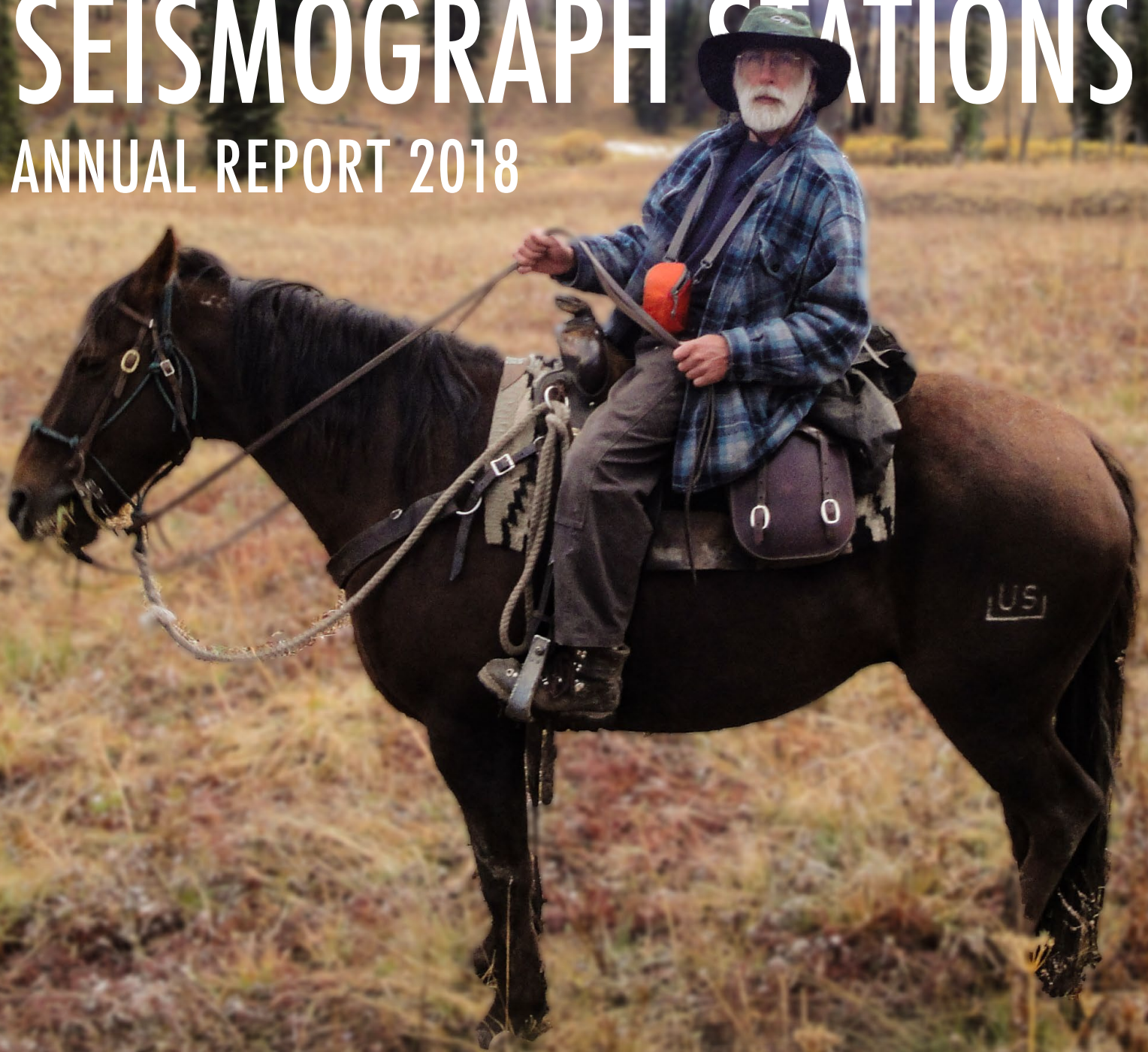


UNIVERSITY OF UTAH SEISMOGRAPH STATIONS

ANNUAL REPORT 2018



IN MEMORY OF DAVID LISKA DROBECK
FEBRUARY 19, 1960 – FEBRUARY 11, 2018

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UNIVERSITY OF UTAH
SEISMOGRAPH STATIONS

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quake.utah.edu

University of Utah
Seismograph Stations
2018 Annual Report
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DIRECTOR'S MESSAGE



Dear Friends,
2018 was an especially difficult year because of the unexpected death of Dave Drobeck on February 11. Dave served the University of Utah Seismograph Stations (UUSS) for over 20 years and was instrumental in developing the Yellowstone Seismic Network into one of the premier volcano

monitoring networks in the world. Dave's loss was especially hard on the UUSS engineering group—Corey Hatch, Wes O'keefe, and Jon Rusho—who had to take up extra work duties while grieving the loss of their colleague. A summary of Dave's career was presented by Bob Smith at a ceremony on February 22, and is reprinted in this report.

While someone like Dave can never truly be replaced, I am happy to report that a former UUSS undergraduate research assistant, Arvind Parapuzha, agreed to return to UUSS as a seismic engineer trainee in May, and that Wes O'keefe worked his first full field season in Yellow-

stone this past fall. On July 1, long-time seismic analyst Mark Hale was promoted to senior application systems analyst. Congratulations, Mark!

The biggest highlight of 2018 was the June 14 announcement that the University of Utah had been selected to receive a \$140 million grant from the Department of Energy to develop the Frontier Observatory for Research in Geothermal Energy (FORGE) site near Milford, Utah. The selection was due in no small part to the effort of UUSS associate director Kris Pankow and her team of students and staff, who created a seismic mitigation plan for the project. Dr. Pankow will continue managing the FORGE seismic risk as work ramps up over the next several years.

We look forward to an exciting new year in 2019. I encourage you to visit our revamped web page at quake.utah.edu to stay up-to-date on our new initiatives and products as well as to find out about the latest seismic activity in Utah. You can also follow UUSS on Twitter with the handle @UUSSQuake.

Best wishes,

Keith D. Koper, UUSS Director

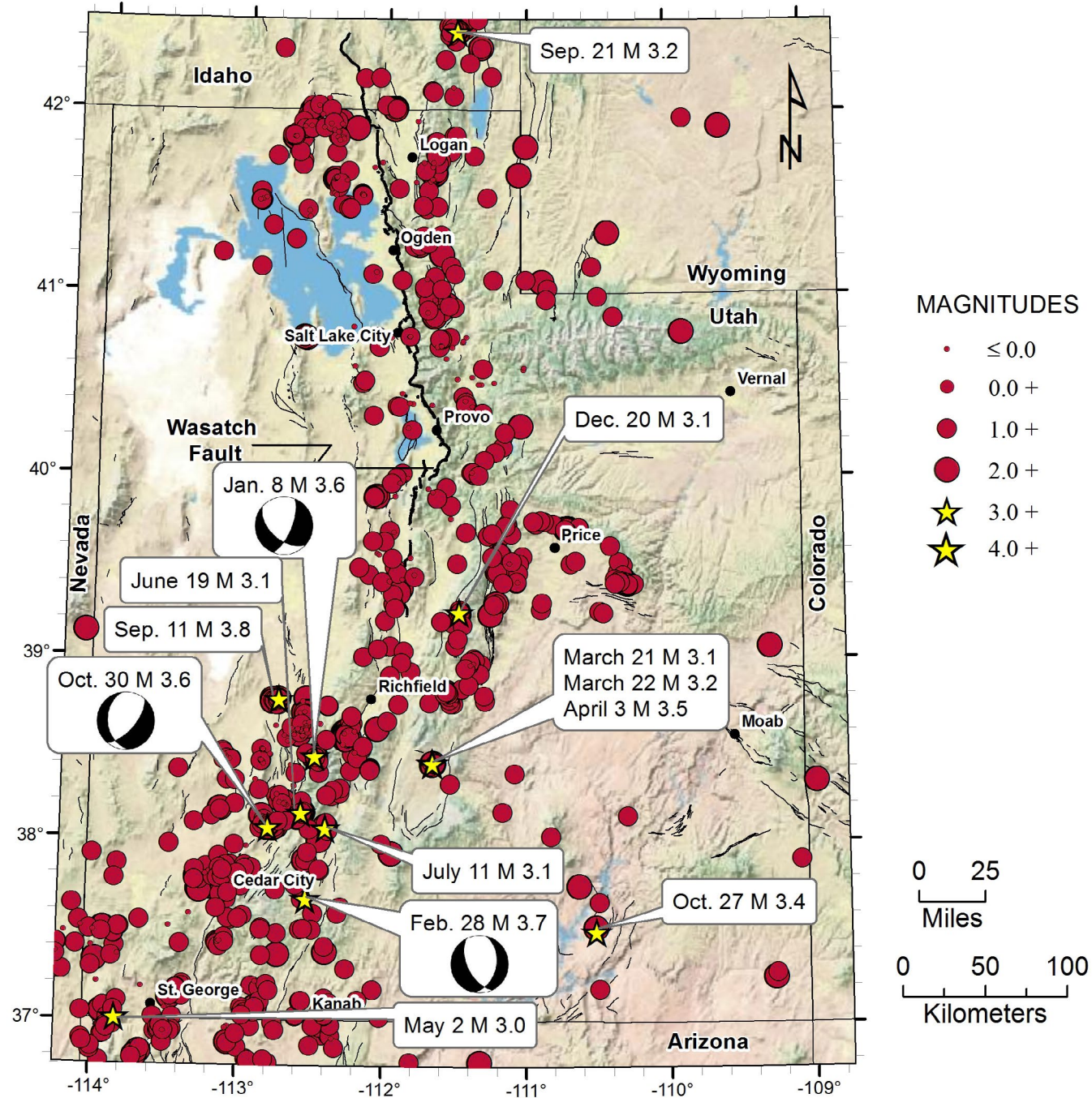


Top Left: UUSS Director Keith Koper. **Top Right:** Seismometer located in Zion National Park. **Middle:** Jamie Farrell holds a seismometer burned by lava during his trip to study the volcano eruption in Hawaii. **Bottom:** Wesley O'Keefe explains the installation process of a seismometer.

SEISMICITY IN THE UTAH REGION

During the 12 month period Jan. 1, 2018 through Dec. 31, 2018 the University of Utah Seismograph Stations (UUSS) located 1,114 earthquakes within the Utah region. The total includes zero earthquakes in the magnitude 4 range, 13 earthquakes in the magnitude 3 range, and 133 earthquakes in the magnitude 2 range. Earthquakes of magnitude 3.0 or larger occurring in 2018 are plotted as stars (see map below).

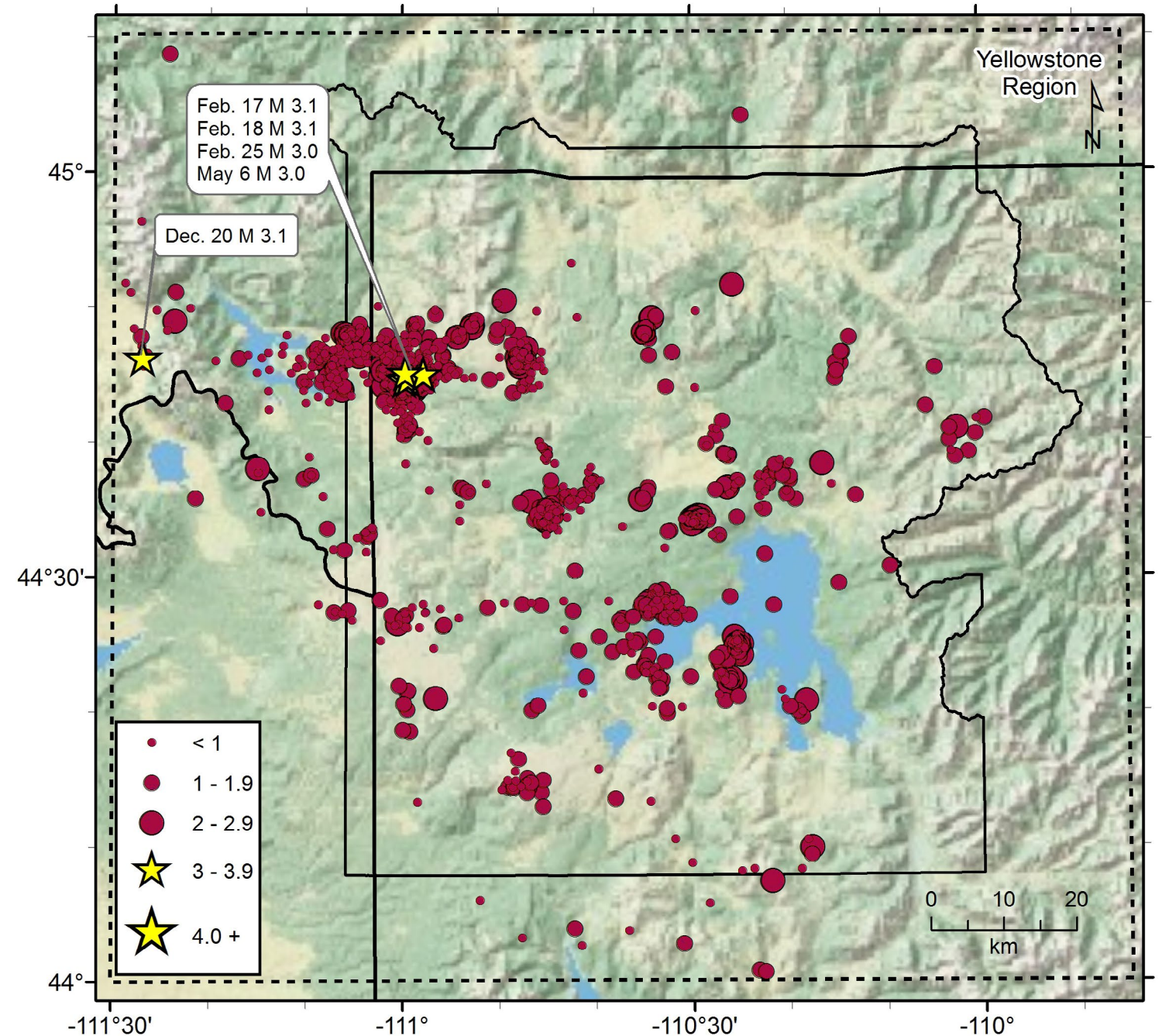
Earthquakes Between Jan. 1, 2018 - Dec. 31, 2018 in the Utah Region

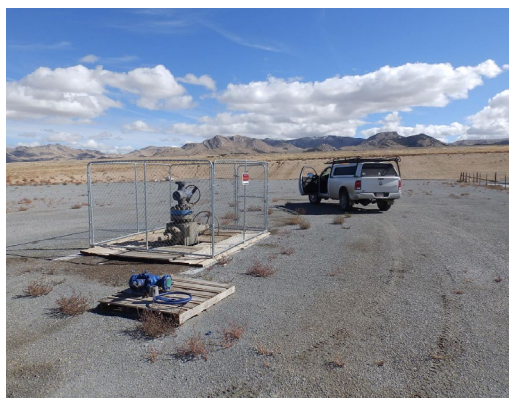


SEISMICITY IN THE YELLOWSTONE REGION

During the 12 month period Jan. 1, 2018 through Dec. 31, 2018 the University of Utah Seismograph Stations (UUSS) located 2,009 earthquakes within the Yellowstone National Park region. The total includes zero earthquakes in the magnitude 4 range, 5 in the magnitude 3 range, and 157 earthquakes in the magnitude 2 range. Earthquakes of magnitude 3.0 or larger occurring in 2018 are plotted as stars (see map below).

Earthquakes Between Jan. 1, 2018 - Dec. 31, 2018 in the Yellowstone Region





UNIVERSITY OF UTAH AWARDED FORGE PROJECT

On June 14, 2018 the University of Utah received \$140 million to continue cutting edge geothermal energy research and development.

The Department of Energy (DOE) chose Utah's Frontier Observatory for Research in Geothermal Energy (FORGE) site outside of Milford, Utah as the field laboratory. The \$140 million will be received over the next five years and comes in addition to the \$10 million the site received in the first phases of the project.

DOE's FORGE project was created to research enhanced geothermal systems (EGS), or man-made geothermal reservoirs. The selection comes after 3 years of planning, site characterization, and competition.

"Enhanced geothermal systems are the future of geothermal energy, and critical investments in EGS will help advance American leadership in clean energy innovation," said U.S. Secretary of Energy Rick Perry. "Funding efforts toward the next frontier in geothermal energy technologies will help diversify the United States' domestic energy portfolio, enhance our energy access, and increase our energy security."

The selection of the University of Utah is rewarding

news to the Energy and Geoscience institute (EGI) based FORGE team. The team includes individuals from the Department of Chemical Engineering at the University of Utah, the Utah Geological Survey, the Governor's Office of Energy Development, the University of Utah Seismograph Stations (UUSS), and other key agencies.

Dr. Kristine Pankow headed up the UUSS involvement in the Utah FORGE project. Pankow and her team were responsible for monitoring background seismicity and potential seismicity related to operations.

Pankow published research that used several different forms of seismic monitoring during phase 2 of the FORGE project to classify the proposed site as "aseismic." The UUSS will continue to monitor the site seismicity. There are currently 5 seismometers around the site with the plans to add more borehole seismometers as the facility develops.

The Utah FORGE selection is a great achievement and will be an important part of enhanced geothermal systems as the team continues to develop, test, and accelerate breakthroughs in enhanced geothermal system technologies and techniques.

PERSONNEL

Faculty

Dr. Keith D. Koper

Director

Professor of Geology and Geophysics

Dr. Kristine L. Pankow

Associate Director

Research Professor of Geology and Geophysics

Dr. James C. Pechmann

Research Associate Professor of Geology and Geophysics

Dr. Jamie M. Farrell

Research Assistant Professor of Geology and Geophysics

Dr. Walter J. Arabasz

Research Professor Emeritus of Geology and Geophysics

[Past UUSS Director, 1985-2010]

Full-Time Staff

William Blycker

Systems Administrator

Valeriu Burlacu

Research Manager

David Drobeck*

Seismograph Technician

Mark Hale

Earthquake Information Specialist

Corey Hatch

Seismic Network Engineer

Cindi Meier

Administrative Officer

Wesley O'Keefe

Seismograph Technician

Arvind Parapuzha

Seismograph Technician

Paul Roberson

Earthquake Information Specialist

Jon Rusho

Seismic Network Engineer

Hao Zhang

Postdoctoral Research Associate

Part-Time Staff

Nicholas Forbes

Student Analyst

Barrett Johnson

Student Analyst

Barry Morse

Station Attendant

Sheryl Peterson

Communications specialist

Katherine Whidden

Research Scientist

Pictured left: the Utah FORGE site near Milford, Utah.

* Deceased

STUDENT RESEARCH



Andy Trow
MS Geophysics – 2018 Graduate
 Thesis Title: Seismic Event Characterization and Ambient Noise Seismic Imaging in South-western Utah, Using Multiple Dense Geophone Arrays.



Guanning Pang
Ph.D. Candidate Geophysics
 Guanning worked on the 2017–2018 Maple Creek earthquake sequence in Yellowstone National Park. He used the waveform recorded in the UUSS system and generated ~4.4 million P wave and S wave differential travel times. Guanning used these differential travel times to obtain high-accuracy relocation and the near source V_p/V_s ratio for the sequence. The results showed hypocenters to be divided into two major subpopulations: a northern cluster with planar structure striking mainly NW–SE and a southern cluster with planar structures striking E–W.



Monique Scales
Ph.D. Candidate Geophysics
 This past year Monique worked on a study showing that $M_L - M_C$ is a portable depth discriminant that distinguishes shallow seismicity from deep seismicity in Yellowstone, Oklahoma, and Italy. She also mentored two UUSS undergraduates in their research projects on refining the UUSS explosion catalog, and characterizing mining-induced seismicity in Utah.



Daniel Wells
Ph.D. Student Geophysics
 Daniel worked on the datasets of four geophone array deployments for the FORGE project in southern Utah. The purpose was to cross correlate the recorded seismic waveforms to both 1) extract phase and group seismic velocity measurements for the region and 2) use the waveforms on the three different components of the instruments to examine the movement of different seismic waves and their particle motion.



Amy Record
MS Geophysics
 Amy transitioned from an undergraduate student to a graduate student. She worked on data from several nodal experiments from 2016–2017 doing detections and locations. This data set is now part of her masters thesis analyzing the seismicity of an area of geothermal interest in south central Utah which includes the FORGE site. Amy also joined the Duty Seismologist rotation in September.



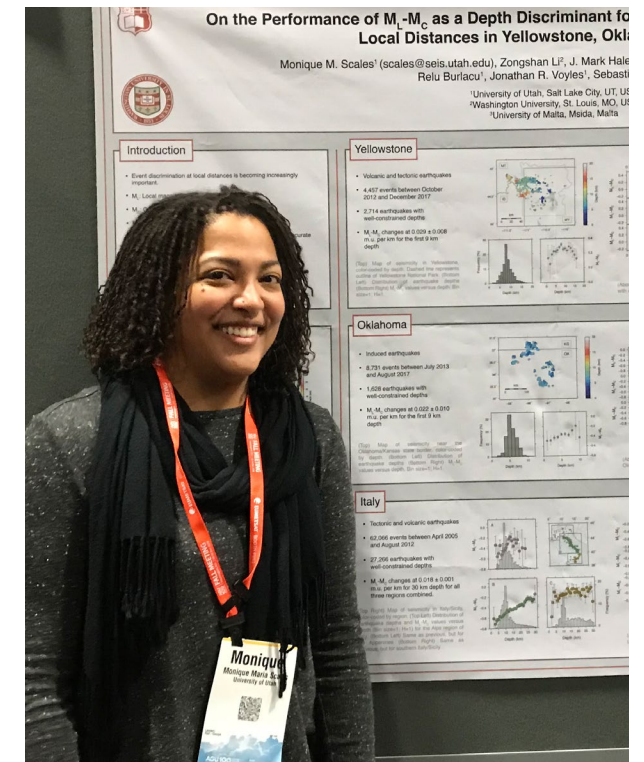
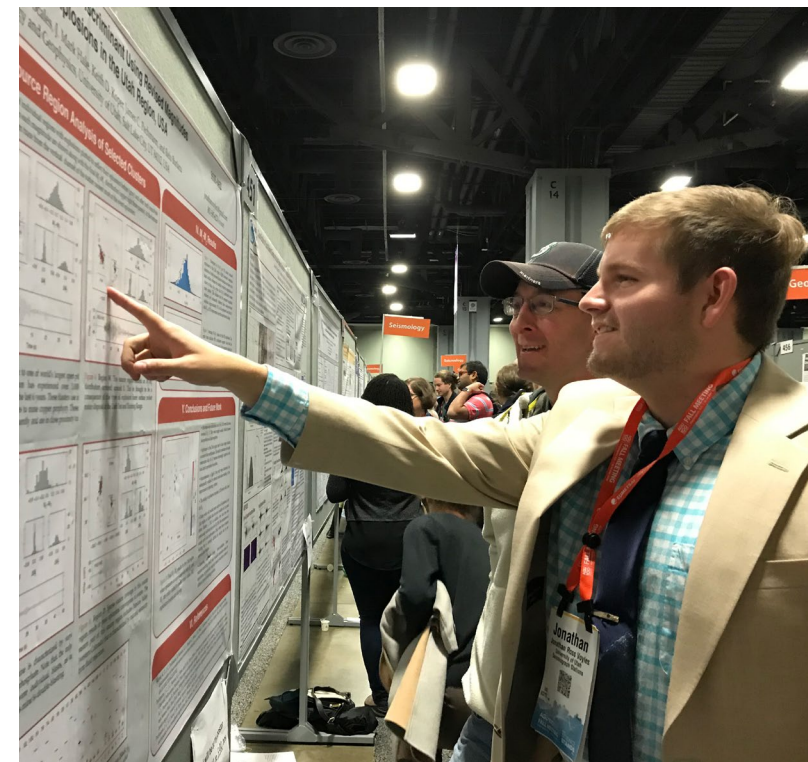
Alysha Armstrong
Junior – Geoscience–Geophysics
 Alysha investigated 205 seismic events occurring near a longwall coal mine in central Utah between July 17, 2014 and July 2, 2017 using high-precision relative relocation algorithms. This allows for a more accurate interpretation of where these seismic events occur with regard to mine structure and mining operations.



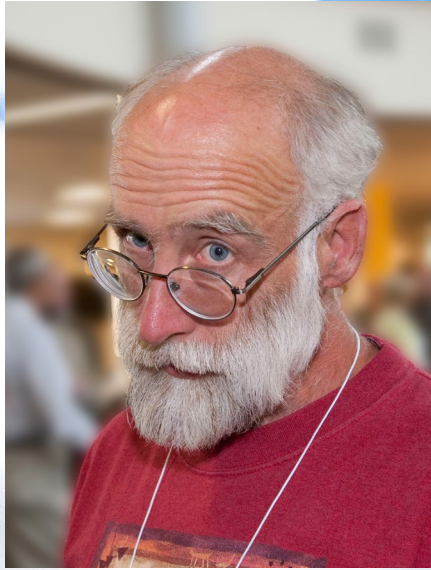
Nicholas Forbes
Junior – Geoscience–Geophysics
 Nicholas worked as a seismic analyst for UUSS where he also participated in research involving signal characterization of mass wasting events in southern Utah. He plans to graduate in the spring of 2019 and pursue a master's degree in geophysics under Keith Koper.



Jonathan Voyles
Junior – Geoscience–Geophysics and Geological Engineering
 Jonathan finished curating a catalog of human-reviewed explosions in Utah in 2018. This catalog was used to evaluate the $M_L - M_C$ local-distance depth discriminant and will be used by researchers in the future.



Jonathan Voyles (left) and Monique Scales (right) present their posters at the American Geophysical Union Fall Meeting.



REMEMBERING DAVE DROBECK

February 19, 1960 – February 11, 2018

Written Summary from Bob Smiths' presentation at the University of Utah Seismograph Stations celebration service for Dave, Feb. 22, 2018.

To you my colleagues, especially to Ken Whipp (Whitey) and Pete O'Neill his close friends, Erwin McPherson, and Dave's early colleagues in the University of Utah Seismograph Stations — I respectfully celebrate the life and accomplishments of a great gentleman, dedicated UUSS seismic engineer/technician, and trusted friend: David Drobeck.

Dave leaves behind his remaining family of two loving sisters, Karen and Susan (Charly) whom I am in communication with, one dog, many good friends, his work colleagues, and us.

Domestically, Dave loved his home where he grew a large garden of well-known and exotic vegetables. He froze and canned extras for all of us. Dave played his guitar on the porch and also in the field, especially serenading us in the Yellowstone quarters where we all enjoyed it.

I note here the association of Erwin McPherson who preceded Dave as the Yellowstone seismic network engineer. Then noting two of Dave's key associates: Ken Whipp, his career long UUSS technical and field colleague and electronics engineer, and Pete O'Neil, Dave's longtime friend and trusted field assistant, both whom have worked the front and backcountry of Yellowstone and Teton National Parks.

I have known Dave for over 33 years and have great respect for his engineering acuity, quick wit, irreverence for authority and, most of all, for his very close friendship with my wife Jan and me.

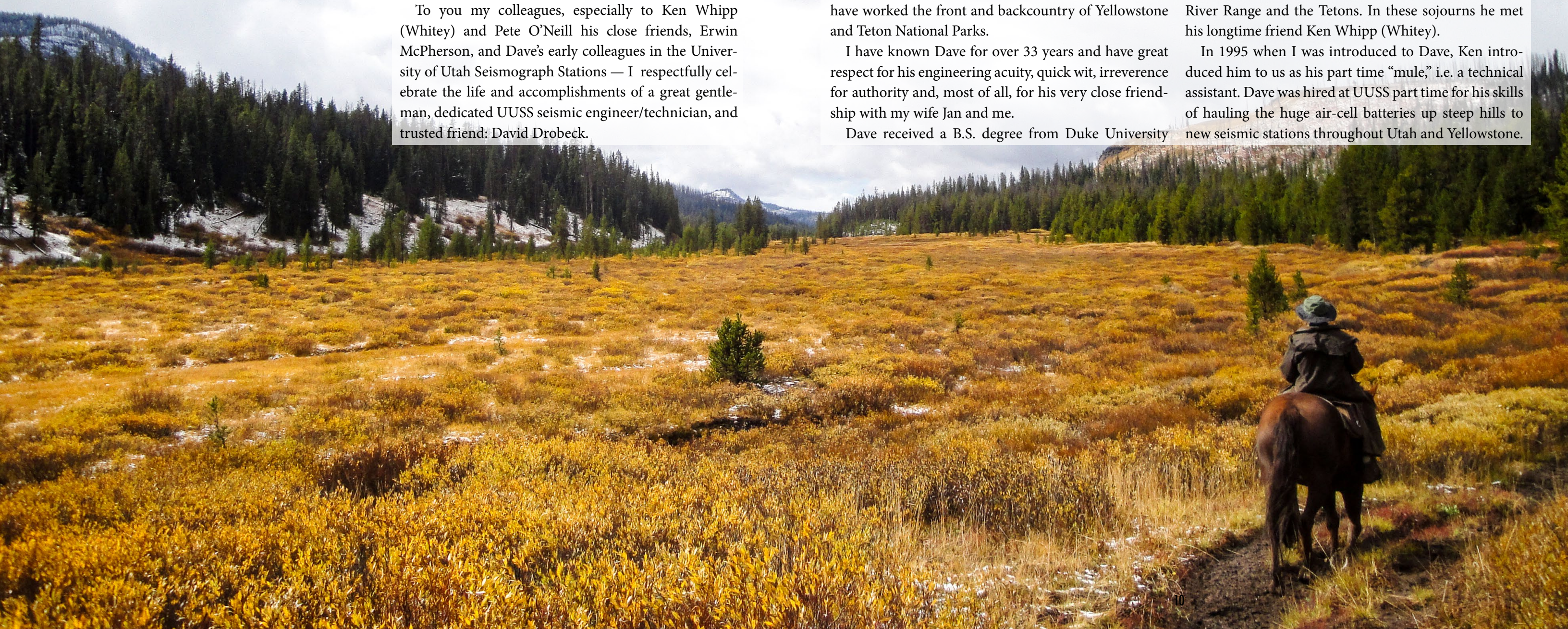
Dave received a B.S. degree from Duke University

around 1985 then came to the University of Utah for a Ph.D. in materials science engineering. Upon completion of his Ph.D., however, Dave recognized living in the wonderful world of the outdoors of the Intermountain West offered him something new he wanted: namely, the opportunity to explore this new wilderness and mountain landscape and most of all, to be his own boss.

The latter skill carried him throughout his career by simply asking "what do you want to get done? Let me do it and do not bother me." It always got done.

Now, not wanting to go on in his Ph.D. field working in labs or offices, Dave took on a new career. His first Utah job was shoveling snow off the roofs of lodges at Alta, Utah, and in the summer exploring the Colorado Plateau canyons, the Green River, the Colorado River and the San Juan River while also discovering the Wind River Range and the Tetons. In these sojourns he met his longtime friend Ken Whipp (Whitey).

In 1995 when I was introduced to Dave, Ken introduced him to us as his part time "mule," i.e. a technical assistant. Dave was hired at UUSS part time for his skills of hauling the huge air-cell batteries up steep hills to new seismic stations throughout Utah and Yellowstone.





Notably, Dave had not taken any courses in electronics. But working with Ken, it became clear that Dave was a fast learner and had the promise of becoming a successful technician. At that time, digital electronics were just coming into our field and Dave quickly grasped the digital electronics knowledge to install, repair, and maintain the digital parts of the UUSS seismic network with Ken doing the analog. Together they made a formidable pair keeping our networks running smoothly for decades.

As Ken says, he recognized Dave's acumen and fast learning skills and then asked UUSS to hire Dave full-time, a request that I recall approving. Dave and Ken with the help of Pete, designed, maintained, and upgraded the entire Yellowstone seismic network from its skeletal beginnings of a dozen old stations inherited from the USGS to building and upgrading its infrastructure to 35 modern digital seismic stations with 165 recorded channels and high reliability telemetry network.

In the late 80s, along came the Global Positioning System and Dave began our early work on GPS studies of ground deformation; growing the Yellowstone GPS network into a reliable permanent array of 25 GPS stations. Note that Dave and Ken, with the help of Pete, maintained this very large and high tech seismic and GPS network in the highest area of the Rocky Mountains and the high mountainous Yellowstone Plateau that can have nine-month winters, snow 10 feet deep, and temperatures as low as -50 degrees. Now this very famous network works reliably all year.

In our Yellowstone responsibilities, Dave accompanied me on several Yellowstone backcountry trips — especially to the remote Thorofare and Mirror Plateau. Moreover, as you know, Dave makes friends with everyone he meets. Thus, in Yellowstone he made good friends with all of the National Park Service personnel, interpreters, rangers, helicopter pilots, etc.

Routinely, Dave would cook up huge breakfast platters that included eggs, tomatoes, garlic, potatoes, onions, and more from his garden for us and the whole NPS crew at our lake apartment. The enticing smell wafted across the compound and brought neighbors over to our apartment by the dozen.

The National Parks Service staff quickly recognized



Dave's skills and held him in high esteem for maintaining our high technology equipment in a sensitive environmental way. He was especially called upon by the NPS on designing and operating photovoltaic systems for their battery charging needs, as the University of Utah was the first organization in Yellowstone to have these systems.

With his experience, Dave was also recognized by other organizations for his technical skills in operating seismic and GPS networks. He was often called to help them design their new systems, notably Incorporated Research Institutions for Seismology (IRIS) and University Consortium in Satellite Navigation (UNAVCO) who operate GPS/GNSS networks, the EarthScope Plate Boundary Observatory and the US Geological Survey.

I am also reminded of Dave's daily work routine where he would take a late lunch around 1:00 pm, then around 2:00 pm he would come to my office, stand at the doorway no matter what I was doing, then saunter in asking what was going on and what was next on our plates. I really miss this daily exchange and his comments on established politics.

It was just Friday before his death that Dave came into my office at 2:00 pm to discuss our plans for Yellowstone 2018 field work, including his determined plan to finish the Thorofare seismic station.

Note that I still have an appointment to meet Dave this summer, August 23, at the Yellowstone, Thorofare Cabin where he will cook up a fine dinner of home-grown veggies — horse-packed for 38 miles with at least one gallon of tomatoes and pounds of garlic.

Thus to Dave's sisters, to Whitey (alias Ken) and Pete, and to all of you, I share a great appreciation for friendship, association, and many happy memories with Dave!

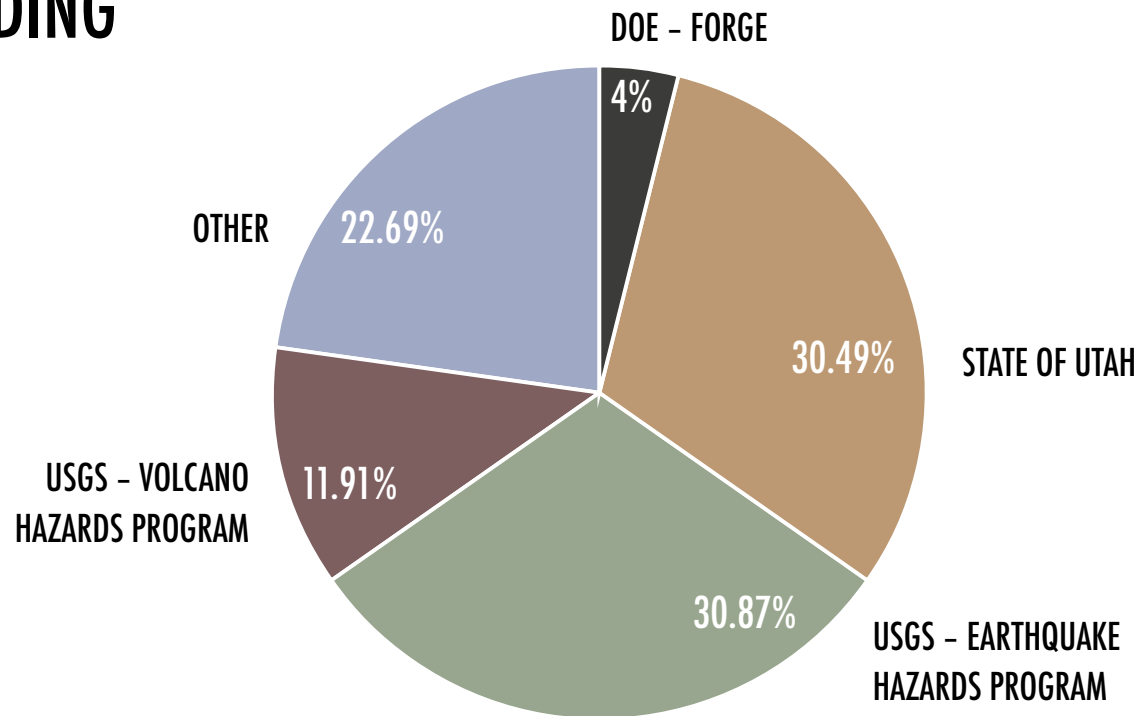
In closing, I thought you might want to know the time the three of us — Dave, Ken and myself, not only as a University of Utah Yellowstone team but as close friends — have put into Yellowstone. Ken with 29 years, Dave with 27 years, and me with 61 years totals 117, rounded is 120 years of Yellowstone public service, volcano and earthquake science and monitoring. More than any other group I know of.

Best to all of you, Dave's family and friends.

Bob Smith



FUNDING



U.S. GEOLOGICAL SURVEY – EARTHQUAKE HAZARDS PROGRAM	30.87%
• Regional and urban seismic monitoring: Wasatch Front and neighboring Intermountain West region	
STATE OF UTAH	30.49%
• Earthquake monitoring, research, education, and outreach in the Utah region	
U.S. GEOLOGICAL SURVEY – VOLCANO HAZARDS PROGRAM	11.91%
• Operation and maintenance of the Yellowstone regional seismic network and earthquake information system	
U.S. DEPARTMENT OF ENERGY – FORGE	4.03%
• Enhanced geothermal system concept testing and development at the Milford, Utah FORGE site	
OTHER	22.69%
National Science Foundation	6.21%
• Mapping fine scale structures in Earth’s inner core with a global array of seismic arrays	3.29%
• Collaborative research: capitalizing on EarthScope transportable array data to better characterize induced seismic sequences	1.89%
• Rapid seismic deployment; 2018 Kilauea lower east rift zone eruption and summit explosions	0.55%
• Origin & propagation of shallow water microseisms: Yellowstone Lake multidisciplinary study	0.48%
Air Force Research Lab	5.21%
• Evaluation of $M_L - M_C$ as a possible depth discriminant at local distances	
University of Utah Matching Funds	3.90%
U.S. Department of Energy	2.57%
• Structurally controlled geothermal systems in the eastern Great Basin Extensional Regime, Utah	
National Institute for Occupational Safety and Health	2.94%
• Tools for improving mine ground control safety and health	
Sandia National Laboratory – Department of Energy	1.55%
• Geophysical monitoring and characterization of the Utah region	
Utah Department of Public Safety - Traveling Educational Earthquake Exhibit	.30%

SPONSORS

- University of Utah
 - College of Mines and Earth Sciences
 - Department of Geology and Geophysics
 - Department of Mining Engineering
 - Energy and Geoscience Institute
- State of Utah
 - Department of Public Safety
- United States
 - Geological Survey
 - Department of Energy
 - Advanced National Seismic System
- The Air Force Research Laboratory
- Idaho National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Montana Bureau of Mines and Geology
- National Earthquakes Hazards Reduction Program
- National Institute for Occupational Safety and Health
- National Science Foundation
- RioTinto
- Sandia National Laboratory
- Scripps Institution of Oceanography (UCSD)
- Southern Methodist University
- Utah FORGE
- Yellowstone National Park

COMMITTEE SERVICE

Dr. Keith D. Koper

- Vice-chair, Utah Seismic Safety Commission, 2010 – present
- Member, Editorial Board, EOS Transactions of the American Geophysical Union, 2010 – present
- Member, US Air Force Seismic Review Panel, 2011 – present
- Member, Board of Directors, Incorporated Research Institutions for Seismology (IRIS), 2016 – 2018
- “Forensic Seismology for Situational Awareness: Seismic Monitoring Beyond Earthquakes”, invited briefing to U.S. Senate staffers, Washington D.C., June 19, 2018
- Member, Department of Energy External Review Panel on Signal Propagation for Lawrence Livermore National Labs, 2018
- Member of Seismological Society of America Richter Award sub-committee, 2018 – present

Dr. Kristine L. Pankow

- Intermountain West Regional Coordinator; Advanced National Seismic System (ANSS); Committees: National Implementation, Comprehensive Catalog, Organizing Committee NetOps Workshop, Large Magnitude Working Group, 2010 – present
- Member, Utah Mine Safety Technical Advisory Council, 2011 – present
- Member, Powell Center Working Group, Future Opportunities in Regional and Global Seismic Monitoring, 2018 – present
- Professional Meeting Session Co-Chair, European Seismological Commission, Valletta, Malta September 2018

Dr. James Pechmann

- Member, Utah Quaternary Fault Parameters Working Group, Utah Geological Survey, 2003 – present
- Member, Utah Ground Shaking Working Group, Utah Geological Survey, 2003 – present
- College Council, 2018 – present



UUSS employees at the annual UUSS picnic.

SEISMO TEA

Date	Name	Lecture
Jan. 17	Kevin M. Ward	Novel Imaging Applications to Outstanding Tectonic Questions: Examples from the Central Andes, Cascadia, and Yellowstone
Jan. 24	Jamie Farrell	Merging Geophysical, Petrochronologic, and Modeling Perspectives of Large Silicic Magma Systems
Jan. 31	Monique Scales	Investigating the Relationship Between Waveform Correlation and Seismic Source Mechanisms
Feb. 7	Guanning Pang	The 2018 Maple Creek Seismic Swarm in Yellowstone National Park
Feb. 28	Andy Trow	Microseismic Event Detection using Multiple Large-N Geophone Arrays in Central Utah
March 7	Ryota Takagi	Ambient Noise Wavefield in Japan Characterized by Polarization Analysis of Hi-net Records
March 14	Sin-Mei Wu	Seismic Observation of Old Faithful Geyser in Yellowstone
March 29	Ramón Arrowsmith	Earthquake Recurrence and Fine Scale Tectonic Geomorphology Along the South-Central San Andreas Fault
April 5	Stephanie Prejean	Dynamic Earthquake Triggering at Volcanoes, a Case Study of an Alaska Eruption and its Precursors
April 11	Node	Broad Nodal Theme — Highlights of Student Research
April 18	Weisen Shen	Imaging the Earth's Lithosphere with Large Seismic Arrays and Recent Progress in Polar Region
Sept. 5	Hao Zhang	Rupture Mechanism of August 19, 2018 M _w 8.2 Deep-Focus Fiji Earthquake
Sept. 19	Guanning Pang	Aftershock or Swarm? An Insight of 2017-2018 Maple Creek Sequence, Yellowstone
Sept. 24	WenZhan Song	Toward Creating Subsurface Camera
Oct. 2	Yehuda Ben-Zion	Properties and Dynamics of the Shallow Crust
Oct. 17	Elizabeth Berg	Tomography of Southern California via Bayesian Joint Inversion of Rayleigh Wave Ellipticity and Phase Velocity from Ambient Noise Cross-Correlations
Oct. 23	Sin-Mei Wu	The Old Faithful Geyser Plumbing System Revealed by Hydrothermal Tremor Migration
Oct. 31	Kevin Mendoza	DAS Data: Distributed Sensing of Strain, Temperature, and Microseismicity
Nov. 7	Carl Tape	Full Moment Tensors: Applications to Earthquakes, Volcanic Events, Collapse Events, and Nuclear Explosions
Nov. 13	Douglas Wiens	Seismological Constraints on the Dynamics of the Antarctic Ice Sheet
Nov. 14	Derrick Chambers	Obspy and Beyond: Python in Seismology
Nov. 16	Kristine Larson	Detecting Volcanic Eruption Characteristics using GPS Data
Dec. 5	Yadong Wang	Ambient Noise Tomography Across the Cascadia Subduction Zone Using Dense Linear Seismic Arrays and Double Beamforming
Dec. 12	Elizabeth Berg	Joint Bayesian Inversion Across the US Array in Alaska using Surface wave Dispersion, Rayleigh Wave Ellipticity, and Receiver Functions

PRESENTATIONS

Date	Personnel	Location	Topic
Feb. 2	Jamie Farrell	University of Wyoming Distinguished Lecture	Seismic Imaging of the Yellowstone Upper Geyser Basin using a Dense Seismic Array
	Jamie Farrell	Chapman Conference	Seismic Imaging of a Large Silicic System: What We Know About the Yellowstone Magmatic System
April 3	Jamie Farrell	Eastern Idaho Public Health Emergency Preparedness	Earthquakes in the Intermountain West: When, Where, Why, How?
April 26	Keith Koper	Southern Methodist University	Imaging Earth's Inner Core with Seismic Arrays
April	Kris Pankow	Women in STEM MUSE Lunchtime Lecture Series, University of Utah	
May 6	Jamie Farrell	Yellowstone Volcano Observatory Biennial Meeting	What's Shaking in Yellowstone? Earthquakes In and Around Yellowstone National Park
May 6	Jamie Farrell	Yellowstone Volcano Observatory Biennial Meeting	Yellowstone Hydrothermal Systems: Public Safety, Science and Recommendation
June 19	Kris Pankow	FEMA and DoD NorthComm Tour	
July	Kris Pankow	Women in Geophysics Talk, University of Utah ACCESS Program	
Aug.	Kris Pankow	USGS/Congressional Staffer Tour	
Aug.	Kris Pankow	FEMA Region VIII Project Tour	
Sept. 4	Keith Koper	European Seismological Commissions General Assembly Valletta Malta Keynote	Using CTBTO International Monitoring System (IMS) Seismic Arrays for Basic Science
Oct. 1	Jamie Farrell	Utah County Emergency Preparedness	Shaking and Baking in the Intermountain West: Earthquakes and Volcanoes, Where, When, and How?
Nov.	Kris Pankow	U of U Department of Geology and Geophysics Distinguished Lecture Series	Developing an Induced Seismic Mitigation Plan for the Utah Frontier Observatory for Research in Geothermal Energy (FORGE)
Nov. 7	Jamie Farrell	Highland Park Elementary 5th Grade	Earthquakes and Volcanoes
Nov. 15	Jamie Farrell	Brigham Young University	The Yellowstone Hotspot: Unraveling the Plumbing System of One of the World's Largest Volcanoes

The UUSS gave 19 tours of the RioTinto Earthquake Information Center, sent the traveling earthquake exhibit to 4 schools, and attended and tabled at multiple events for the university and other government associations.



Right: Jamie Farrell gives a presentation to a visiting group in the RioTinto Earthquake Information Center.

UUSS JUMPS IN TO STUDY VOLCANO



In May 2018, the big Island of Hawaii had dozens of fissures open up in Kilauea Volcano's East rift zone. The unique event provided an opportunity to understand a volcano like never before.

UUSS's Jamie Farrell, as well as Geology and Geophysics professor Fan Chi Lin and undergraduate student Matthew Miller, acted quickly and reached out to Hawaiian Volcano Observatory (HVO) to ask permission to deploy a temporary seismic network around the volcano. The network's purpose was to locate where earthquakes originated to help volcanologists understand what happens to a volcanic crater as the magma chamber empties.

HVO granted permission and Lin and Farrell secured funding from the National Science Foundation's RAPID program for the project. In early June, the three set off with HVO scientists and members from Hawaii Civil Defense to deploy a network of 82 portable seismometers from Kilauea's summit to the East rift zone.

"The scientific target is trying to see whether we can detect how the magma moves from the summit all the way to the lower rift zone," Lin told AtTheU. "There's a big uncertainty there. One component of our study is whether we can reveal what the subsurface magma channel looks like."

Wearing hard hats and gas masks, the team worked quickly over four days. The seismometers were immediately put to good use and helped detect a magnitude

5.3 earthquake that occurred during the network setup.

"We got our sensors up pretty darn close," Farrell told AtTheU. "They're in danger of being covered by lava if it breaks out or changes paths or if a new fissure opens up. But you get really good data if you can get that close. That's a risk we were willing to take."

In mid-August, Farrell returned to Hawaii to collect the sensors. Out of the 82, only one was lost in the jungle and one was burned, presumably by nearby fresh lava. The data were retrieved and reviewed for sharing with the scientific community at a later date.



Jamie Farrell and Fan-Chi Lin deploying portable seismometers near the Kilauea Volcano in Hawaii.

ABSTRACTS, PUBLICATIONS, & REPORTS

ABSTRACTS

Seismological Society of America, May 14–17, Miami, FL

Kilb, D. and K.L. Pankow (2018). Exploring subtle temporal changes in earthquake catalogs to guide identification of dynamically triggered events.

Koper, K.D., J.C. Pechmann, J.M. Hale, R. Burlacu, K.L. Pankow, W.L. Yeck, H.M. Benz, R.B. Herrmann, D.T. Trugman, and P.M. Shearer (2018). The 2017 earthquake sequence near Sulphur Peak, Idaho.

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Arvind Parapuzha participating in tower training.



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