

# MONTANA TECH

## GEOPHYSICAL ENGINEERING

August 2017

Volume 4, p.1

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## LETTER FROM THE CHAIR

I am pleased to announce that the Geophysical Engineering Department at Montana Tech has just completed a successful Accreditation Board for Engineering and Technology (ABET) accreditation review. We remain one of only two ABET accredited geophysical engineering programs in the United States.

This year the Department received \$20,000 from Montana Tech capital equipment funds for new seismic cables. These cables will allow us to fully utilize our 144-channel seismic recording system. In addition, we used student fees to purchase a new RTK-capable Global Positioning System (GPS). This new GPS design is simple plug-and-play with no cables required. Any cell phone or tablet that has a web browser and Wi-Fi can control the system. The new GPS will complement our older Leica GPS system to support student projects, class exercises and research.

The Department continues to become more and more involved in the use of Unmanned Aerial Vehicles (UAVs) to collect geophysical data. We now have two quad-copters and can fly a magnetometer and multispectral imager. We hope to acquire a larger UAV and more instrumentation in the near future.

On Friday, October 20, 2017, we will have our annual Industrial Advisory Board (IAB) meeting in Butte, Montana, to coincide with Homecoming weekend. The IAB provides industry input to our program. Please feel free to contact me if you are interested in serving on the IAB. The IAB is an important component of the accreditation process and we take IAB input seriously.

Montana Tech is in the middle of a major Capital Campaign to raise funds to support important campus goals including a number of endowed professorships. The Geophysical Engineering Department can grow and strengthen by recruiting an outstanding researcher and teacher to fill an endowed chair position. With declining state support in recent years, we have begun to rely heavily on Montana Tech Foundation funds to support the Department. We have a rapidly growing need to replace aging equipment and provide scholarship support. If you would like to help us meet our fundraising goals and help support an endowed professorship, then please contact me and we can discuss how you might help.

Marvin Speece, Professor and Chair



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### **Generous Supporters of the Department: January 2016 - July 2017**

#### **Corporate and Foundation Gifts**

Chevron Corporation

Newmont Mining Corporation

Wells Fargo Educational Matching Gift Program

#### **Individual Gifts**

Brian Church

Jim Girard

Barbara Pape

Brian Sayre

Cy Webster

Leif and Trilby Cox

Robert Cronholm

Eric and Connie Johnson

William and Mary Ellen Sill

David and Elizabeth Erickson

Keith Sjostrom and Mary Ann Moore

Mark and Catherine McRae and Family



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### Faculty News



**John Getty:** With another school year behind us, I have bit of time to reflect. I can tell you that teaching physics is an intellectual endeavor that goes well beyond the physical science, into the social and cognitive realms. While my students did ok on a nationally normed test, I clearly have some opportunities for improvement!

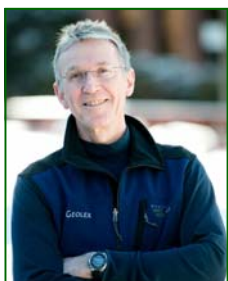
Montana Tech is becoming more heavily invested in remotely piloted vehicles. These unmanned aerial systems (UAS or “drones”) are being applied in a wide range of applications in several disparate departments. I recently authored a proposal to create a Montana Tech commercial drone pilot certificate program. That effort awaits only sufficient funding to cover start-up costs.

Montana Tech’s involvement in proppant for hydraulic fracturing operations continues with a new research contract. The purpose is to provide support for the development of a method that is expected to turn the massive slag pile just outside Anaconda, Montana into a revenue stream. The dual products of the process are pig iron and proppant. The principle investigator for the effort is Dr. Avimanyu Das, visiting faculty in the Department of Metallurgical and Materials Engineering. The M&ME department is assisting with the high temperature chemistry and I am providing the analysis and quality control for the proppant that is produced.

The ASTM International D18 committee on Rocks and Soil continues the development of standards for hydraulic fracturing. As of the June 2017 meeting, I have begun a two-year assignment as chair of the D18.26 subcommittee on Hydraulic Fracturing. The five sections comprising the subcommittee are Site Investigation and Monitoring, Site Infrastructure and Construction, Materials Characterization (fluids, proppants, grouts, etc.) and Reporting and Terminology.



**Jim Girard:** Jim continues to teach physics and manage the physics lab.



**Curtis Link:** Curtis Link retired from the Department in 2013. He is Professor Emeritus of Geophysical Engineering Department. After part of a year working for Geolex in Helena, he is back at Montana Tech as Director of the Freshman Engineering Program.



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**Marvin Speece:** Former graduate student Leif Knatterud finished his thesis and his research paper is in revision for the journal *Interpretation*. His work involves the processing and interpretation of seismic and gravity data from the Avon Valley, Montana: a pull-apart basin related to sinistral transpressive shear across the Lewis and Clark shear zone. Brad Rutherford continues to work on his paper for the journal *Tectonics* that discusses the regional tectonics of northwestern Montana. Nikolas Nesladek has just completed his thesis on comparing optical fiber measured strain to geophone data in an underground mine setting. He completed this project in collaboration with Mary MacLaughlin from the Geological Engineering Department at Montana Tech with funding from the National Institute for Occupational Safety and Health. Fiber-optic sensing technology has advanced to where ground motion can be monitored using fiber-optic cable. I am working with Michael Masters in the Liberal Studies Department at Montana Tech and Geophysical Engineering undergraduates Jacob Clarke and Andrew Wilson on a Montana Tech Summer Undergraduate Research Fellowship (SURF) project to use Ground Penetrating Radar (GPR) to characterize a Native American prehistoric site near Dewey, Montana.



**Xiaobing Zhou:** I continue to teach Gravity and Magnetic Exploration, Elements of Geophysics, Electricity and Magnetism, Field Geophysics, Senior Design, and Remote Sensing for both upper level undergraduates and graduates. Since Spring 2017, I started teaching the Senior Design course. For research, I have continued the project funded by Montana University System Research Initiative as part of a two-year project "Enhancing Montana's Energy Resources: Research in Support of the State of Montana Energy Policy Goals", in collaboration with researchers from both Montana Tech and Montana State University. The project will end by the end of June, 2017. I have continued collaboration with researchers in Nanjing University of China in applying remote sensing techniques in snow/ice and salinity monitoring. A few publications came out from such collaborations. Two visiting scholars from China have joined us since the end of 2016 doing research on remote sensing image segmentation/classification and the ionosphere effect on radar remote sensing. We started working on data collection using Unmanned Aircraft Systems (UASs), we have now two drones (DJI Inspire 1 and DJI Phantom 2 plus) available for such activities. I passed the FAA Unmanned Aircraft General Knowledge Test and am now a certified remote pilot for small UASs (0.55l – 55 lbs).

**Khalid Miah:** I have diverse research interests including seismic signal processing, fiber-optic distributed sensing and robotics. I served as a session Chair of a technical program in the SEG Annual Meeting in Dallas, TX in October, 2016. I reviewed several journal articles and conference abstracts including IEEE, Applied Geophysics, and the SEG meeting. I organized and led a students' field-trip to the Barrick Golden Sunlight mine in Whitehall, Montana. I am also actively engaged in the Indigenous Mentoring Program (IMP) organized by the University of Montana system. At present, I am the department representative for Montana Tech Faculty Senate.





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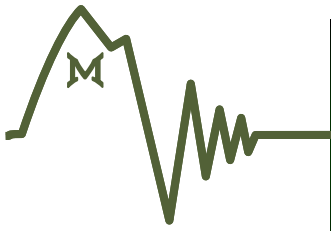
**Mohamed Khalil:** I continue to teach resistivity and electromagnetic, petro-physics, and general physics for both graduate and undergraduate students. I am supervising two master degree candidates. My application for the Faculty Grant Initiative (FGI) has been accepted this year. This summer, I started my research of unexplained land subsidence at some locations in Butte, MT. In addition, a resistivity and VLF-EM survey at Virginia City was very successful during this summer's field course. We got valuable information explaining the origin of two natural springs and landslides at the area. Results of our Lolo-creek study have been presented at SAGEEP, 2017, Denver, Colorado. Two research papers have been submitted to peer-reviewed journals.



## Recent Publications

### Recent publications:

- Chen, J., Ke, C., Zhou, X., Shao, Z., and Li, L., 2016, Surface velocity estimations of ice shelves in the northern Antarctic Peninsula derived from MODIS data: *Journal of Geographical Sciences*, 26(2), 243-256.
- Gebril, A., and Khalil, M. A. 2017, Applying geophysical methods to estimate hydraulic parameters for the saturated zones in Lolo Creek, Montana: National Ground Water Association (NGWA), Denver, Colorado.
- Ha, C. D. M., Shepherd, K., Mack, A., Rutherford, B. S., and Speece, M. A., 2016, Geophysical investigation of buried slag at the Parrot tailings site, Butte, Montana: 2016 Fall Meeting, AGU, Abstract NH11A-1705.
- Hall, T., Wilson, T. J., Henrys, S., and Speece, M. A., 2016, Sediment volume record of Paleogene-Neogene Transantarctic Mountains erosion and landscape modification, McMurdo Sound region, Antarctica: 2016 Fall Meeting, AGU, Abstract C53C-0725.
- He, L., Ke, C., Zhou, X., Cui, Y., and Shan, L., 2016, Antarctic sea ice change based on a new sea ice dataset from 1992 to 2008: *Climate Research*, 71, 155-169.
- Khalil, M. A., Santos, F. M., and Speece, M. A. 2016, A static shift correction for 2-D resistivity data through frequency domain electromagnetic data: Symposium on the Applications of Geophysics to Engineering and Environmental Problems, Abstract 58.
- Li, M., and Zhou, X., 2016, Aeromagnetic expression of rare earth element (REE) deposits in New Mexico, USA: 2016 Fall Meeting, AGU, Abstract GP43A-1232.



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### Recent Publications, continued

- Ogunsakin, O. R., Apple, M.E., Zhou, X., Peyton, B., and Spangler, L., 2016, Green Algae from Coal Bed Methane Ponds as a Source of Fertilizer for Economically Important Plants of Montana: 2016 Fall Meeting, AGU, Abstract H4313-1411.
- Orubu, K., and Khalil, M. A. 2017, 2D and 3D resistivity imaging to study dewatering of Lolo creek, Montana USA: Symposium on the Applications of Geophysics to Engineering and Environmental Problems.
- Xia, X., Ke, C., Zhou, X., and Zhang, J., 2016, Assessment and adjustment of sea surface salinity products from Aquarius in the southeast Indian Ocean based on in situ measurement and MyOcean modeled data: Acta Oceanologica Sinica, 35(3), 54-62.
- Zheng, W., Du, J., Zhou, X., Song, M., Bian, G., Xie, S., and Feng, X., 2017, Vertical distribution of snow cover and its relationship to temperature over the Manasi River Basin of Tianshan Mountains, Northwest China: Journal of Geographical Sciences, 27(4), 403-419.
- Zhou, X., Zhou, Z., Apple, M.E., and Spangler, L., 2016, Monitoring of coalbed water retention ponds in the Powder River Basin using Google Earth images and an Unmanned Aircraft System: 2016 Fall Meeting, AGU, Abstract NH11B-1732.
- Zhou, Z., and Zhou, X., 2016, Accuracy comparison in mapping water bodies using Landsat images and Google Earth Images: 2016 Fall Meeting, AGU, Abstract H51H-1620.

### Recent MSc Theses:

- Leif Knatterud, 2017, *Structural Setting of the Avon Valley, West-Central Montana, Interpreted from Gravity and Seismic Reflection Data.*
- Nikolas Nesladek, 2017, *Comparing Distributed Acoustic Sensing to Three-Component Geophones in an Underground Mine.*

### 2016 Senior Design Project:

- Ngoc Ha, 2017, *Sinkhole Investigation using Seismic, Electric, and Ground Penetrating Radar Methods:* Prepared for City and County of Butte-Silver Bow, Montana.



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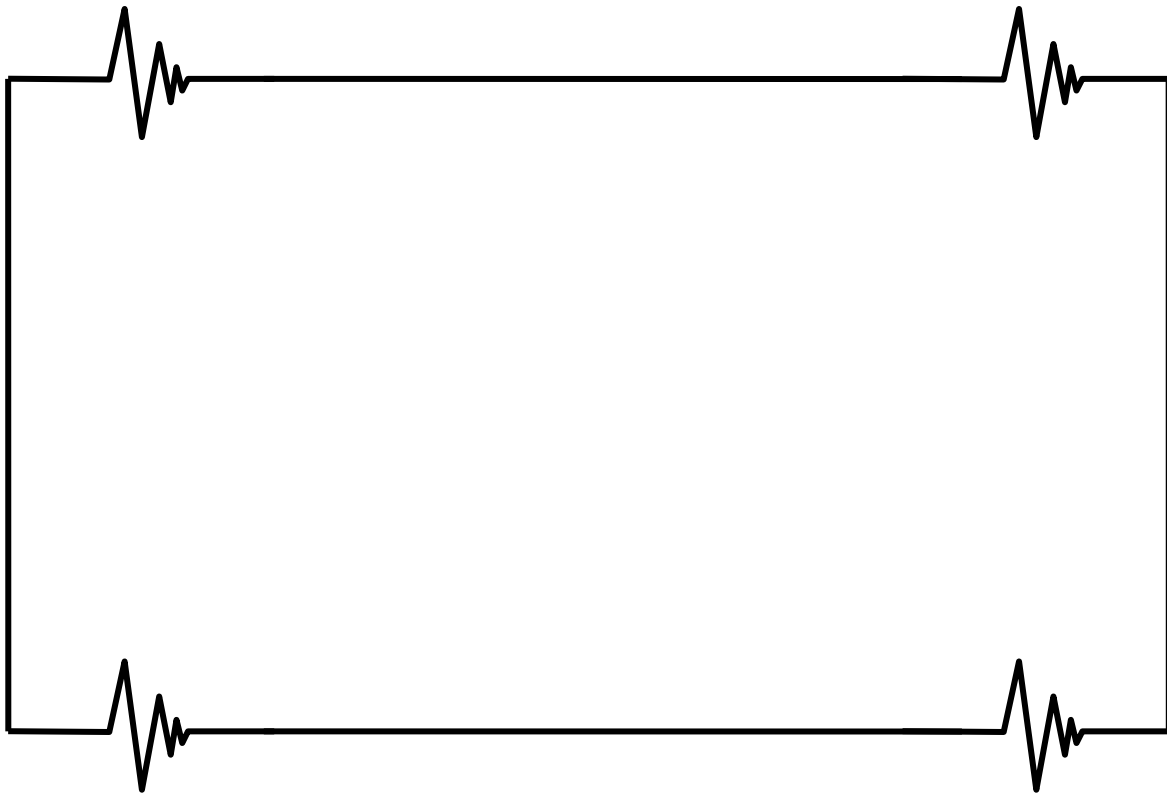
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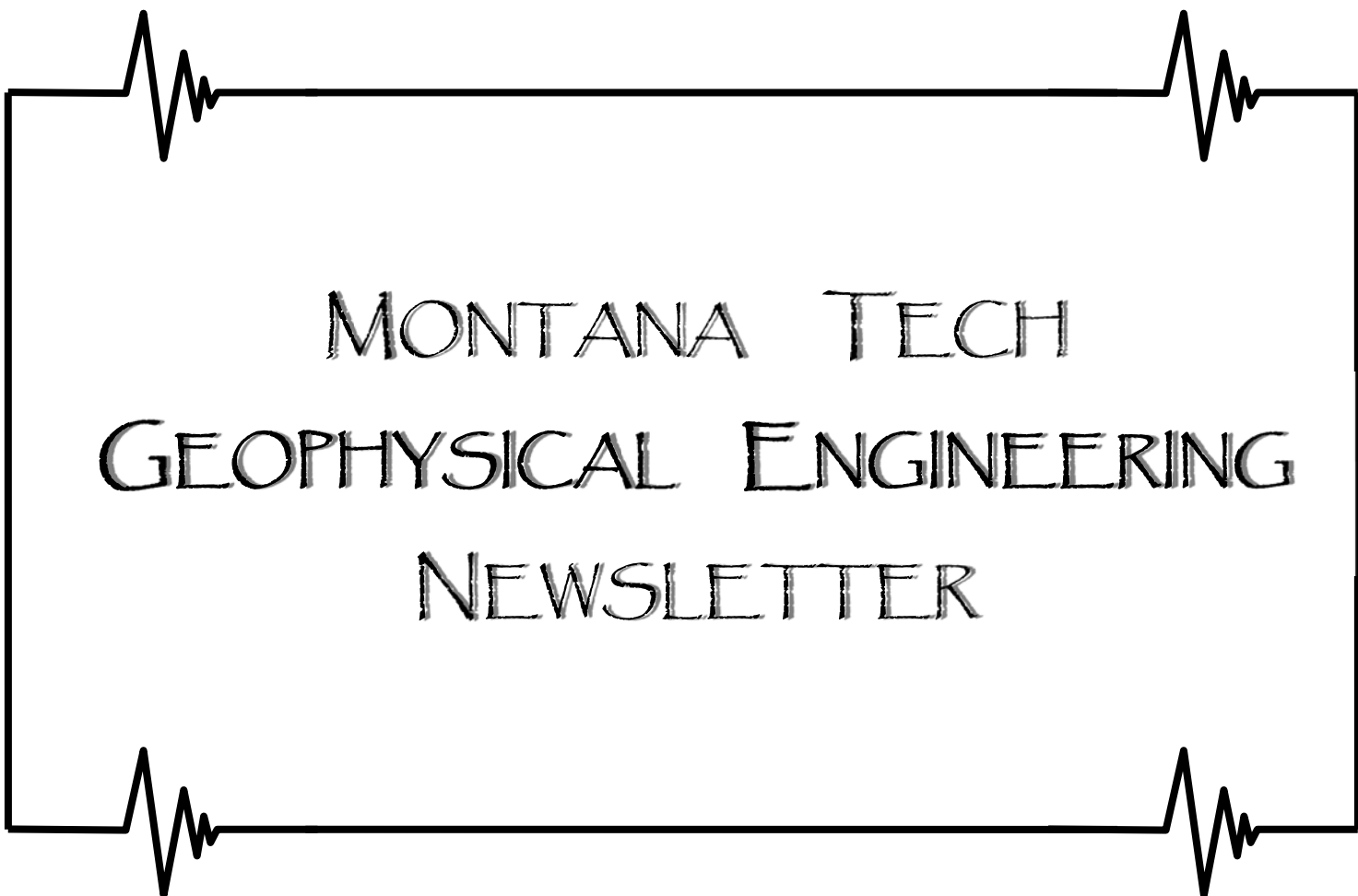
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### FIELD CAMP 2017





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