



Probability Management

2021 Annual Report
ProbabilityManagement.org

A letter from our Executive Director

A physicist once said that we should not move the heavy particles, by which they meant protons and neutrons. This implies that we should only move electrons and photons, which is what Zoom and 2020 have been all about. Covid-19 disrupted our annual gathering of ProbabilityManagement.org enthusiasts, but beyond that it was an incredibly productive year for me and the nonprofit. Here are some of the highlights.

Technology

- We released version 4.0 of the Enterprise Tools. These tools include new features including advanced HDR generator from Hubbard Decision Research, scatterplots of input and output cells, multi-scenario simulation and multi-scenario libraries, and save and retrieve PMTable sheets for advanced analysis
- We continued to build upon Tom Keelin's Metalog technology and Doug Hubbard's portable, seedable random number generator.
- Development of the PM 3.0 Standard, now in beta test, enhances the 2.0 Standard to include virtual SIPs, consisting cross platform formulas that can generate identical streams of random variates in any computer environment.

Applications

- Military Readiness: At the MORS 88th Symposium in June, team members Sam Savage, Connor McLemore, and Shaun Dohoney received the John J. Walker, Jr. Award for their September 2019 article, "Operational Readiness Rollup."
- In the Financial Management arena, we continued our collaboration with GFOA and developed the PRECISE Uncertainty Project, which helps CFOs from municipalities estimate the chances of meeting their projections.
- Working with Keith Shepherd of the World Agroforestry Centre (ICRAF), ProbabilityManagement.org supported the development of a risk-return model for evaluating Climate Smart Agriculture project options for African governments and the World Bank.

Education

- We were pleased to announce that Highmark Health became the latest firm supporting ProbabilityManagement.org.
- Partnering with Stanford University, we developed an introductory course on probability management available on EdX with the option of a verified certificate of completion.
- With Kaiser Permanente, we developed and implemented a first-level certification program.
- Lockheed Martin: we developed several courses on Metalog distributions with Tom Keelin.

Outreach

- We offered several webinar series.
- Along with other ProbabilityManagement.org team members, I spoke throughout the year at a variety of venues.

What is coming up in 2021:

- 3.0 Standard: We expect to release the 3.0 Standard, which encompasses both the HDR Generator from Doug Hubbard and Metalog Distribution from Tom Keelin.
- Chancification: Returning to the analogy with electricity upon which the discipline of probability management was founded, the 3.0 Standard takes us from direct to alternating current. In 2021, we will be focused on wiring organizations for probability in a process we call Chancification.
- ChanceCalc: This add-in, prototyped in 2020, will allow users without simulation experience to make chance-informed decisions based on estimates of uncertainty stored in the cloud by experts.
- Continued collaboration with our sponsors: Lockheed Martin, Kaiser Permanente, Highmark Health, Lockheed Martin, and Chevron.

I am looking for to a transformative year. As always, we are most grateful to our sponsors, partners, and supporters.

Sincerely,



Sam L. Savage
Executive Director

Our Sponsors and Strategic Partners

We gratefully acknowledge financial support from the following organizations.

Sponsors



Foundation for Creativity in Dispute Resolution | Computerlaw Group LLP | Keelin Reeds Partners

Strategic Partners



2020 Accomplishments

Despite the pandemic, ProbabilityManagement.org had a fruitful year that included a number of developments, laying the groundwork for an even more productive 2021.

Technology

ChanceCalc

We performed early development on ChanceCalc, an Excel add-in that accesses uncertainties stored as SIP Libraries in the cloud, then calculates the chance of achieving your targets in native Excel with a single command. In 2021, we plan to release a beta version of ChanceCalc and launch the beta test.

Chancification

Electrification develops the infrastructure to replace technologies using fossil fuels with those using electricity. In a new initiative we're calling Chancification, we have developed information systems to replace calculations based on numbers with those based on uncertainties.

A serious barrier to using simulation is the lack of expertise in generating the appropriate random inputs. Yet the lack of expertise in generating electricity has not been a barrier to using light bulbs. Chancification defines data structures that obey both the laws of arithmetic and the laws of probability, letting users roll up risks and opportunities across the enterprise.

Release of 4.0 Tools

In May of 2020, we released the 4.0 Enterprise Tools, which included the following new features:

- Advanced HDR generator from Hubbard Decision Research
- Scatterplots of input and output cells
- Multi-scenario simulation and multi-scenario libraries
- Save and retrieve PMTable sheets for advanced analysis

Standard

A joint effort with Doug Hubbard and Tom Keelin initiated in 2018, the 3.0 PM SIPmath Standard represents uncertainties as virtual SIP arrays based on Hubbard's HDR Generator and Keelin's Metalog Distributions. The virtual SIPs consist of cross platform formulas that can generate identical streams of random variates in any computer environment. In 2020 we achieved the first functional prototypes of this standard, which is expected to be released in 2021.

Applications

PRECISE Uncertainty

We collaborated with Shayne Kavanagh of the Government Finance Officers Association (GFOA) to develop the PRECISE Uncertainty project, in which historical tax revenue data was collected from city finance officers and used to create a dashboard to help users estimate the chances of achieving their projected revenue estimates.

Agriculture

Working with Keith Shepherd of the World Agroforestry Centre (ICRAF), ProbabilityManagement.org supported the development of a risk-return model for evaluating Climate Smart Agriculture project options for African governments and the World Bank and also assisted in models for fertilizer planning.

Education

EdX Course

Partnering with Stanford University, ProbabilityManagement.org developed and launched an EdX course, Introduction to Probability Management, taught by Dr. Savage. By the end of 2020, over 1300 students had enrolled in the course and 81 of those paid to receive a verified certificate of completion.



Highmark Health

Highmark Health joined ProbabilityManagement.org as a sponsor in late 2020. We will partner with Justin Schell, Senior Risk Management Consultant at Highmark, to develop programs for second-level certification and education in 2021. By the end of 2020, 6 Highmark Health employees had received first-level certification.

Kaiser Permanente

Together with Eng-Wee E. Yeo, we developed a first-level certification program that was successfully administered to 7 Kaiser Permanente employees.

Lockheed Martin

We worked with Phil Fahringer to develop several web based courses on the Metalog distribution with Tom Keelin. This educational foundation has led to future commitments from Lockheed Martin to continue development in this area.

K-12 Education

Dr. Savage participated in the following educational activities in 2020:

- Mentored a Palo Alto High School student in the Advanced Authentic Research (AAR) program.
- Served as advisor to the Palo Alto High School Investment Club.
- Partnered with GFOA to develop a webinar and COVID-19 model to help a Wisconsin school district make decisions about reopening schools.

Outreach

Annual Conference

Our planned 2020 Annual Conference on Data, Decisions, and the Value of Information, scheduled for April 21-22, was canceled due to the COVID-19 pandemic.

Webinars

ProbabilityManagement.org coordinated and presented several webinars on a variety of topics:

- Value of Information Webinar Series - April-June. This six-session webinar series was organized to highlight the Value of Information theme and speakers from our canceled April 2020 Annual Conference. The series featured Ron Howard, the inventor of the Value of Information, along with other distinguished speakers.
- Managing Risk in Revenue Forecasts Webinar Series - November-December. This four-part webinar series was a collaboration between PM.org and GFOA.
- SIPmath Modeler Tools for Windows Series - June-July. These three webinars, hosted by Sam Savage and Brian Putt, highlighted new features of the 4.0 Enterprise Tools.

Website Update

In June, we rolled out a major update of our website. Our focus was to streamline the presentation of information and refresh the color palette and fonts to align with our logo.

Speaking Engagements

Despite the pandemic, Dr. Savage and other ProbabilityManagement.org team members spoke throughout the year at a variety of venues.

- Invited as a Plenary Speaker for the Virtual MORS Emerging Techniques Forum. Presented on Chancification: Taking Digital Reasoning Beyond the Flaw of Averages, December 8.
- Presented on the Flaw of Averages to the UK National Environmental Research Council (NERC), December 3.
- Presented to the Society of Decision Professionals, SF Chapter on Networked Simulation with Stochastic Libraries, February 4.
- Co-presented on Military Readiness with Shaun Dohoney at the INFORMS Conference on Security. Co-panelist on Risk Analysis: What Has Gone Wrong with Risk Analysis? Backing up OR with PR, February 9-10.

2020 Accomplishments

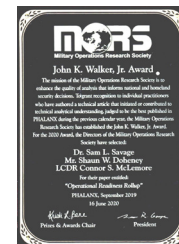
Speaking Engagements (continued)

- Panel member for the San Francisco chapter of the Society of Decision Professionals presentation on: Sharing Decision Quality with Young People is Fulfilling and Beneficial, March 19.
- Recorded podcast with Shayne Kavanagh of GFOA for the Fiscal First Aid Resource Center: Decision Making Under Uncertainty, April 17.
- Interviewed and featured in an article for Avia Investors: The Probability Specialist: Sam Savage, May 7.
- Presented with Shaun Doheny and Connor McLemore on Decision Analysis and Readiness and conducted two tutorials: SIPmath Tools and Risk Analysis at the MORS 88th Symposium (virtual). Shaun, Connor, and Sam were awarded the prestigious Walker Award for their 2019 article, “Operation Readiness Rollup,” June 15–19.
- Led a session for Stanford University’s Project Leadership Institute (PLI) for Department of Energy employees, June 8.
- Presented “Uncertainty in Decision-Making” for the annual conference of the Decision Analysis Affinity Group (virtual), June 24.
- Coordinated and co-presented with five featured speakers for Risk Academy’s 2020 Risk Awareness Week, October 12–16.
- Presented for two sessions on Risk and Readiness at the INFORMS Annual Conference (virtual), November 13.

Recognition and Publications

Walker Award

At the MORS 88th Symposium in June, team members Sam Savage, Connor McLemore, and Shaun Doheny received the John J. Walker, Jr. Award for their September 2019 article, “Operational Readiness Rollup.” The Walker Award recognizes the author(s) of the technical article judged to be the best published in *PHALANX*, *The Magazine of Military Operations Research*, during the previous calendar year.



Articles

ProbabilityManagement.org was featured in the following articles and blog posts:

- The Amazing Future of Risk Management – SIPs and SLURPs by Alex Sidorenko. This blog post described the benefits of using databases of simulation values to generate random samples within models (January).
- The Flaw of Averages and ICU Capacity by Dr. Christian B. Smart. This blog post addressed how the Flaw of Averages is affecting management of ICU capacity during the COVID-19 pandemic (July).
- Probability Specialist: Sam Savage. Dr. Savage was interviewed by AIQ about how scenario planning and probabilistic modeling can be used to help deal with complex risks (July).

Limbic Analytics Blog Posts

Sam wrote a number of well-received posts for his Limbic Analytics blog in 2020, including several about the coronavirus pandemic.

- A Combination of Coronavirus and the Flaw of Averages Can Drive You Nuts (January)
- A Case Study in the Value of Information (March)
- The Flaw of Averages in Flattening the Curve (March)
- The Value of Information About COVID-19: What Will the Information We Learn In the Next Two Weeks Be Worth? (March)
- Introduction to the Value of Information And the XLTree Software (March)
- Riding My Book (April)
- Balancing Broomsticks: Coming Out of Coronavirus Captivity (April)
- COVID-19: The Solution is Obvious (May)
- Scenario Analysis on Steroids (May)
- Simulation Trials vs. Scenarios (June)
- Flying Into the Eye of the Pandemic (August)
- The Axiomatic Fallacy Fallacy (December). This blog post was noticed by an employee of the National Security Agency and shared with our permission on their internal website.



Podcasts

Dr. Savage participated in the following podcasts, available on the Publications page of our website:

- Decision Making Under Uncertainty: recorded in May with Shayne Kavanagh of GFOA for their Fiscal First Aid Resource Center.
- Operational Readiness Rollup: recorded in July with Connor McLemore about their Walker Award-winning paper co-authored with Shaun Doheney.

2021 Goals and Planned Activities

In 2021, ProbabilityManagement.org will continue its dedication to making uncertainty actionable.

Our 2021 goals and planned activities include:

Tools & Standards

- Finalize and release the 3.0 SIPmath Standard in json format
- Develop and implement the Beta testing program for ChanceCalc
- Expand use cases for SIP libraries in
 - Pandemic modeling
 - Government Finance
 - Military Readiness
- Convene the Technology and Standards committee to finalize the 3.0 Standard
- Develop R and Python code for generating 3.0 SIP Libraries

Education and Training Initiatives

- Promote ChanceCalc and the adoption of Chancification within organizations
- Offer webinar series on varied topics: ChanceCalc, Chancification and the SIPmath Modeler Tools
- Continue developing probability management certification program with our partners, Kaiser Permanente and Highmark Health: enhance the first-level certification program and develop the second-level certification program
- Work with Lockheed Martin to develop systems of stochastic information for incorporation into decision support analysis models
- Engage with Chevron to promote chance-informed decision making within their organization

Outreach

- Continue speaking engagements and presenting to relevant stakeholders
- Nurture and expand partnerships across organizations as we highlight the benefits of chance-informed decision making
- Refresh and update ProbabilityManagement.org website with new content: 3.0 SIPmath Standard, the HDR/Metalog collaboration, ChanceCalc and Chancification
- Begin planning 2022 Annual Conference

Publications

- Continue to author and co-author relevant articles, blog posts, and newsletters
- Publication of updated edition of *The Flaw of Averages*
- Publication of *Probability Management: A Cure for the Flaw of Averages*

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, 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.





Statement of Operations

For the years ended December 31,

	2020	2019
	Unrestricted	Unrestricted
Income		
Corporate Contributions	72,700.00	105,100.00
Individual Contributions	1,700.00	4,635.00
Matching Gifts	6,000.00	100.00
Program Service Fees	8,531.37	32,100.00
Enterprise Tools Sales	11,150.00	9,650.00
Education	141,773.53	103,980.57
Other Income	28,533.75	4.11
Total Income	270,388.65	255,569.68
Expenses		
Program Services		
Education & Outreach	178,178.02	160,574.46
Standards	0.00	0.00
Tools	66,858.78	41,739.58
Program Service Support		
General & Administrative	12,413.76	10,219.72
IT	7,610.13	5,338.68
Facilities	118.00	106.00
Total Expenses	265,178.69	217,978.44

Statement of Cash Flows

For the years ended December 31,

	2020	2019
Cash Flows from Operating Activities		
Change in net assets	\$5,209.96	\$37,591.24
Adjustments to reconcile change in net assets to net cash provided by operating activities:		
Accounts Receivable	\$3,803.71	(\$36,503.71)
Accounts Payable	\$14,638.50	\$3,751.75
Prepaid Expenses	(\$52.25)	(\$1,004.25)
Unearned or Deferred Revenue	(\$5,745.00)	\$595.00
Net cash provided by Operating Activities	\$19,779.15	\$2,603.03
Cash Flows from Investment Activities		
Purchase of property and equipment	\$0.00	\$0.00
Net cash provided by Investing Activities	\$0.00	\$0.00
Cash Flows from Financing Activities		
Long-Term Liabilities: PPP Loan	\$0.00	\$0.00
Net cash provided by Investing Activities	\$0.00	\$0.00
Net Change in Cash and Cash Equivalents	\$19,779.15	\$2,603.03
Cash and Cash Equivalents at the beginning of the period	\$68,938.28	\$34,054.06

Statement of Financial Position

<i>For the years ended December 31,</i>	2020	2019
Assets		
Current Assets		
Cash and cash equivalents	88,717.43	69,478.28
Accounts receivable	31,200.00	36,503.71
Prepaid expenses and other assets	2,579.68	2,527.43
Total Current Assets	122,497.11	108,509.42
Property and Equipment	0.00	0.00
Total Assets	122,497.11	108,509.42
Liabilities and Net Assets		
Liabilities		
Accounts payable and accrued expenses	24,973.73	4,205.50
Unearned or deferred revenue	0.00	5,745.00
Long-term liabilities	0.00	0.00
Total Liabilities	24,973.73	9,950.50
Net Assets		
Opening Balance Equity	2,431.25	2,431.25
Unrestricted Net Assets	89,882.17	58,536.43
Net Income	5,209.96	37,591.24
Total Net Assets	97,523.38	98,558.92
Total Liabilities and Net Assets	122,497.11	108,509.42



Detailed Income and Expenses

For the years ending December 31,

	2020	2019
	Unrestricted	Unrestricted
Income		
Contributions		
Corporate Contributions		
Chevron	0.00	35,000.00
Foundation for Creativity in Dispute Resolution	500.00	100.00
Highmark Health	32,200.00	0.00
Hubbard Decision Research	0.00	5,000.00
Kaiser Permanente	35,000.00	30,000.00
Lockheed Martin	0.00	30,000.00
Lone Star	5,000.00	5,000.00
Individual Contributions	1,700.00	4,635.00
Matching Gifts	6,000.00	100.00
Program Income		
Program Service Fees	8,531.37	32,100.00
Enterprise Tools Sales	11,150.00	9,650.00
Education		
GFOA	13,388.00	2,727.00
ICRAF	15,000.00	5,000.00
Lockheed Martin	113,020.00	96,103.57
Other	365.53	0.00
Other Income		
Interest Income	2.75	4.11
Tax Refund		
CARES Grant Income	28,531.00	
Total Income	270,388.65	255,569.68

Expenses

Program Services

Education & Outreach

Compensation and Benefits	174,795.54	113,019.22
Travel Expenses		
Airfare	0.00	6,195.44
Lodging	915.95	5,633.11
Ground Transportation	12.78	2,025.90
Parking	8.95	318.55
Travel Meals and Entertainment	83.97	1,752.68
Total Travel Expenses	1,021.65	15,925.68
Meals and Entertainment	95.67	1,270.06
Marketing and Publicity		
Trade Shows	1,746.00	5,566.69
Conferences	0.00	21,325.38
Marketing Collateral	0.00	783.35
Marketing Materials	52.34	1,596.98
K-12 Education		
Email Marketing		
Public Relations		
Total Marketing and Publicity	1,798.34	29,272.40
Other Expenses		
Books, Dues, and Subscriptions	209.39	350.00
Office Supplies	257.43	737.10
Total Other Expenses	466.82	1,087.10
Total Education & Outreach	178,178.02	160,574.46

For the years ending December 31,

	2018	2018
	Unrestricted	Unrestricted
Standards	0.00	0.00
Tools		
Compensation and Benefits	66,858.78	41,739.58
Total Tools	66,858.78	41,739.58
Total Program Services	245,036.80	202,314.04
Program Service Support		
General & Administrative		
Compensation and Benefits	3,687.00	4,113.50
Office Expenses		
Office Supplies		
Postage and Shipping	103.11	97.40
Business Taxes and Fees		
Insurance		
Directors & Officers Insurance	1,485.75	1,650.00
Liability Insurance	363.02	2,443.75
Professional Services		
Accounting	2,750.00	1,844.76
Legal Fees	2,770.00	370.00
Banking and Financial		
Payroll Service Fees	777.00	
Bank Fees	188.50	212.00
Checks		
Online Payment Fees	264.38	1,138.31
Total General & Administrative	12,413.76	10,219.72
IT		
Compensation and Benefits	250.00	
Software and Hardware		
Software Site Licenses	6,497.13	4,535.68
Expensed Software and Hardware		
Depreciation and Amortization		
Software and Hardware - Other		
Website	863.00	704.00
Meals and Entertainment		
Total IT	7,610.13	5,338.68
Facilities		
Rent Expenses		
Rent - PO Box	118.00	106.00
Repairs and Maintenance		
Total Facilities	118.00	106.00
Total Program Service Support	20,141.89	15,664.40
Total Expenses	265,178.69	217,978.44
Change in Net Assets	5,209.96	37,591.24



Probability Management

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

Contact Us:

Sam Savage, Executive Director
Melissa Kirmse, Director of Operations
Mary Claire Meijer, Executive Assistant

sam@probabilitymanagement.org
melissa@probabilitymanagement.org
maryclaire@probabilitymanagement.org