the papers was nominated for the 2020 Barchi Prize.

2019 Accomplishments

Speaking Engagements (continued)

- July 30 - Shaun Doheney presented on behalf of Probability Management to the Government Accountability Office (GAO) in Washington, DC.
- August 19 - Stanford Executive Program - Savage gave multiple presentations to the Saudi Industrial Development Fund (SIDF) group.
- September 12 - Savage served as a panel member of the Transparency Task Force Symposium, “How should the finance sector be reformed?” in Boston, MA.
- September 12 - Savage presented at Geocomp Corporation in Acton, MA.
- September 19 - Savage presented on the Flaw of Averages to the SF Bay Association for Computing Machinery (ACM) in San Jose, CA.
- October 3 - Savage was a panelist for a Public Sector Digest webinar: “Building Asset Management Strategies in the Age of Climate Change for Coastal Communities.”
- October 9 - Savage gave a presentation at the Center for Catastrophic Risk Management (CCRM) at U.C. Berkeley on adding organizational variables to risk analysis.
- October 14-18: Risk Awareness Week - Savage recorded a 3-part webinar.
- November 19 - Stanford Webinar - Savage gave a free interactive webinar on project risk.
- Dec 4-5 - Savage was plenary speaker and also presented with Shaun Doheney “The Lego Blocks of Readiness - From Ready or Not to How Ready for What” for the MORS Emerging Techniques Forum in Alexandria,VA.
- December 8-11- Savage was co-chair for the Risk Analysis Track of the INFORMS Winter Simulation Conference (WSC) in Maryland. This year-long effort culminated in multiple presentations, an exhibit booth, blog posts and published papers.
- Dec 12-14 - Savage provided a 1 ½ day workshop for the United States Marine Corps at Quantico, VA.

Publications

Please visit probabilitymanagement.org to read the following articles:

- Probabilistic Design of Sustainable Reinforced Concrete Infrastructure Repairs Using SIPmath by Michael Lepech, Melissa Zirps, and Sam Savage. *Proceedings of the 2019 Winter Simulation Conference,* December 2019.
- A Multi-Dimensional, Counter-Based Pseudo Random Number Generator as a Standard for Monte Carlo Simulations by Doug Hubbard. *Proceedings of the 2019 Winter Simulation Conference,* December 2019.
- The Metalog Distributions and Extremely Accurate Sums of Lognormals in Closed Form by Tom Keelin, Lonnie Chrisman, and Sam Savage. *Proceedings of the 2019 Winter Simulation Conference,* December 2019.
- Calculating Carrier Air Wing Readiness: An Additive Approach by Shaun Doheney, Connor McLemore, and Sam Savage. *Phalanx*, December 2019
- Measuring Military Readiness by Shaun Doheney, Sam Gray, Connor McLemore, and Sam L. Savage. *ORMS Today*, December 2019
- Characterization of Historical Methane Occurrence Frequencies from U.S. Underground Natural Gas Storage Facilities with Implications for Risk Management, Operations, and Regulatory Policy by Richard A. Schultz, Douglas W. Hubbard, David J. Evans, and Sam L. Savage. *Risk Analysis*, November 2019
- Curing the Flaw of Averages in Climate Change by Dr. Sam Savage. *Public Sector Digest*, September 2019
- Operational Readiness Rollup by Shaun Doheney, LCDR Connor S. McLemore, and Sam L. Savage. *Phalanx*, September 2019

2020 Proposed Activities

Probability Management

In 2020, ProbabilityManagement.org will continue to improve the communication and calculation of uncertainty.

Our 2020 goals and planned activities include:

Tools & Standards

- Release 4.0 SIPmath™ Tools and publish user documentation.
- Publish 3.0 SIPmath Standard.

Education Initiatives

- Pilot certification process (Kaiser).
- Strengthen partnerships with educational institutions/groups including Oakland Public Schools, the Palo Alto High School investment club, and Stanford University.
- Develop new relationships with educational institutions.

Outreach

- Continue speaking and presenting to relevant stakeholders.
- Present to Gates Foundation with Keith Shepherd.
- Nurture and expand partnerships across “communities of practice” including:
  - Readiness
  - Agriculture
  - Healthcare
  - Finance
  - GFOA
  - Utilities
- Launch updated ProbabilityManagement.org website in order to:
  - Streamline content
  - Improve graphics
  - Highlight updated Tools and PM communities of practice
- Revitalize social media presence via LinkedIn

Publications

- Continue to author and co-author relevant articles, blog posts, and newsletters.
- Integrate publication of *The Flaw of Averages*, 2nd Edition.
- Rewrite *Decision Making With Insight*.

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's*Best!*®, 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, SIPmath Group, an AnalyCorp venture, and serves as an expert witness.

Michele Hyndman
Board Member

Michele Hyndman has over 20 years of public relations and communications experience. She has worked in broadcast television, at a public relations firm, and is the Assistant Director, Development Marketing & Communications for Stanford University's Graduate School of Business. 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.

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

Deborah Gordon
Board Member

Deborah C. Gordon retired in August 2019 after 22 years as the Executive Director of Stanford University's Preventive Defense Project, co-founded and directed by former Secretaries of Defense, William J. Perry and Ashton B. Carter. She currently consults to several high tech companies and has over 40 years of experience in algorithm design, signal processing, and network security. She holds several U.S. and Canadian patents for her work in medical instrumentation. She serves on the Board of Directors of Probability Management, the Council on Strategic Risks, the Arms Control Association, and Technology for Global Security. She has served both as Mayor and Council Member of Woodside, CA. Gordon holds a BS in computer science from the University of Southern California.

Our Team

Tom Keelin
Chief Research Scientist

Tom Keelin has combined a career in decision analysis practice with innovations to advance the field. As Chairman of Millennial Capital, LLC, he has served as general partner for multiple successful real estate funds. He leads strategic decision-making for acquisitions, operations, dispositions, and portfolio management – using decision-analysis, modeling and probabilistic-simulation. Tom is also a founder and Managing Partner of Keelin Reeds Partners, a management consulting firm that provides strategy and decision analytic services. In that role, he has developed asset valuation, portfolio management, and business-development-deal-terms methodologies that have enabled greater success for dozens of client companies. In both roles, he recognized the need for better continuous-uncertainty representations and developed and published new probability distributions accordingly.

Previously, as Worldwide Managing Director of the Strategic Decision Group, he led the client work for and co-authored the Harvard Business Review article "How SmithKline Beecham Makes Better Resource Allocation Decisions" (Mar-Apr '98). Through that work, he and his colleagues invented the portfolio-management standard which subsequently was adopted widely across life-sciences industry. Earlier, with Decision Focus, Inc, Tom developed the Over/Under Capacity Planning model, which effectively addressed demand uncertainty in electric power system planning and was widely adopted by many utilities and regulatory commissions over the following decade. Tom is a Fellow of the Society of Decision Professionals, and a founder and director of the Decision Education Foundation, a not-for-profit organization that helps youth learn good decision skills for life. Tom holds three degrees from Stanford University: BA in Economics and MS and PhD in Engineering-Economic Systems.

June Klein
Chief Financial Officer

June Klein attended University of California, Santa Barbara, where she obtained her bachelor's degree in Business Economics in 1980, and was selected as the Outstanding Graduating Senior in Economics. June became a Certified Public Accountant in California in 1983. She was awarded an MBA focusing on Management of Technology from the Walter A. Haas School of Business at U.C. Berkeley in 1988. In 2010, June received her Doctorate in Education at Fielding Graduate University through their Educational Leadership and Change program. In 2016 she was awarded Nonprofit CFO of the Year from the Silicon Valley Business Journal.

Bridget Cash
Program Director

Bridget Cash is the Program Director for Probability Management. She specializes in nonprofit leadership, community outreach, stakeholder facilitation and strategic communications.

Bridget's passion for nonprofit work began at the American Red Cross (Palo Alto Area Chapter) where she served as the Director of Volunteer Resources. There she developed a deep appreciation for commitment to mission, teamwork, culture and strategic partnerships. Since then, Bridget has consulted on numerous environmental projects, promoting public engagement through outreach as well as stakeholder and meeting facilitation. She has served on the board of directors for the PACT Foundation (President) and Mountain View Little League as well as on her School Site Council. Bridget holds a BS in biochemistry from the University of Wisconsin - Madison.

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

Our Team and Committee Chairs

accounting system for the company and manages the day-to-day accounting. Her duties include event planning, corporate communications, payroll, and logistics. Melissa graduated summa cum laude from the University of Maryland with a Bachelor of Arts 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 has developed software for creating and manipulating Stochastic Information Packets (SIPs), and a compressed form of SIP representation called Distribution Strings.

Mary Claire Meijer
Executive Assistant

Mary Claire Meijer supports the Executive Director and other team members by managing internal and external communications, coordinating travel, and organizing speaking and meeting schedules that are essential for the company to promote its mission. She has a background in senior care housing, and while raising her family was actively involved in numerous volunteer efforts including multiple years of directing a large volunteer team for a 200+ member high school cross country and track program. Mary Claire graduated with a Bachelor of Arts Degree in Health and Society from Brown University.

Thomas Chesnutt
Chair of Water Practice

Dr. Chesnutt is the Founder of A & N Technical Services, Inc. He has extensive experience in water rate development, stochastic simulation and demand forecasting. Tom has worked both the theoretical and applied sides of water demand forecasting. He developed and taught a graduate course in Water Demand Modeling and Forecasting at Jordan University of Science and Technology and has developed and implemented water demand models for dozens of water utilities.

Dr. Chesnutt holds a Ph.D. and M.Phil. in Policy Analysis from the RAND Graduate School, an M.S. in Technology and Science Policy from the Georgia Institute of Technology and a B.A. in Economics from Kenyon College. He is a member of the American Water Works Association, the International Water Association, the American Association for the Advancement of Science, the American Statistical Association, and the Institute for Operations Research and Management Science (INFORMS). Dr. Chesnutt was a co-creator of the VARDEF language for enacting stochastic simulation of water systems. Dr. Chesnutt is a Certified Analytics Professional (CAP®) and an Accredited Professional StatisticianTM (PStat®).

Shaun Doheney
Chair of Resources and Readiness Applications

Shaun Doheney is a Principal Analyst at Innovative Decisions, Inc. He holds a B.S. in Mathematics, an M.S. in Operations Analysis, and a Graduate Certificate in Data Analytics. As a Marine Corps Lieutenant Colonel (Retired) and Marine Operations Research Analyst, he performed qualitative and quantitative analyses and evaluations across major DoD decision support processes. His past projects featured optimization, multiple-objective decision analysis, quantitative risk analysis, discrete event simulation, and survey design and analysis. He has applied these techniques to force development system processes; wargaming; concept-based assessment; capabilities-based assessment; operational risk analysis; cost-benefit analysis; manpower and human resource development processes; and assignment and schedule optimization. His more recent efforts have focused on guiding adoption of analytic methods and optimizing allocation of resources across operational scenarios to inform portfolio funding decisions over a multi-year horizon.

Committee Chairs

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.

Shayne Kavanagh, Chair, Government Finance Applications

Shayne Kavanagh is the Senior Manager of Research for Government Finance Officers Association. Shayne has been developing the practice and technique of long-term financial planning for local government. In addition to working with local governments in a consulting capacity on financial planning and risk analysis, he is the author of a number of publications on financial planning and budgeting.

Connor 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 Principal Operations Research Analyst at CANA Advisors.

Brian Putt, Chair, Energy Practice

Brian is an Independent Consultant applying probabilistic analysis to Decision Quality practices with over 40 years' experience in Oil and Gas operations and development. He has been using and promoting the use of SIPmath for the past five years. He was instrumental in promoting the use of SIPmath at Chevron as the Organization Capability Manager for Upstream Oil & Gas before his retirement from Chevron in 2016. He has given presentations about Decision Quality to both industry groups and Universities that

Committee Chairs

have included examples of SIPmath applications. He conducts training classes on the SIPmath toolbar. He has developed a series of more than 40 YouTube videos discussing the use and application of SIPmath. Brian has provided valuable support in the design and testing of SIPmath over the past several years. He holds a BA in Economics from Claremont McKenna College, BS in General Engineering from Stanford University, and a MS in Operations Research from Stanford University.

Matthew Raphaelson, Chair, Banking Applications

Matthew Raphaelson is a former senior finance executive in banking with 25 years industry experience. He has also served as a Director of BAI, a banking industry association focused on research, training and thought leadership. Throughout his career, he has applied quantitative modeling and decision-making under uncertainty to launch new business initiatives and manage multi-billion dollar businesses.

Raphaelson is a graduate of the University of Michigan, with degrees in economics and political science, and holds an MBA from Stanford Graduate School of Business. He is a Trustee of the San Francisco Conservatory of Music.

Steve Roemerman
Chair, Best Modeling Practices

Steven D. Roemerman 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.

Kennan Scott, Chair, Secondary Education

Kennan Scott was born and raised loving transportation and the New York City Subway. After receiving his Bachelors of Science in Civil Engineering from Northeastern University he bolted for the west coast and the allure of automated public transit. Shortly after arriving in the Bay Area he found work with BART, the automated transit system he coveted and began designing transit infrastructure. It was during his time working with BART on the eBART extension that he was able to reconnect with and seek out his own emotional and social connections with transportation. In order to better serve riders, Kennan received a Masters in Urban and Regional Planning from San Jose State University with a focus on transportation management. The son of a long tenured special education teacher, Kennan always held education in high regard. When given the opportunity to change fields and teach engineering in West Oakland, he saw this as a chance to make a difference in the black community. Kennan Scott is passionate about creating healthy communities, advancing the field of education through interdisciplinary approaches that merge planning, engineering, advocacy, and coalition building.

Keith Shepherd
Chair of Agricultural Applications

Keith Shepherd is a Principal Scientist and Research Theme Leader of Land Health Evaluation, Restoration, and Investment Decisions at World Agroforestry, based in Nairobi, Kenya. His research focuses on (i) evidence-based approaches to measuring and monitoring land and soil health, and (ii) improving stakeholder decision-making through decision analysis. Keith has pioneered the application of light-based sensors for rapid and low-cost measurement of the quality of soils, plants and agricultural inputs in Africa. He has also developed a decision-focused approach to agricultural research and development which deploys participatory Bayesian approaches and value-of-information analysis to improve development decision-making in data-limited environments. Keith is also Head of Diagnostics and Decision Science with

Committee Chairs

the start-up initiative Innovative Solutions for Decision Agriculture (ISDA). With 40 years' experience in tropical land management, Keith has also worked with Hunting Technical Services; the University of Reading, the International Rice Research Institute, the International Centre for Research in the Dry Areas, and the Agricultural Research Division of the University of Botswana, Lesotho and Swaziland. He holds a BSc Soil Science and PhD in Agricultural Botany from the University of Reading, UK.

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.

Financials

Statement of Operations

For the years ended December 31,

	2019	2018
	Unrestricted	Unrestricted
Income		
Contributions		
Corporate Contributions	105,100.00	79,500.00
Individual Contributions	4,635.00	2,510.00
Enterprise Tools Sales	9,650.00	3,500.00
Education	103,980.57	39,700.00
Other Income	4.11	2.89
Total Income	**255,569.68**	**169,638.64**
Expenses		
Program Services		
Education & Outreach	160,574.46	102,464.60
Standards	0.00	0.00
Tools	41,739.58	17,867.75
Program Service Support		
General & Administrative	10,219.72	14,632.96
IT	5,338.68	4,191.64
Facilities	106.00	96.00
Total Expenses	**217,978.44**	**139,252.95**
Change in Net Assets	**37,591.24**	**30,385.69**

Statement of Cash Flows

For the years ended December 31,	2019	2018
Cash Flows from Operating Activities		
Change in net assets	$37,591.24	$30,385.69
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Accounts Receivable	($36,503.71)	$0.00
Accounts Payable	$3,751.75	($810.00)
Prepaid Expenses	($1,004.25)	($611.50)
Unearned or Deferred Revenue	$595.00	$1,530.00
Net cash provided by Operating Activities	$2,603.03	$32,821.19
Cash Flows from Investment Activities		
Purchase of property and equipment	$0.00	$0.00
Net cash provided by Investing Activities	$0.00	$0.00
Net Change in Cash and Cash Equivalents	$2,603.03	$32,821.19
Cash and Cash Equivalents at the beginning of the period	$66,875.25	$34,054.06
Cash and Cash Equivalents at the end of the period	$69,478.28	$66,875.25

Financials

Probability Management

Statement of Financial Position

For the years ended December 31,	2019	2018
Assets		
Current Assets		
Cash and cash equivalents	69,478.28	66,875.25
Accounts receivable	36,503.71	0.00
Prepaid expenses and other assets	2,527.43	1,523.18
Total Current Assets	108,509.42	68,398.43
Property and Equipment	0.00	0.00
Total Assets	108,509.42	68,398.43
Liabilities and Net Assets		
Liabilities		
Accounts payable and accrued expenses	4,205.50	2,097.00
Unearned or deferred revenue	5,745.00	5,150.00
Total Liabilities	9,950.50	7,247.00
Net Assets		
Opening Balance Equity	2,431.25	2,431.25
Unrestricted Net Assets	58,536.43	28,334.49
Net Income	37,591.24	30,385.69
Total Net Assets	98,558.92	61,151.43
Total Liabilities and Net Assets	108,509.42	68,398.43

Financials

Detailed Income and Expenses

For the years ending December 31,

	2019 Unrestricted	2018 Unrestricted
Income		
Contributions		
Corporate Contributions		
Chevron	35,000.00	7,500.00
Foundation for Creativity in Dispute Resolultion	100.00	2,000.00
Hubbard Decision Research	5,000.00	0.00
Kaiser Permanente	30,000.00	0.00
Lockheed Martin	30,000.00	30,000.00
Lone Star	5,000.00	10,000.00
PG&E	0.00	30,000.00
Individual Contributions	4,635.00	2,510.00
Matching Gifts	100.00	5,000.00
Program Income		
Program Service Fees	32,100.00	39,425.75
Enterprise Tools Sales	9,650.00	3,500.00
Education		
GFOA	2,727.00	4,700.00
ICRAF	5,000.00	
Lockheed Martin	96,103.57	35,000.00
Other Income		
Interest Income	4.11	2.89
Tax Refund		
Total Income	**255,569.68**	**169,638.64**
Expenses		
Program Services		
Education & Outreach		
Compensation and Benefits	113,019.22	73,418.45
Travel Expenses		
Airfare	6,195.44	3,644.14
Lodging	5,633.11	1,616.82
Ground Transportation	2,025.90	408.91
Parking	318.55	151.80
Travel Meals and Entertainment	1,752.68	823.14
Total Travel Expenses	15,925.68	6,644.81
Meals and Entertainment	1,270.06	1,791.77
Marketing and Publicity		
Trade Shows	5,566.69	
Conferences	21,325.38	18,267.41
Marketing Collateral	783.35	
Marketing Materials	1,596.98	729.61
K-12 Education		
Email Marketing		
Public Relations		99.00
Total Marketing and Publicity	29,272.40	19,096.02
Other Expenses		
Books, Dues, and Subscriptions	350.00	1,354.19
Office Supplies	737.10	119.81
Total Other Expenses	1,087.10	1,513.55
Total Education & Outreach	**160,574.46**	**102,464.60**

For the years ending December 31,

	2019 Unrestricted	2018 Unrestricted
Standards	**0.00**	**0.00**
Tools		
Compensation and Benefits	41,739.58	17,867.75
Total Tools	**41,739.58**	**17,867.75**
Total Program Services	**202,314.04**	**120,332.35**
Program Service Support		
General & Administrative		
Compensation and Benefits	4,113.50	5,915.00
Office Expenses		
Office Supplies		55.76
Postage and Shipping	97.40	58.79
Business Taxes and Fees		570.00
Insurance		
Directors & Officers Insurance	1,650.00	1,980.00
Liability Insurance	2,443.75	715.50
Professional Services		
Accounting	1,844.76	2,468.00
Legal Fees	370.00	1,190.00
Banking and Financial		
Bank Fees	212.00	154.80
Checks		
Online Payment Fees	1,138.31	1,525.11
Total General & Administrative	**10,219.72**	**14,632.96**
IT		
Compensation and Benefits		430.00
Software and Hardware		
Software Site Licenses	4,535.68	3,014.64
Expensed Software and Hardware		
Depreciation and Amortization		
Software and Hardware - Other		
Website	704.00	747.00
Meals and Entertainment		
Total IT	**5,338.68**	**4,191.64**
Facilities		
Rent Expenses		
Rent - PO Box	106.00	96.00
Repairs and Maintenance		
Total Facilities	**106.00**	**96.00**
Total Program Service Support	**15,664.40**	**18,920.60**
Total Expenses	**217,978.44**	**139,252.95**
Change in Net Assets	**37,591.24**	**30,385.69**

Probability
Management

Probability Management
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