



Greetings New Mexico Tech alumni,

In January 2018, with the best interests of the university in mind, the New Mexico Institute of Mining and Technology (NMT) Board of Regents, myself, and the NMT Research Foundation approved an updated draft Memorandum of Agreement (MOA) and presented it to the New Mexico Tech Alumni Association (NMTAA) on February 27, 2018. After prior consultation with the NMTAA, NMT had determined that the proposed new (2018) MOA was necessary in order to (1) strengthen a positive working relationship among the university, the NMTAA, and the NMT Research Foundation and (2) to ensure a shared vision and common goals among the three entities that are all focused on the success of NMT, its faculty and its students.

In preparation for the proposed new MOA, NMT reviewed best practices among universities and their supporting entities and consulted with numerous alumni. The new MOA would have provided more support to the NMTAA, created an effective, positive working relationship among NMT, the New Mexico Tech Foundation, and the NMTAA, and helped achieve the vision and goals of NMT's administration. Under the proposed 2018 MOA, the NMTAA would have remained a separate entity; however, for financial accounting and auditing purposes, would have become a component unit of NMT (similar to the relationships between NMT and the NMT Research Foundation or the NMT University Research Park Corporation that exist to benefit NMT). The 2018 MOA

would also have incorporated the NMT Research Foundation as a key participant to strengthen relations and align the fund raising goals of the University and the NMTAA.

After NMT presented the proposed MOA to the NMTAA, the NMTAA responded that "any substantive discussion" would be "premature" and that the draft agreement "proposes a variety of significant changes which appear to alter the fundamental aspects of the NMTAA purpose, operation, and organization." NMT responded by clarifying that under the proposed MOA, the NMTAA would remain a separate 501(c)(3) entity but would become a component unit of NMT for the benefit of the university. Although the NMTAA offered approaches to address current issues and improving relations under the 2014 MOA, NMTAA leadership did not address the proposed 2018 MOA, which was developed specifically to enhance an effective working relationship. Questions raised, such as including members from the NMT Research Foundation as the 2018 MOA was designed as a combined effort on behalf of the university, were never addressed by NMTAA representatives. Subsequent correspondence and social media exchanges indicate that the NMTAA prefers to remain an "independent" entity and that agreements should focus on what is the "most beneficial course for the Association."

Based on the NMTAA's lack of substantive response to the proposed new MOA, on June 29, 2018, the NMT Board of Regents unanimously voted to exercise the termination option provided in the 2014 MOA between NMT and the NMTAA. In light of the Regents' vote, I sent a letter to NMTAA President Kenneth Silsbee to give notice that, pursuant to Section 4.5 of the 2014 MOA, NMT was exercising its option to terminate the 2014 MOA effective as of September 3, 2018.

NMT's proposed 2018 MOA, and the subsequent termination of the 2014 MOA, is designed to strengthen university relations with all alumni, our most valued assets and supporters, and to provide an effective structure for building and growing those relationships. The NMTAA has existed over two university administrations but has not measurably helped NMT achieve its vision and mission or provided the collaborative effort to support the university and its students and faculty. The proposed MOA was carefully researched and crafted to (a) reflect best practices among a university, a foundation, and an alumni base, and to (b) bring the NMTAA, the NMT Research Foundation, and NMT into an appropriate and functional relationship to help the university move forward. The draft

was completed with the help of university legal counsel and supported unanimously by the Board of Regents and the NMT Research Foundation. Based upon NMTAA responses, it has become evident that the purpose of the NMTAA is not in alignment with the vision of NMT, the Board of Regents and the NMT Research Foundation, which is to provide the level of support to the university, faculty and students so that all can excel.

NMT is building the type of broad support to carry the university into the next decade and beyond. This endeavor requires the strongest collaboration among the NMT Research Foundation, the university and its alumni base.

I came to NMT with a vision and have been steadily accomplishing these goals with the regents' and university's support. A strong focus on Tech's alumni has been a priority from day one. Over the past two years I have worked with the NMT Research Foundation to strengthen NMT's Office for Advancement and Alumni Relations. Five new staff members have been hired, including a new position of Alumni Relations Manager. A new Alumni Relations program, housed in the NMT Office for Advancement and Alumni Relations, will be rolling out new outreach efforts, new programs and will be more visible than ever before. Our alumni are the pride of NMT and NMT is proud to finally have the ability to pay them

the homage they deserve.

You'll be hearing more about these efforts in the weeks and months to come. In the meantime, the most effective way to stay up to date with upcoming alumni events, links to national and local news stories, and other NMT-specific items of interest is via our Alumni Interaction FaceBook page:

www.facebook.com/NMTAlumniInteraction/

I continue to have a larger vision for NMT which involves strengthening our support for students, faculty, and alumni. Our Tech family is intricately entwined, with each facet instrumental to the ongoing success and growth of NMT. It is my expectation that the new Alumni Relations program will demonstrate the highest regard for our esteemed alumni. Your opinion matters. Please don't hesitate to reach out with questions.

Sincerely,



Dr. Stephen G. Wells
President, New Mexico Tech

a word from the director.

Greetings!

Welcome to the summer 2018 edition of Gold Pan. New Mexico Tech has successfully completed another academic year, graduating one of our largest classes ever. 397 freshly minted Techies have been unleashed into the world to follow in the footsteps of the Techies who went before them. They have large shoes to fill.

The Office for Advancement continues to be busy during the summer months even though the campus is much quieter with many students and faculty gone. The Advancement Office has more than tripled its staff, all here for the benefit of our alumni, students, faculty, and research. What does an Advancement Office do? Wiktionary.org defines institutional advancement as "a division of an institution focused on the improvement of the entity, primarily involved in fundraising activities. It is, therefore, heavily involved in communications (especially alumni relations), marketing, and public relations." I think this is a succinct description of the purpose of an Advancement Office.

Alumni relations matter a great deal to the mission of our office. Yes, we would love for you to give back to New Mexico Tech and support another generation of scientists and engineers. But alumni matter to us for reasons well beyond their wallets. Every one of you



Colleen Foster

who has excelled at your job, solved a problem no one else could, discovered new methods or processes, taught a meaningful class, or performed a kind deed — you are representing your alma mater. You are the outcome (or the product) of this system called higher education. We happen to think that New Mexico Tech's system works pretty darn well judging from all the CEOs, inventors, scholars, and teachers we have on our rolls.

We have created a new position, Alumni Relations Manager, and have hired Rachel Montoya to fill this

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GAME ON! GAMES

OCTOBER
18 — 21, 2018



New!
Improved!

Saturday
Night Concert

Block
Party

Parade

Department
Reunions

Class Reunions

Memorial
Service

Comedy
Night



GOLD PAN

ALUMNI MAGAZINE

Summer 2018

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ON the COVER



Tina Güth (*PhD in Physics with Dissertation in Astrophysics, 2018*) is honored with the 2018 Founders Award, which is awarded to the student who has made the most significant contributions to the NMT community. (She was featured in "The Last Word" in the Summer 2017 Gold Pan.) Fellow graduate Gareth Jones (*PhD in Physics with Dissertation in Astrophysics, 2018*) shares Tina's joy and appreciation.

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rocket launch opens new horizons



Mustang 6B launch from Spaceport America, located in the Jornada del Muerto desert basin in New Mexico, directly west and adjacent to U.S. Army's White Sands Missile Range

by Lynn Arthur

Photo credits: Jim Perry, White Sands Research and Developers, LLC

Sound was just the first barrier broken by a rocket launched recently by New Mexico Tech students.

The operational experience gained by the team involved will likely open doors they can only now just imagine.

On April 15, 2018 at 7:05 a.m., 16 Techies witnessed the results of meticulous planning and teamwork as the sounding rocket they spent four months refining surged through the sky over Spaceport America in Upham, NM.

The reusable rocket – a 10.9' long, 6.1" round craft called the Mustang 6B, soared to an altitude of 24,127 feet to a chorus of elated cheers and whistles from the ground. Built around a commercial solid rocket motor, it reached a maximum speed of 1372 feet per second - 1.27 times the speed of sound. After reaching apogee, the research rocket

safely returned to earth by parachute and landed very close to the predicted impact point. It was recovered intact, allowing students to retrieve recorded performance data.

This launch was the latest and most successful joint mission between NMT's Mechanical Engineering (*MEchie*) Design Clinic and White Sands Research and Developers, LLC (*WSRDs*) – a Las Cruces business specializing in aerospace R&D.

"I think it was a major success all the way around for New Mexico Tech, for the students, and for White Sands Research and Developers," said *WSRD's* president, Dr. Christina Lohn who served as the mission's logistics and launch weather officer. "We came up with an ambitious plan to work together with the rocket team to continually make more complex, higher flying rockets and eventually reach space."

NMT undergrads have been building and flying rockets as part of their

junior and senior design clinic courses since 2012 and they have partnered with *WSRDs* since 2014.

"The rocket design project is an excellent example of collaborative efforts between New Mexico Tech, a private company, and New Mexico's spaceport," said NMT Mechanical Engineering Department Chair Andrei Zagrai. "It highlights New Mexico's distinct focus on space activities and prepares cadres for the emerging commercial space industry."

This year's NMT team, comprised of 18 *MEchie* students in total, was led by senior Aaron Misla and advised by Dr. Michael Hargather, an associate professor of mechanical engineering. The rocket the students launched in April is an updated (longer and heavier) version of the Mustang 6A that the team sent up in November 2017. Tech students developed most of the Mustang's on-board components including the separation, recovery, and data acquisition systems.



Predawn rocket assembly (l to r) Aaron Misla, James Nolan, Megan Armstrong, Connor Deuschle (back), Joshua Berson, and Andrew Wanchek

WSRDs developed the aerodynamic components – the carbon fiber nose cone, payload section, and motor shroud – which form most of the outer shell. In addition, the company purchased a larger \$2000 commercial rocket motor for the 6B flight.

WSRDs also provided the mission’s chief engineer, Dr. Paul T. Jaramillo, a New Mexico native who earned his first degree from Tech in 1982, a B.S. in petroleum engineering. Jaramillo’s lifelong love of flight not only led to his doctorate in aerospace engineering but also helped to fuel a campaign that brought postsecondary aerospace education to

New Mexico for the first time in the early 2000s. Jaramillo and Lohn, whose work together includes developing the very first policies and procedures for safe operations at Spaceport America, launched their small business back in 1999. In the years to follow, the couple received multiple awards and accolades recognizing their leadership in getting an Aerospace Engineering Department established at New Mexico State University. Jaramillo and Lohn’s tenacious lobbying simultaneously helped to secure annual state funding for aerospace research at NMT.

Jaramillo’s passion and the

“invaluable foundation” he said he received as a Tech undergrad also inspires his continued connection to our University where he also serves on the Mechanical Engineering Department’s advisory board.

“I am a Tech alum and I have a lot of pride in what you guys did,” Jaramillo told NMT rocket team leads during a post-launch review meeting. Repeatedly praising what he deemed a “beautiful launch,” Jaramillo added for the students, “Even when things went wrong, you stepped up to the plate and made them right!”

It is difficult to overstate the benefits Tech students receive from corporate partnerships like these. NMT MEchies get professional training and real-world experience that other engineering students may not see for years. “What you’ll find is that aerospace engineers in general tend to lack operations experience and in almost any field that’s the case,” Jaramillo explained. Speaking of Spaceport

America’s well-known military neighbor, he added, “What we’ve heard from the White Sands Missile Range is that they really value students who have hands-on experience. So that’s an edge; hands down it’s an edge.”

The professional training and observation Tech students experienced before and during the April launch were extensive. Each week of the spring semester, there were action-oriented meetings with students and WSRDs. The undergrads estimate they averaged 15 hours outside of classes each week preparing for the April mission. Prior to the launch, a day-long mission readiness review and dress rehearsal involved a complete tour of the \$220-million, state-subsidized Spaceport America grounds, where Virgin Galactic remains a largely dormant but impressive anchor tenant. Later, there were more than two hours of step-by-step review and preparedness checks led by WSRDs. Performance



Launch pad team (l to r) Alejandro Rodriguez, Ryan Garcia, Tanner Graham, and James Ritter



Student team lead Aaron Mislá, prelaunch

objectives were delineated and safety objectives were repeatedly stressed. Clearance was required from the New Mexico Spaceport Authority, the U.S. Army's White Sands Missile Range, and the Federal Aviation Administration.

Launch day started well before dawn; the outside temperature was approximately 29 degrees Fahrenheit. Spaceport roads were locked down at 3:30 am while the students began assembling and loading the rocket on the vertical launch pad.

WSRDs sent up a weather balloon to examine wind speed and direction, pressure, temperature, and humidity at different levels in the atmosphere. Ground winds exceeding 14 miles an hour would shut down the launch, but that morning the wind was minimal and conditions were ideal for liftoff.

"Everything needs to come together 100 percent; that's why we call it rocket science," Lohn said. Indeed, the students' originally-scheduled launch on April 14 was scrubbed, first due to a small defect with the rocket's original igniter and later as a result of increasing winds. Despite the frustration of having to disassemble and build everything up again, there were important lessons gained.

"This really does give us all the idea of how we are going to see and be doing things in the real world," said motor and rail task group leader Ryan Garcia, 23, a senior from Los Lunas. "It's so crucial that we learn this now."

The hands-on experience coupled with the success of this latest launch places Tech's design team members that much closer to realizing their dream jobs. NASA, Space X, and Sandia National Labs are a few of the places named by the current sounding rocket team members,

who aspire to careers in areas including robotics engineering, nuclear engineering, mechatronics for space rovers, and missile defense systems.

"This is the roughest semester yet and I'd gladly do it again to see the rocket go up once more," said junior Connor Deuschle, 26, from Highlands Ranch, CO, who worked on avionics for the April launch.

"This has been one of the most stressful projects I have ever worked on, but easily the most rewarding," added Alejandro Rodriguez, 21, a senior from Truth or Consequences whose mission focus was motor separation and recovery.

Junior members of this year's NMT student rocket team also include Megan Armstrong, 20, Los Alamos; Joshua Berson, 20, Edgewood; Benjamin Bohling, 21, San Acacia; Damian Gallegos-Patterson, 29, Albuquerque; Luis Molinar, 21, Bernalillo; James Nolan, 21, Bosque Farms (*who also served as this mission's junior team lead*); James Ritter, 21, Colorado Springs, CO; and Andrew James Wanchek, 21, Bakersfield, CA. Senior team members include Tanner Graham, 23, Alamogordo; Dylan Johnston, 21,

Albuquerque; and Javier Koerdell, 24, Santa Fe.

The rocket team was also supported by three ambitious volunteers. Benjamin Katko, 31, is a MEchie senior from Los Alamos who is accepted into a PhD program at UC San Diego and presently working with Los Alamos National Laboratory on an augmented reality project to make nuclear criticality safety more effective and efficient. His enthusiasm involved him on multiple design clinic projects this year. Volunteer John Sanchez, 23, is a NMT research assistant from Belen who recently graduated from NMT's mechanical engineering program; his peers revere him as "an authority" on avionics. Soon he will begin his graduate studies at Tech. Calla Lang, 20, is a MEchie sophomore from Clayton, CA, who described her volunteer work on the team as "an

invaluable way to be exposed to design early."

The entire team was led by Misla, a 23-year-old Rio Rancho native who plans to work as an aerospace engineer after completing graduate school. "I would like to help humanity as far as we can into space," he said. "I want to push the boundaries!"

Misla said he considers his experience with Tech's MEchie Design Clinic to be a unique privilege. "We're building New Mexico Tech a small space program," he said. "It means a lot because I want to be employed in a company that wants to go into space; so, for me it's great practical experience."

Junior and senior design projects are mandatory for mechanical engineering majors at Tech. One year's work builds into the next, providing students with a wealth of practical

experience and application.

Design clinic projects are underwritten by University funding and alumni donations, as well as contributions from the organizations who partner with NMT students. Other design clinic projects this year are in research areas such as optimal plant growth, prosthetic limb design, and one team is building a protective mobile bunker prototype that could be used to secure computers and other equipment on explosive testing sites.

"MEchies are a wide reaching group as far as what we can do and what we can figure out. The common link is we dip our toes in everything," Misla said, adding that his ideal career will allow him to both draft and build his designs. "I chose to be a MEchie because I really like to work hands on."

It is the practical and extensive experience Tech's mechanical engineering students receive through their design teams which makes the NMT mechanical engineering program "unique in the nation" according to Dr. Zagrai.

"It allows students to experience engineering design early in freshmen and sophomore years and further master their engineering skills and creativity in a four-semester sequence of junior and senior design clinic courses," Zagrai explained. "Such a sequence permits students to work on long-term complex projects equally beneficial to their education and project sponsors – New Mexico private sector, institutions, and national labs."

One recent example of an NMT MEchie alum who embraced the



Mission patches and pure joy after a successful launch (l to r) Dr. Michael Hargather, Ryan Garcia, Tanner Graham, Joshua Berson, Ben Katko, Luis Molinar, James Nolan, Aaron Misla, Damian Patterson-Gallegos, Ben Bohling, Andrew Wanchek, Dr. Christina Lohn (WSRDs), Dylan Johnston, Dr. Paul Jaramillo (WSRDs), James Ritter, John Sanchez, Alejandro Rodriguez, Calla Lang, Connor Deuschle, Lisa Shelton (WSRDs Pad Manager), William Shelton (WSRDs Launch Director), and James Perry (WSRDs photographer)

design clinic experience is Jaramillo and Lohn's son, Joachim Lohn-Jaramillo, who served as Tech's prior Sounding Rocket Team lead. He earned his B.S. in Mechanical Engineering, with a Minor in Explosives Engineering, in only three years while maintaining a GPA of 4.0. The 22-year-old alum is now working on computer vision as part of his doctoral fellowship at Dartmouth College.



Tail recovery by Ben Bohling, Joshua Berson, Andrew Wancheck, Aaron Misla, and Damian Patterson-Gallegos

WSRDs plans to continue collaborating with Tech students to develop even more sophisticated systems and flight instruments for the Mustang rocket. "It's our goal to use a similar version of the Mustang 6B commercially in the future," Lohn said.

Ideally for WSRDs, the professional operational experience and technical guidance the company has shared with Tech students over the years will yield a significant commercial

client seeking to test space-bound payloads. "You want to test things for the International Space Station in smaller rockets first before you put them on larger rockets," Lohn explained.

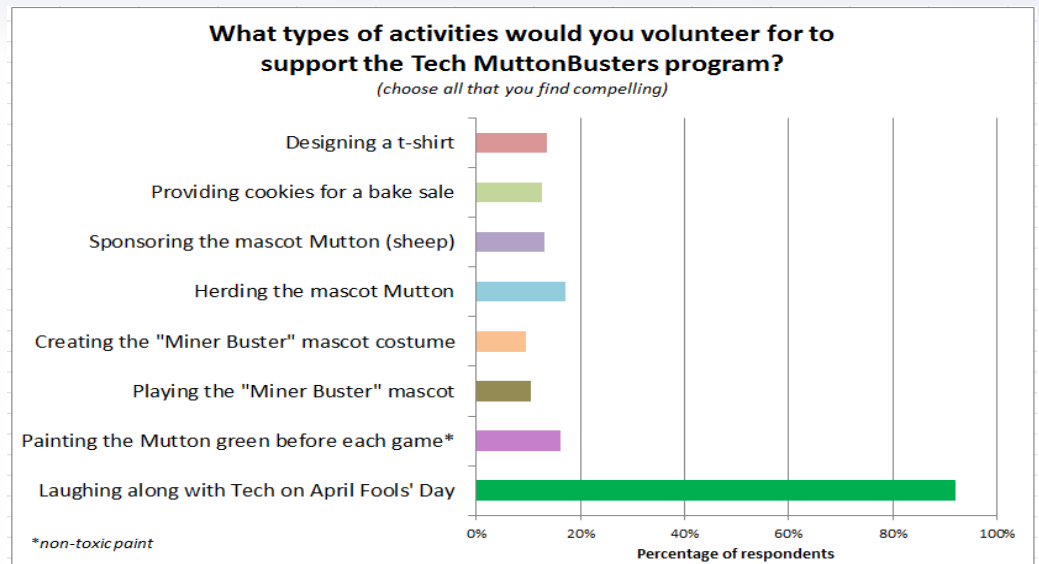
"We have made a humongous investment. Once we land a customer, we hope to recoup some of the R&D expense" she said, adding that at that point, WSRDs would like to increase launches with NMT student rocket teams to at least two per year. That would be a win for everyone, including Spaceport America, whose CEO, Dan Hicks, was among many to congratulate Tech on the April rocket launch. "The partnership with Spaceport America has resulted in four launches with each being more ambitious than the previous," Hicks said. "These students will be fine additions to America's aerospace workforce."

2018 april fools' day!

The Office for Advancement and Alumni Relations created a 2018 April Fools' Day story about football returning to NMT, with a new team name and mascot: NMT MuttonBusters. The spoof was emailed to all alumni and current students and posted on the NMT Alumni Interactions Facebook page; their responses were heavily favorable.



We thank Edie Steinhoff for creating the MuttonBuster mascot concept graphic



faculty spotlight

william x. chavez, ph.d.

by Lisa Majkowski

Dr. William X. (*Bill*) Chavez has had a long and successful career as an Economic Geologist and professor in the Mineral Engineering Department at New Mexico Tech. I recently had the opportunity to talk with him about his time at New Mexico Tech, his passion for geology, and some of his adventures.

Bill Chavez is an alumnus of New Mexico Tech, coming to Socorro in August 1973 from the Mohave Desert area of Southern California. He had seen an ad for the New Mexico School of Mines posted at his high school, and when he was a junior, he and his parents visited. Bill said that it was love at first sight. “We drove into Socorro from



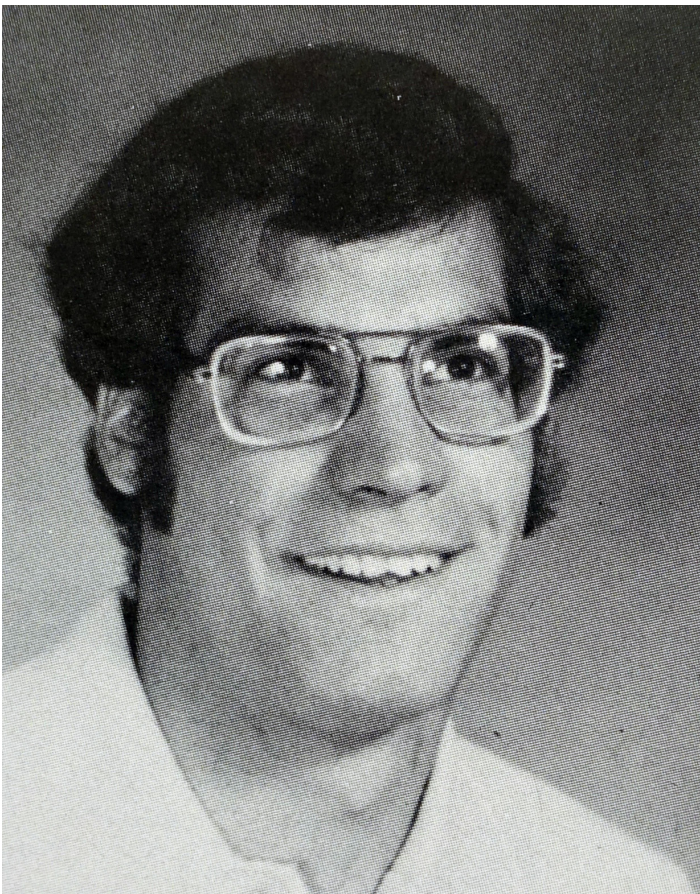
William X. Chavez, New Mexico Tech Professor

the west. I saw the rocks and loved it.”

Bill double majored in Geologic and Mine Engineering (receiving BS degrees for both in 1977), and went on to work in Northern California for Fluor Utah for 16 months. He then enrolled at UC Berkeley and received his MA and PhD in Geologic Engineering. He enjoyed his time at

Berkeley - “one of the first things that I learned at Berkeley was look both ways on a one-way street” - and was getting ready to teach summer geology field camp when Clay T. Smith called him about job opening at NMT in the Geological and Environmental Engineering Department.

He started as a Tech professor in January 1985,



William X. Chavez, New Mexico Tech student – 1976 Porphyry

hired by then President Dr. Lawrence Lattman. In a strange coincidence, while working in Chile back in 1982, Bill shared a taxi going to Antofagasta with “a New Yorker working on a hydrology project” who turned out to be Dr. Lattman (*before he became Tech President in 1983*).

Why New Mexico Tech?
“I can see the hills in the east [*from my office*] - this is why I’m here, and to continue Clay T. Smith’s work as an Economic Geologist.”

Some of Bill’s memorable experiences at Tech were seeing the changes on campus (*after being at UC Berkeley*) and getting to work alongside some of his former professors - Clay T. Smith, Kent Condie, and Fred Kuellmer - being on the same campus and doing the things that they inspired him to do.

I asked Bill if he had any interesting tales from his work all over the globe.

“The geologic location can be dangerous. The political situation in a country can be dangerous. I’ve worked under the protection of armed guards and security in Ecuador. In Columbia and Ecuador, there were areas where the companies contract with the military, who would form an umbrella of protection around the geologists. In



Dr. William Chavez at Ministro Hales, a copper mine in northern Chile

Eastern Turkey, I wanted to go up a hill but couldn’t because of old landmines.

“The geologic environments are difficult. It was once so cold in Chile that we had to shut down the drill rigs. We had extreme floods in Columbia on one trip. We had to cross a raging river by jumping from boulder to boulder. The river was full of mud and debris. If you fell in, you’d be battered to death. This is what I do and it’s fantastic.”

None of these dangers deter him. “You’ve got to

go where the rocks are. Aside from the rocks, traveling all over the world lets you meet people.”

While Bill was on assignment in Iran, he said that he felt safer than in some US cities. He was very well taken care of and the Iranian geologists were very attentive. One of his best memories is of a honey and date kiosk outside of the compound. “I love honey and dates and the vendor came to expect me, having a plate of honey and dates ready for me each day. Then the vendor asked me if I would

take a picture with him and his son. The British geologists at the site later sent me a photo of the vendor with that picture displayed at the kiosk. This was one of the proudest moments of my life.”

In Eastern Turkey, there was an elderly Kurdish woman who would come by and watch Bill teach the Turkish and Australian geologists. The group would include her for lunch every day. She, too, wanted her picture taken with Bill. An Angolan professor gave Bill some beautiful wood carvings, which he still displays at his house, and he once received a wonderful bottle of Pisco (*South American brandy*) as pay.

Bill says, “These are people; during the explorations, you get to see and meet the people.”

What does the future hold? “I plan to keep the strength going in Economic Geology, and contributing to Tech’s reputation as an internationally-respected institute.” Bill says that he “will die with his (*hiking*) boots on” and has no plans for retiring. Clay T. Smith attended Bill’s wedding and then passed away a few days later. That’s what Bill sees for himself - “always working and being with friends and colleagues.”

chemical engineering

<http://nmt.edu/academics/chemeng/index.php>

plasmon enhanced photocatalysis for sustainable energy

Dr. Sanchari Chowdhury is on a team studying plasmonic nanostructures, which can concentrate incident light as much as 1000 times in the near-field due to localized surface plasmon resonance. The strong electromagnetic field at the surface of plasmonic nanoparticles such as gold and silver can be used to manipulate the energy and electron absorption of vicinal photocatalyst or adsorbed reactant molecules.

The design of novel catalysts using plasmonic nanostructures, (Fig. 1) which can efficiently exploit photon-induced charge and heat to drive energetically demanding chemical reactions at the relatively milder condition, is of both economic and environmental interests.

Their research objective is to understand the detailed mechanism of interfacial energy and electron transfer among plasmonic nanomaterials and photocatalysts. They plan to use information from their fundamental study to design suitable photocatalytic systems for important reactions such as CO₂ reduction.

optically active 2D materials

Dr. Pabitra Choudhury and a research team (including Dr. Sanchari Chowdhury) have studied 2D layered nanomaterials such as molybdenum disulphide nanomaterials, which are optically active with potential applications in photocatalysis and photo-thermal therapy. Their goal is to understand the effects of the nanomaterials morphology, such as defect and layer thickness, on their bandgap and how those affect their photon-induced properties.

Computational design of hetero-structure layered materials for electronics and energy applications

A team of researchers, including Dr. Pabitra Choudhury, have determined that a reactive seed layer can be created on a 2D surface, without perturbing the electronic properties of the 2D substrate, for depositing a thin layer of dielectrics uniformly on the functionalized 2D surface for designing low power

electronic devices (such as super-capacitor or field effect transistor).

On the other hand, 2D porous catalytic materials are suitable for various catalytic applications such as conversion of natural gas (mainly methane) into liquid feedstock (mainly methanol) under mild conditions and non-expensive Pt-free electrocatalysts for both oxygen evolution and oxygen reduction reactions (OER and ORR) with low overpotential.

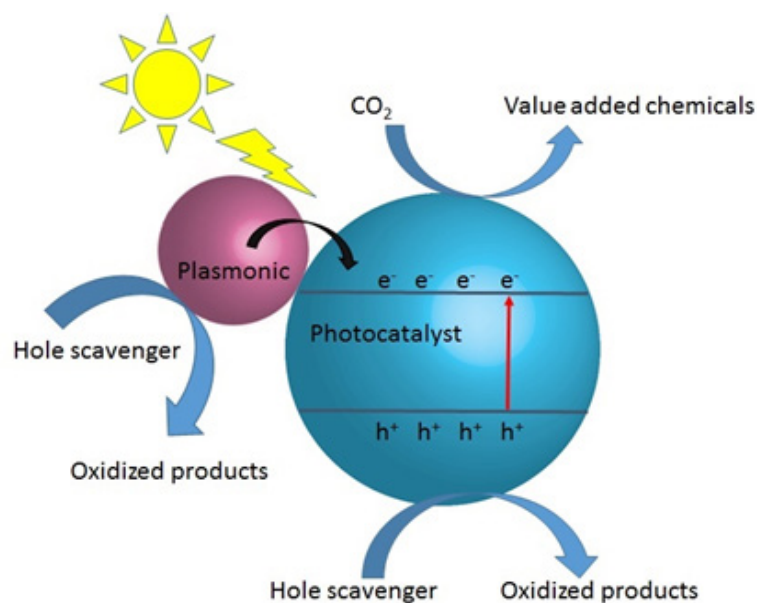


Fig. 1 Schematic representation of formate production on gold-TiO₂ composite under solar light

computer science & engineering

<http://nmt.edu/academics/compsci/index.php>

smartphone-based system for college class attendance tracking

A research team of three undergraduates (Nico Ponder, Hugo Rivera, and Eugene Garcia) were mentored by professors Jun Zheng and Rita Kuo (Fig. 2) on a project to investigate the use of smartphones for college class attendance tracking. The project was supported by the Collaborative Research Experiences for Undergraduates (CREU)



Fig. 2 CREU Team (l to r): Dr. Rita Kuo, Hugo Rivera, Eugene Garcia, Nico Ponder, and Dr. Jun Zheng

programs sponsored by Computing Research Association Committee on the Status of Women in Computing Research (CRA-W) in conjunction with the Coalition to Diversify Computing (CDC).

Class attendance is shown to be strongly correlated with the GPA of college students, and a better indicator than SAT scores, HS GPA, studying skills, or the amount of time spent studying. Traditionally class attendance is taken manually by the instructor, which may be impossible with a large class, or waste too much class time.

With guidance from Dr. Zheng and Dr. Kuo, the three undergraduates designed a smartphone-based system that can efficiently, accurately, and cost-effectively track college class attendance. The results of this research project have been

published in one journal paper, one conference paper, and in a poster presented at the annual NMT Student Research Symposium.

earth & environmental science

<http://nmt.edu/academics/ees/>

impact of natural cements on groundwater flow

Geologic faults usually make the news only when they have produced damaging earthquakes. However, faults also quietly impact society by controlling the flow of groundwater and petroleum in aquifers and oil fields. A fault acting as a barrier for fluids can make the difference between a productive well or a terrible one.

Professors Peter Mozley, John Wilson, and Glenn Spinelli are examining the role that natural cements play in controlling the ease with which fluids pass through faults. The cements, composed of minerals precipitated from groundwater over thousands of years, fill open spaces in the rock,

clogging them and inhibiting fluid flow. The Tech professors and their students are mapping the 3D distribution of cements in a fault zone north of Socorro. (Fig. 3) Then they will directly measure the impact of the cements on groundwater flow by drawing water from wells adjacent to the fault.

socorro magma body

The Socorro magma body (SMB), Earth's second largest (discovered in the 1970s by E&ES Professor Al Sanford and students), lies 19 km below Socorro. It causes earthquakes and active surface uplift (up to ~2.5 mm/yr). Professors Gary Axen, Jolante van Wijk, Fred Phillips, and Bruce Harrison, with graduate students Brad Sion and Shuoyu Yao and Bureau of Geology geologist Dave Love, study its history and dynamics (NSF funded). Sion maps deformed river terraces (dated with cosmogenic ^{36}Cl and ^{14}C), documenting prehistoric



Fig. 3 Coring across the Loma Blanca fault: collection of fault zone and host sediment samples

SMB-related surface uplift between ~3,300 and ~35,000 years ago. Yao's numerical models show that active inflation causes uplift and stresses above the SMB that likely trigger earthquake swarms.

Related E&ES SMB research by professors Sue Bilek, Mark Murray, and Mark Person, NMT students, and UNM collaborators includes seismic, magnetotelluric, and GPS studies. Public outreach will involve E&ES undergrad Maia Johnson (*educational displays*) and MST students (*K-12 curriculum development*).

management

<http://nmt.edu/academics/management/index.php>

determinants of trademarking: evidence from arizona and new mexico startups

Professor Haoying Wang and Petroleum Engineering undergraduate student Shuming Dou have completed a project that looks at the innovation behavior of startup firms in the Southwest. 632 startups from Arizona and New Mexico are included in the study.

The study reveals several important patterns on the trademark

activities of startups. First, the propensities of innovation as indicated by trademark activities vary geographically and are likely driven by spatial heterogeneities in the corporate environment for small and medium-sized enterprises (*SMEs*). Second, startups tend to use trademarks as both an intellectual property safeguard and an innovation strategy conditional on factors such as company age and size. Third, technology-related startups find trademarks less attractive in comparison to other startups, which explains their preference of patents over trademarks.

This research project has demonstrated the feasibility of scraping public information from the internet with data analytics to provide insights into important entrepreneurship and innovation policy issues. The study is currently under review at Industry and Innovation.

"studio g" opens at new mexico tech

NMT's budding student entrepreneurs now have a new avenue for taking their inventions to the marketplace. NMT signed an agreement with NMSU's Arrowhead Center in December 2017 to open

"Studio G," a student maker space to support inventions and innovations. Dr. Youngbok Ryu is the Management Department champion for Studio G; he hosted an event in mid-January to familiarize students with Studio G's offerings. NMT initiated a student entrepreneurship club to help develop student interest, and a program application webpage has been set up.

Available resources include legal consulting, accounting assistance, intellectual property advice from a patent law attorney, and faculty mentorship.

2018 inventors and entrepreneurs workshop

The 3rd Annual Inventors and Entrepreneurs Workshop in April 2018, hosted by the NMT Innovation Center's Executive Director Dr. Peter Anselmo, had

nearly 200 registrants. The Workshop, with extensive sponsorship from The Kauffman Foundation and New Mexico Gas Company/Emera, hosted a number of round-table discussions and presentations aimed specifically at cultivating and developing entrepreneurship among minority groups and students from rural areas. It featured expert panels, keynote speakers, group challenges and networking opportunities.

The Workshop culminated in The Wolves' Den, modeled after ABC's Shark Tank television series; students pitched their intellectual property and ideas to a panel of potential investors from New Mexico, New York, and California.

Luna Community College's Jessica Weber won the top prize for her invention (*Fig. 4*), a



Fig. 4 2018 Wolves' Den 1st place winner Jessica Weber (*center*), who is transferring from Luna Community College to Tech in August

passenger vehicle wheel well de-icer. Richard Trujillo, also of Luna, took home second place for his presentation of a new style of travel toothbrush. Third place was won by NMT student Sooraj Bhatia (*Physics*) for his proposed elder care alert system intended to prevent falls and minimize injuries.

mechanical engineering

<http://nmt.edu/academics/mecheng/index.php>

autonomous structural composites for next-generation unmanned aircraft systems

Dr. Donghyeon Ryu has landed a NASA EPSCoR

grant of \$750,000 to complete a three-year project (*which began Fall 2017*) to develop novel structural composites for NASA's next generation of unmanned aerospace vehicles. The research team also includes Dr. Nikolai Kalugin (*Materials Engineering*) and Dr. Andrei Zagrai and Dr. Bin Lim (both Mechanical Engineering).

The end goal is to have multifunctional composites that can detect damage without external electrical power. In addition, the composites will harvest energy from ambient vibrations through coupled mechanical-radiant-electrical-energy conversion mechanisms. A mechanoluminescent layer

that emits light in response to mechanical stimuli will convert mechanical energy to radiant energy. A photovoltaic layer will convert radiant energy to electrical energy while exhibiting self-sensing capability.

The first year will be devoted to designing the composite. The second year will see the team, including students, fabricating a wing and testing. The third and final year will involve validation testing at White Sands Missile Range, including ballistic testing to evaluate how the material will withstand impacts with space junk and other natural objects.

analyzing boundary layer equations

Dr. Tie Wei, with Dr. Yvan Maciel (*Université Laval, Québec*) and Dr. Joseph Klewicki (*University of New Hampshire*), recently published a paper analyzing boundary layer equations in the peer-reviewed journal *Physical Review Fluids*. Their article "Integral Analysis of Boundary Layer Flows with Pressure Gradient" finds estimates for the skin friction and mean wall-normal velocity in terms of the Rotta-Clauser parameter (*Fig. 5*).

The authors then compare these estimates with experimental and numerical data even under non-equilibrium conditions.

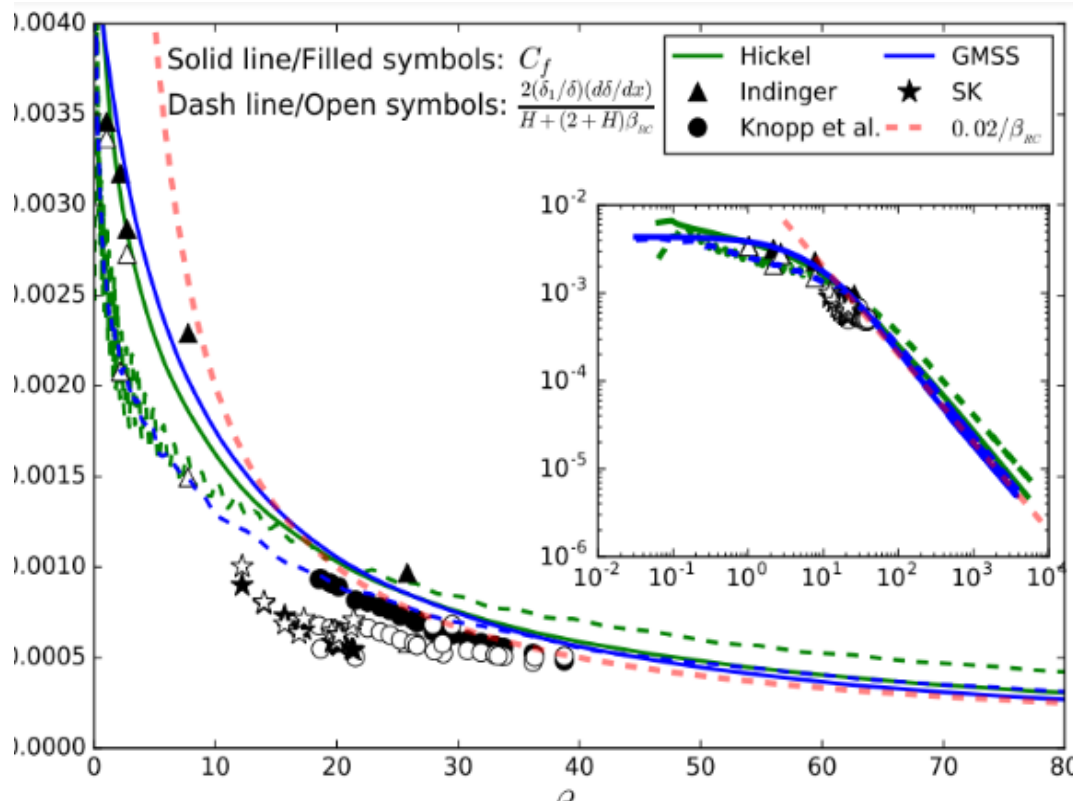


Fig. 5 Integral analysis of boundary layer flows with pressure gradient

psychology

<http://nmt.edu/academics/psych-ed/index.php>

effects of pineal melatonin on breast cancer

Studies in Europe and the US have shown that blind women have dramatically reduced rates of breast cancer; one has shown that exposure to light-at-night correlates with increased rates of breast cancer. How light-at-night

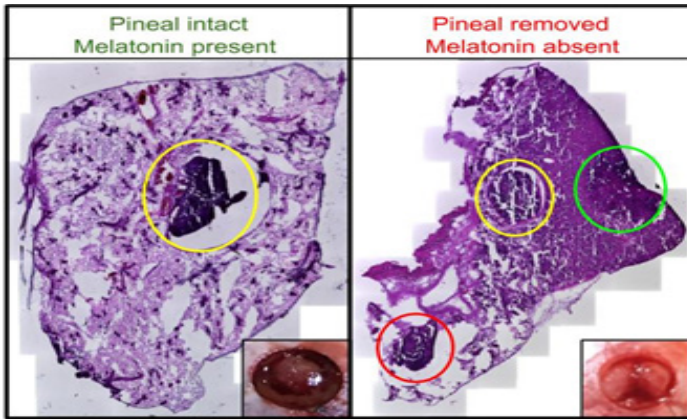


Fig. 6 Example sections of mammary tissue for mice with pineal intact or removed (inset photos show pineal surgery). In both mice there was tumor morphology consistent with a ductal carcinoma (yellow outline).

surgery without pineal removal. Breast cancer was induced and number and types of tumors that formed were compared (Fig. 6).

Assessment of breast tissue by histology showed only limited differences in tumor number and size. However, there was a dramatic difference in the types of tumors between the two groups. Mice with melatonin primarily developed ductal carcinomas, which have more than a 95% 5-year survival rate. In contrast, all of the mice lacking melatonin developed a wide variety of tumor types, including multiple metaplastic tumors,

which have about 20% 5-year survival rate. Gene expression profiling of tumor type markers supported these findings, showing that mice without melatonin developed more aggressive and diverse tumors types.

This is the first study to show that deficits in pineal melatonin alter the profile of breast cancer to more aggressive types associated with much worse prognosis. Risk reduction strategies for people with identified breast cancer risk might include increasing daytime exposure to sunlight and avoiding using lights after dusk.

increases breast cancer rates is not known, but a light-induced reduction in the pineal hormone, melatonin, is a likely candidate.

Dr. Stewart Thompson and student Carley Barron

(MS Biology), worked with a research team of NMT students and faculty to study effects of pineal melatonin on breast cancer. The pineal gland was surgically removed from mice and compared to controls that had

st. patrick's day reboot



In an effort to revitalize St. Patrick's activities on the Tech campus, students from the Cooney Miner's Club, Student Government Association, Alcohol Safety Awareness Program, and other student clubs hosted

several activities March 23-24, 2018.

Events on Friday included Pit Digging, a Night Chipping Contest (*hole 8 of the golf course*), an Alcohol Goggle Driving Course, Fire Pits (*for warmth and roasting hot dogs*), and music.

On Saturday pole crossing and Blarney Stone kissing were open to all students and attendees.



President Wells, enthusiastic volunteer and pit digger

research: department spotlight

materials engineering

Materials engineers try to understand the physics and basic science principles of materials so that other engineering disciplines can apply that knowledge when designing or building components, devices, and systems. Physicists, chemists, mathematicians, and mechanical and chemical engineers all do materials engineering.

Materials engineering is an equipment-heavy discipline, using specialized tools such as scanning electron microscopes (*SEMs*), transmission electron microscopy (*TEM*), and Auger spectroscopy to look at atomic layer-levels of materials to determine the science and mechanisms that explain what has been observed.



Materials Engineering students and staff (back row) and faculty (front row)

Faculty in the New Mexico Tech Materials and Metallurgical Engineering Department (MATE) specialize in a number of focus areas, and are pursuing a wide variety of research projects. More information can be found online at: nmt.edu/academics/mateeng/faculty/index.php.

john mccoy, ph.d.
chair

Dr. John McCoy, Chair of Materials Engineering, has a chemistry background. His current focus areas are polymers and “soft”

materials, modeling, and experimental work.

curing kinetics of epoxies
with tertiary amine
hardeners

Dr. McCoy and fellow researchers are conducting calorimetry

studies associated with the curing of Bisphenol A diglycidyl ether (DGEBA) epoxy with hardener diethanolamine (DEA). Curing involves a complex series of reactions (including zwitterion formation, anionic chain growth, and termination).

The tertiary amine formed after initial reaction of the secondary amine to form an adduct acts to open the epoxide ring to form the zwitterion which then propagates in chain growth. The hydroxyls accelerate the reaction. Currently they are acting to separate contributions

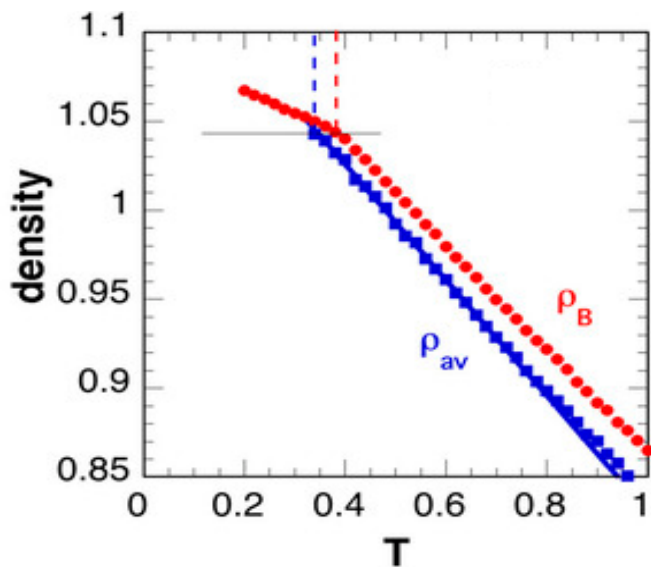


Fig. 1 Average density of free film $nN/A = 14.2$ with $n = 80$ (blue squares) and bulk density vs temperature (red circles). Dashed lines indicate T_g 's of free film and bulk systems; horizontal solid line is drawn at the density of the bulk system at T_g^B

by studying DGEBA reaction with dibutylamine and octanol.

physical aging of epoxies

Thermal and mechanical properties of glasses vary with time as they “age” at temperatures below their glass transition. Two epoxies have been studied: DGEBA cured with diethanolamine (DEA) and DGEBA cured with a polyamine Jeffamine T-403.

Use is made of simple theories of aging (e.g., KAHR and Eyring Models) to understand the aging process. Particularly interesting is the effect of compressive stress on the effects of aging; both small, sub-yield stresses and large, post-yield stresses are studied.

computer simulation of glassy behavior of thin films

A problem of long standing interest is how the thickness of a film affects the glass properties (e.g., glass transition temperature (T_g) and relaxation behavior).

John Curro (*PhD Materials Engineering*) and Dr. McCoy proposed a Density Functional Theory based theory of how T_g varies with film thickness (Fig. 1). In collaboration with former student Craig Stevenson (*MS Mathematics, 1995*), they are exploring this connection with Molecular Dynamics Simulations. Current work is focusing on relaxation times.

t. david burleigh,
ph.d., pe
co-chair

Dr. David Burleigh, Co-chair of Materials Engineering, specializes in corrosion of materials, electrochemistry, and oxidation.

rapid anodizing of steel for corrosion resistance

Dr. Burleigh’s research lab has developed the process for anodizing steel in hot caustic solutions. The anodic oxide is a thin layer of magnetite (Fe_3O_4) and protects the steel

steel and takes five minutes to grow the oxide film. Current research efforts are shortening the time to 10-30 seconds and also developing the process to work on different types of steel.

bioabsorbable magnesium alloys for medical implants

Dr. Burleigh’s research lab has been developing magnesium alloys and coatings for medical implants. The objective is to control the dissolution rate of orthopedic screws and staples so that there is no need for a second surgery to retrieve the painful implant.

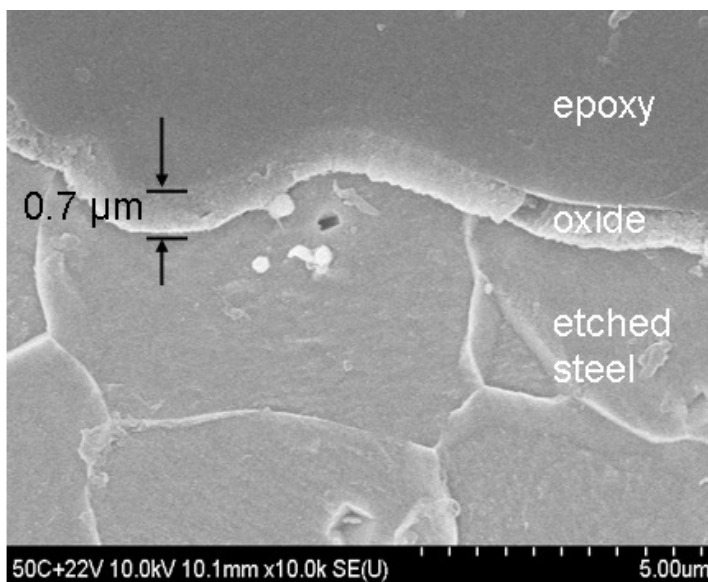


Fig. 2 FESEM cross-section of oxide film on steel grown at 50°C, +2.2V

from rusting in water and humid atmospheres (Fig. 2). Additional protection can be achieved by filling the pores with oils such as WD40. The current process works on 1010

paul fuierer, ph.d.

Dr. Paul Fuierer’s background is primarily physics. His research areas

are ceramics (especially electronics ceramics, such as capacitors, resistors, and piezoelectrics) and additive manufacturing of ceramics.

aerosol deposition for producing dense, nanocrystalline ceramic and composite films

Aerosol deposition (AD) is a revolutionary way of producing thick ceramic films using a kinetic particle spray. The deposition takes place at room temperature, occurs at a very rapid rate compared to other techniques, and can be done on virtually any substrate material. The resultant ceramic

coating is nanocrystalline and is fully dense. Tremendous potential exists for sensing, catalytic, energy and tribology related applications.

Dr. Fuierer's group is leading this technology in the U.S, while his German colleagues at University of Bayreuth are leaders in Europe. Together the two teams have designed new gas sensors and sensing materials.

Fuierer's group is now focused on depositing functional ceramics of various types (e.g., aluminum oxide, titanium dioxide, lithium cobalt oxide, molybdenum disulfide, and silicon)

and exploring additional application areas for these unique films (Fig. 3). Also of interest is the multi-scale surface roughness and intrinsic stress state of the coatings.

oxide ion conducting bismuth vanadate ceramics for fuel cells and electrochemical devices

Bismuth vanadate ceramics, stabilized by partial substitution of V5+ with transition metal ions, exhibit high ionic conductivity at temperatures below 500°C.

Dr. Fuierer's research group has developed processing schemes using sinter forging and

templated grain growth (tgg) to produce high density and partially textured polycrystalline $\text{Bi}_2(\text{V}_{0.9}\text{Cu}_{0.1})\text{O}_{5.5-8}$ ceramics. Bulk ceramics show high oxide ion conductivity ($10^{-1} \Omega\text{cm}^{-1}$) at 500°C. Long term stability of the conductivity at this temperature over a range of pO_2 was demonstrated for ceramics with small grain size and titanium co-doping. Measured thermal expansion (16-20 ppm/°C), showing small anisotropy in textured samples, may be compatible with stainless steel in new low temperature, metal-supported solid oxide fuel cell designs..

unique particle textures for photovoltaics

Dye sensitized solar cells (DSSCs) are third generation photovoltaics with great economic potential. Multiscale and textured structures are required to maximize efficiencies, and new, inexpensive dyes are required to be cost effective.

Work by Dr. Fuierer and his group on this multi-pronged project involves developing manufacturing strategies to obtain out of plane texture in large area coatings. Experiments investigate the tendency

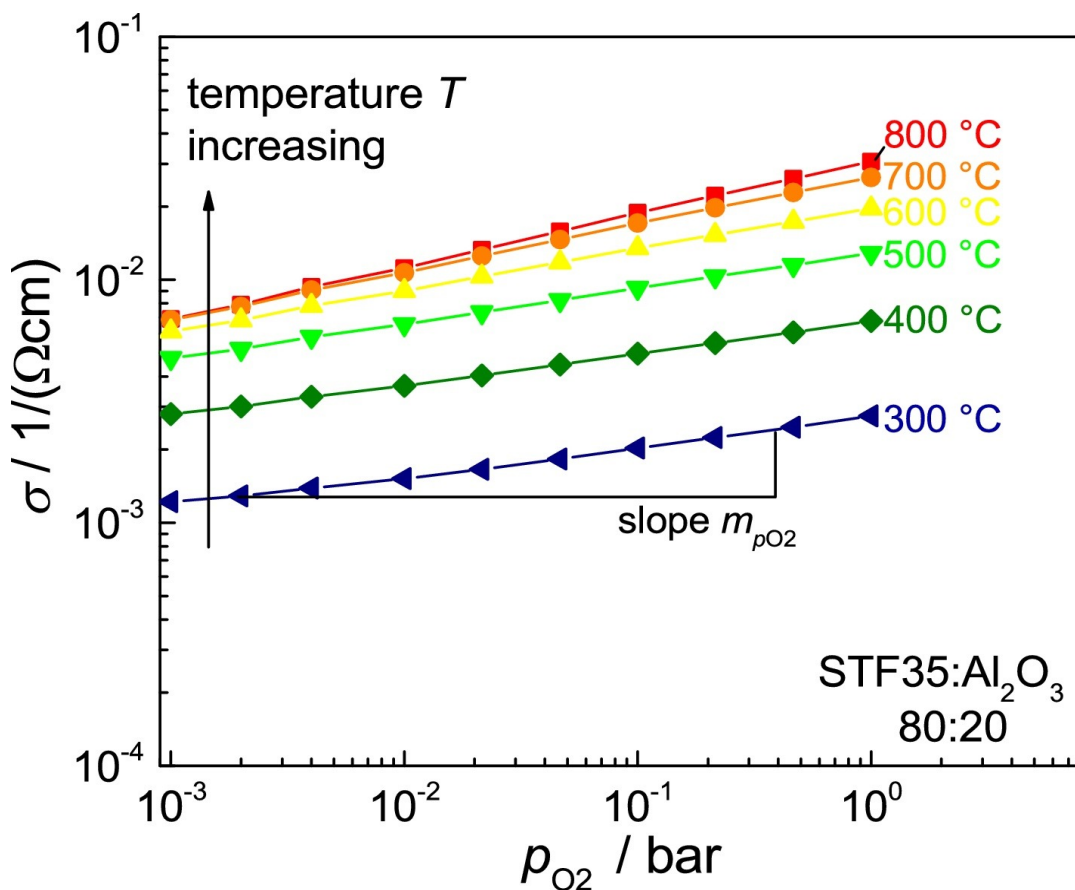


Fig. 3 Conductivity as a function of the oxygen partial pressure for a composite film with the composition STF35:Al₂O₃ = 80:20 between 800 and 300 °C obtained during stepwise cooling

of fine metallic wires to orient vertically in the interstices of a monolayer of close-packed spheres. Design of experiments and analysis of variance (*ANOVA*) are used to identify main effects and conditions to achieve optimal orientation.

The other aspect is an investigation of natural rather than synthetic dyes to be incorporated into solar cells, and tests their performance.

**chelsey hargather,
ph.d.**

Dr. Chelsey Hargather specializes in modeling metallurgy, and leads the Advanced Computational Metallurgy Lab (*ACML*). Their research involves developing and improving new metallic alloys using a variety of computational tools. They currently focus on first-principles quantum mechanical calculations and are exploring thermodynamic modeling using the CALculation of PHase Diagrams (*CALPHAD*) technique.

**first-principles calculations
of diffusion coefficients
in metals and metal alloy
systems**

The diffusion coefficients of an alloy system are

critical to understanding phase formation, mechanical properties, and failure mechanisms such as creep. Dr. Hargather's research group calculates vacancy mediated self-dilute impurity and non-dilute impurity diffusion coefficients and associated thermodynamic properties as a function of temperature for a variety of metal alloy systems.

They are currently exploring the importance of vibrational entropy on the diffusion coefficient calculations, as well as calculating non-dilute impurity diffusion coefficients in the Ag-Au system.

**efficient computational
methodology for calculating
elastic properties of high
entropy alloys**

High entropy alloys are a new class of engineering materials composed of equal or nearly equal quantities of five or more metals in a single solid solutions phase. With more research, they have the potential to replace conventional alloy systems in a variety of applications because of their improved strength-to-weight ratios, and high corrosion and oxidation resistance.

Dr. Hargather's group is currently focusing on developing more

efficient computational methodologies using density functional theory to investigate slip and deformation behavior of various fcc and bcc high entropy alloy systems.

nikolai kalugin, ph.d.

Dr. Nikolai Kalugin's background is in physics. His research areas include optical and electron transport properties of semiconductor nanostructures, graphite, graphene, carbon nanotubes, and more. He has published one paper with a Nobel Prize winner.

Oxide (*rGO*) surfaces (*Fig. 4*). A high degree of surface coverage of Er_2O_3 - Er_2SO_2 nanoparticles was achieved. This result is likely due to sulfur impurities in the GO starting material which act as nucleation sites for the formation of Er_2O_3 - Er_2SO_2 particles during thermal reduction.

Despite the small size, due to high concentrations of Er^{3+} , the nanocrystals demonstrate strong PL and upconversion response. As a result, this work provides a promising solution towards making Er^{3+} -based imaging

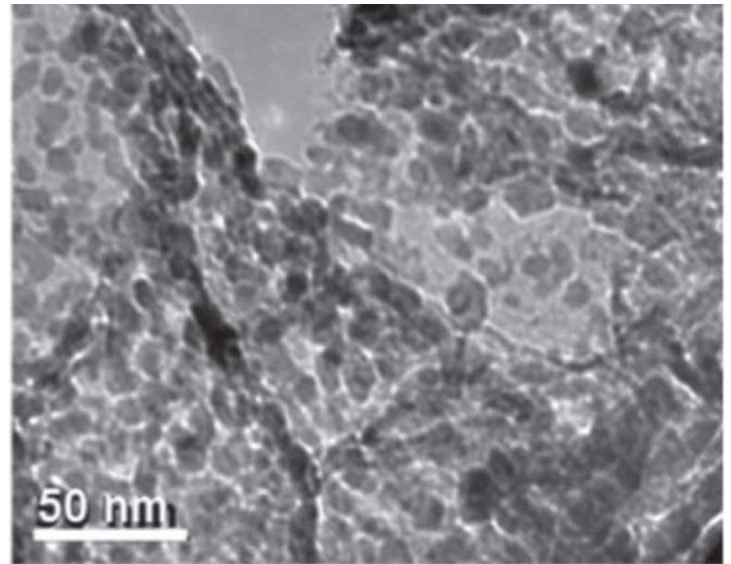


Fig. 4 Adopted from Nanotech 28 (2017), 195603

**rare-earth-containing
nanoparticles for bioimaging**

Dr. Nikolai Kalugin and his research team have developed a method to synthesize small (~ 3 - 18 nm) Er_2O_3 - Er_2SO_2 nanocrystals dispersed on reduced Graphene

probes and upconversion sensors for biomedical applications.

**interface junction electron
states in 2d materials**

Dr. Nikolai Kalugin and his research team have

revealed a previously unobserved type of electronic state with a relatively strong optical response tied to the interface junction between graphene sheets with different numbers of monolayers on each side of the junction.

These interface states are localized and have an enhanced dipole matrix element for interband excitation. Photo-excited electrons generate photocurrent and photovoltage at the rectifying junction between suspended and nonsuspended parts of graphene flakes. Because of the one-dimensional geometry, the interface junction states support a polarization dependent photocurrent which is aligned along the junction in inhomogeneous graphene samples (Fig. 5).

The team's results demonstrate the capability of graphene interface junctions to form 1D electronic states, whose properties can be exploited for electronic and optoelectronic

applications. They discovered these states in graphene but anticipate that similar type of states will be important and will influence physical properties for all other 2D few-monolayer semiconducting materials.

graphene-based stationary phase materials for separation of chiral drugs

A team of University of New Mexico and NMT researchers (including Dr. Nikolai Kalugin) have recently developed a method of making graphene-based inorganic-organic hybrid materials for application in fine organic synthesis and separation of enantiomers.

These synthesized hybrid materials can be created in multi-step reactions which involve preparation of graphene-based materials, with controlled morphology and chemical composition, followed by modification of graphene-based materials by organic molecules. The targeted applications for these materials are in pharmacy,

fine organic synthesis, and separation of chiral compounds.

solution of "three-phase problem" for oil industry

Dr. Nikolai Kalugin and fellow researchers have been exploring the problem of accurate measurements of flowrate and compositions of oil-gas-water mixtures in a pipeline. This problem remains one of the key challenges in the petroleum industry. Currently used methods are expensive, slow,

laser spectroscopy. They describe the technique and device, which provide real-time composition analysis not only for the three major components of flow (oil, water, and gas, Fig. 6), but also can monitor the changes in composition of oil, gas, and water components at the level of a chemical analytical laboratory. The demonstrated technique is not only much more informative, but less expensive, safer, less energy consuming, and much more compact than compared existing alternatives.

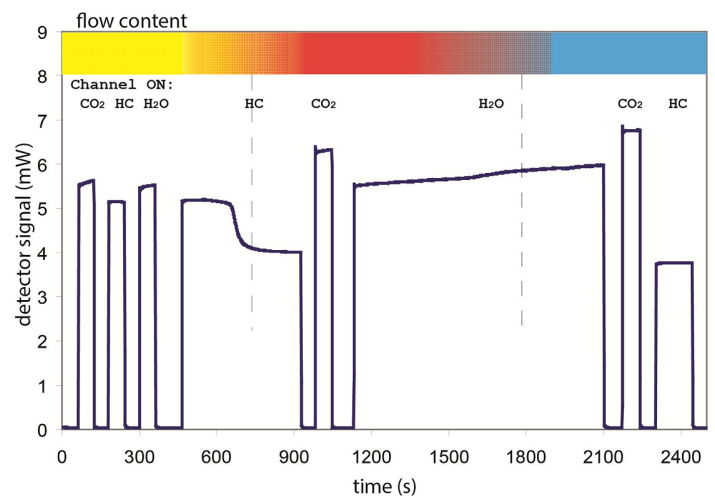


Fig. 6 Magnitude of detector response for different components of mixture, indicated as hydrocarbons (HC), water (H₂O), and CO₂, and different compositions of fluid flow

not portable, and (in some cases) require extra safety measures such as gamma radiation-based flowmeters.

In their work, they provide the solution of the three-phase flow problem based on the use of Mid- and Far-Infrared

oxidation of ultrathin GaSe

Research of 2D semiconductors is one of the most rapidly progressing areas of solid state physics. Two-dimensional Gallium(II) selenide (GaSe) provides advantages not present in bulk GaSe: the bandgap

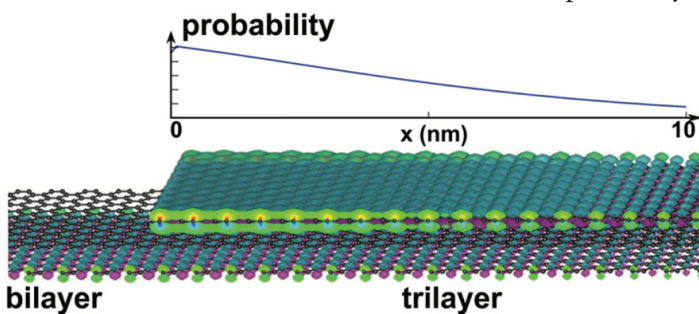


Fig. 5 Adopted from 2D Materials 4 (2017), 015002

has been predicted to enlarge up to 4 eV, and atomically thin layers provide a pathway towards novel responses emerging from 2D heterostructures. Recently, ultrathin GaSe photodetectors have been successfully fabricated demonstrating comparably large photoresponse and fast response times. A limitation of ultrathin GaSe is its sensitivity to oxidation.

Dr. Nikolai Kalugin is a member of a research team whose work demonstrates both the proclivity of ultrathin GaSe to oxidize and the Raman-based spectral signatures that can be utilized to track its occurrence. Specifically, the products of the oxidation reaction, namely those stemming from Ga₂Se₃ and a-Se, are shown to evolve in conjunction with the reduction of photoluminescence and Raman scattering intensity associated with GaSe. While oxidation occurs upon exposure to ambient air, it can be accelerated via photoinducement, thereby presenting the possibility of patterned 2D heterostructures realized by laser processing that transforms the solid itself.

bhaskar majumdar, ph.d.

Dr. Bhaskar Majumdar is an experimentalist, looking at the science of materials to understand their

mechanics and behaviors. His research interests include structure-property relations of materials and microstructure optimization through thermomechanical processing. One area of recent activity is in developing materials for solid state magneto-caloric cooling for refrigeration applications. Another focus is whisker mitigation in tin (Sn) electroplatings; his team has developed an electroplating technique using Indium (In); a provisional patent has been filed and discussions with potential investors are ongoing.

whisker mitigation in Pb-free Sn electroplating

The growth of tin (Sn) whiskers on a wide range of Sn-coated electronic components pose catastrophic short-circuit problems in many long term applications, e.g.,

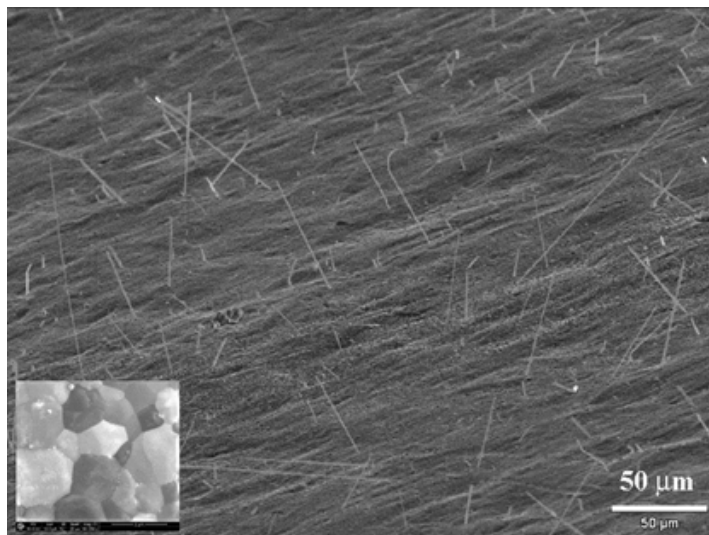


Fig. 7 Whiskers in Sn electroplatings and their mitigation through novel Sn-In alloy technology developed under an NSF grant. Mechanisms established through surface science studies

aerospace, defense, nuclear, and transportation. In the past, this was largely mitigated by adding a few percent lead (Pb) to Sn, but that is no longer possible due to the worldwide ban on Pb. Dr. Bhaskar Majumdar and his research group's work on an NSF award has demonstrated Indium (In) as an alloying element not only mitigates but actually eliminates Sn-whisker growth (Fig. 7). This has been a major breakthrough following 50 years of research aimed at eliminating Sn whiskers in solder applications.

Furthermore, they have identified a key mechanism responsible for whisker mitigation - that In leads to alteration of the structure and chemistry of the 3-4 nm surface oxide on Sn, along with enriched In in the near surface (20-70 nm depth) and grain boundary

regions. Essentially, they show that In compromises the tenacity of the oxide coating. They observed similar segregation in Pb-doped Sn, and it constitutes a major departure from conventional understanding of the role of Pb in Sn whisker mitigation.

Additional fundamental studies of mechanisms such as texture changes are in progress, and one goal is to obtain a general understanding of whisker mitigation not only in Sn films on copper, but also in aluminum films on silicon, cadmium films on alloy steels, etc. A US provisional patent application has been filed for Sn-In films.

magnetocaloric alloys based on non-stoichiometric Ni₂MnGa alloys — magnetostructural effect enhancements through thermomechanical texturing and elemental doping

Magnetocaloric materials have gained significant interest as an environmentally friendly and efficient solid state refrigeration technology. Dr. Bhaskar Majumdar's research team has been working on Heusler alloys, primarily the non-stoichiometric Ni₂MnGa systems that rely on magnetic field

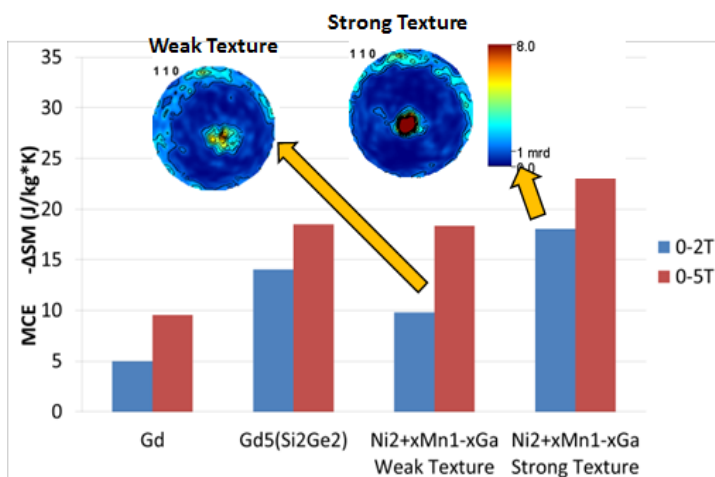


Fig. 8 Improvement in the magnetocaloric performance of Ni₂MnGa alloys through texture modification. The y-axis represents magnetic entropy change on application of 0-2 or 0-5 Tesla field.

Submitted by Helena Mozden Whyte (B.S. Chemistry, 1970)

Since 2013, the American Association of University Women (AAUW) has hosted Tech Trek NM, a week-long, immersive, residential summer STEM camp for girls entering 8th grade. This summer, for the third consecutive year, New Mexico Tech hosted the AAUW Tech Trek NM, with 65 girls from 58 middle schools participating.

The girls took classes in STEM fields and explored opportunities for academic studies and careers that they may not have previously considered. They asked professionals how they came to be scientists, mathematicians, or engineers, and how they handled difficulties along the way. This weeklong camp sparked the girls' curiosity and placed them on a path toward success.



Tech Trek NM 2017 staff (l to r): Bottom row: Helena Whyte (1970), Dana Baylis-Aguirre (PhD Physics), Phyllis Ludi (1978). Middle row: Celia Pacheco (Computer Science), Bryn Botko (2017), Adriana Gallegos (Mechanical Engineering). Top row: Bonnie Dodge (2008), Jacqueline Baros (Electrical Engineering), Chandra Sundaram (Computer Science).

induced first order structural transformation ('magnetostructural transformation') for improved magnetocaloric effect (MCE). The work was originally funded by the Army Research Laboratories.

The magnetostructural transformation temperature is sensitively dependent on composition, so that alloying chemistries have to be optimized for martensitic transformation close to RT.

Significant MCE increase (up to 80%) has been observed following stress assisted thermally cycling of samples (Fig. 8), and has demonstrated that one primary mechanism responsible for the increased MCE is the development of preferred crystallographic orientation in the martensite phase.

The rationale for this approach derived from their previous work on shape memory NiTi samples. In situ neutron diffraction work at LANL showed favorable texture when a sample was cooled from the austenite to the martensite under low applied stress.

This is an effect due to very low shear modulus at the transformation temperature. That work was funded initially through ARO and later through NSF.

In more recent work they have studied the influence of elemental doping in order to bring the magnetostructural transformation from about 60 C to room temperature while at the same time enhancing MCE.

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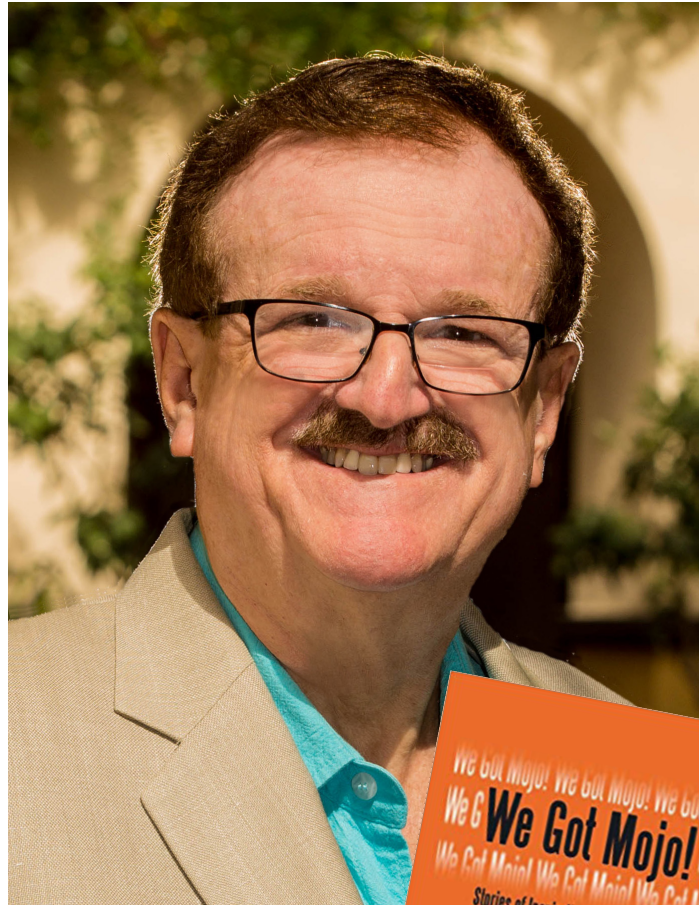
giving makes him whole

raul deju, ph.d.

by Carla Bastos

In an age where conventional wisdom emphasizes the accumulation of wealth but not necessarily giving back, how does one develop a philanthropic bent? Tech alumnus Raul Deju (*PhD Hydrology, 1969*) has some clear and definite thoughts on the matter, many of which are in his seventh book, ***We Got Mojo***, written with 35 of his BFF (*Best Friends Forever*) and published in 2016.

The unthinkable circumstances that brought Deju to New Mexico Tech (*NMT*) played a significant role in shaping the man and the generous donor that he is today. As the only child of a comfortable Cuban family and an exceptional elementary student at his Catholic school in Havana, he was to some extent insulated from the looming upheaval under the Castro regime that took over the island in the late 1950's. But soon the food shortages and closing of churches and all forms of entertainment became all too real; private school students



Dr. Raul Deju

were harassed; citizens deemed anti-revolutionary were tried and sometimes executed by firing squad in a matter of days. Over 80,000 people were taken to these firing squads over just a few years.

It was during this new reality that Deju's parents made a difficult and life-altering decision for their young son. In cooperation with the Catholic Diocese of Miami, the U.S.

alone to the U.S. Thanks to the connections and efforts of a family friend, Raul Deju became one of these "Peter Pan Kids" who travelled to Neverland seeking a better world. When he arrived in Miami, Raul had skipped the second, sixth, and seventh grades and was facing a senior year in high school with limited English language skills.

In his book ***We Got Mojo!***, Deju details a life that, while blessed with a superior intellect and unshakeable determination, could not have been the success it became were it not for the many people whose paths he crossed.

There were the Catholic nuns in Miami who taught him English and guided him, along with teachers and family friends who collectively filled parental roles and nurtured him through that first year in the US.

With their encouragement, and despite not having had much exposure to the sciences in Cuba, he signed up for physics, calculus,

government had implemented the Visa Waiver Program to allow young Cuban students to complete their education in the States. Over a two-year period, more than 10,000 Cuban students made their way

and advanced biology as a high school senior.

There was the high school physics teacher who had a physicist-friend named Dr. E. J. Workman, then the president of New Mexico Institute of Mining and Technology, who helped him apply for Tech's work-study program.

There was the Florida congressman and others who helped him apply for visas to later bring his parents and other relatives to Miami where they would be able to settle and build new lives.

There were the people of Socorro who hired him to do odd jobs and helped him learn various skills in order to thrive as a young man alone who had only been speaking the English language for one year. Those caring and hospitable friends included Sheriff Apolonio "Polo" Pineda, Mayor Holm Bursum II, Dr. Roshan Bhappu, and other faculty members and neighbors in the area.

Deju often scrounged for food in those days, living in New Mexico year-round because he could not afford travel or frills. He had to be resourceful, industrious, and determined. In his initial work study assignment at the Bureau of Mines, he was the lead author of a peer reviewed paper published in the Transactions of

the American Institute of Mining and Metallurgical Engineers and presented by him at their Annual Meeting while he was merely a teen. While at Tech, he also tutored in math and physics, and was one of the early Fortran II computer language teachers. He was even able to buy his first car by the end of his sophomore year - a 1957 Ford Fairlane that cost him all of \$800.

At the end of his junior year he was accepted into an intensive program at the Institute for Space Physics at Columbia University, and undertook this program in New York City while at the same time finishing his undergrad work in Math and Physics at Tech. Although studying math and astrophysics, he eventually moved into a doctorate groundwater hydrology program under the tutelage of Dr. Mahdi Hantush and Professor Ed Jacob. Deju remembers the rigors of working three jobs while completing his classes, his dissertation, and passing his PhD exams in under three years. However, the demands made him stronger and more determined. The variety of fields he touched fulfilled his need for mental challenges.

As expected, Raul Deju's remarkable academic career could only lead to an even more astounding professional

life - appointments, opportunities, and a model of leadership and accomplishment that belie the nervous youngster arriving alone in a foreign land. He has written more than 100 peer reviewed articles and seven books. The first book, *Regional Hydrology Fundamentals* was published in New York when he was 25. He has worked for Gulf Oil as a hydrologist, taught at the University of Pittsburgh, overseen the development of a uranium mine in northern Canada, and served with the National Academy of Science and Engineering, the Atomic Energy Commission and later, the US Department of Energy in Washington where he met Shari, his wife of nearly 40 years.

Dr. Deju became one of the senior executives of International Technology, URS, and Waste Management. In the late 1990's he served as Chairman of Isadra, an early internet company and one of the founders of Headwaters and EnergySolutions, two companies that he led, grew and took public. But Deju is not through working: today he serves as Senior Partner of Brightstar Capital Partners, a New York based private equity company where, as he says, he has the opportunity to work closely with some great friends. He also sits on the boards of a number

of companies such as Gluware Inc. and Texas Water Supply Company (*a Brightstar portfolio company*).

Despite his many successes, Deju's focus remains steady and grounded. He has a deep curiosity about many people, regions of the world, and subjects, which he says keeps the mind active. He is currently writing a new book and supports several charities throughout the world ranging from helping veterans, literacy programs, anti-slavery efforts, environmental causes, and mentoring entrepreneurs. Retired he is not.

His spirit of philanthropy came at an early age from his family. They always believed and taught him that if you have something extra, you must help someone who doesn't. He is also intentional about surrounding himself with people who share the same beliefs of philanthropy.

In We Got Mojo!, Deju lists his 20 'rules' for success, developed over his lifetime. Rule 11 reads: Success isn't just about me. Let gratitude lead you to your calling. Incorporate giving, mentoring, and helping into your daily life and make it part of your success. Find your epiphany. Remember Luke 12:48: "From everyone who has been given much, much will be demanded,

and from the one who has been entrusted with so much, much more will be asked.”

Of his fellow BFF who model this rule, he says, “We actually get more for our heart than we give from our pocket.”

Deju donates to entities that are making a difference, and always does his research to make sure he knows where his money is going. New Mexico Tech is one of his favorite recipients. Dr. Deju and his wife Shari have funded (*and continue to do so*) a program in the Math Department to

allow students who have math deficiencies to catch up by taking a class prior to their first semester at Tech. They have donated to scholarships and to purchase equipment for research. They are the lead donors to the upcoming University House that will break ground on campus later this year. The University House will serve as a place for major meetings and to bring together people for great causes and major events.

The reason he gives to Tech is because, “When I had nothing, people at Tech befriended me. People in Socorro treated me like a human being.”



Raul Deju, director of the Institute of Entrepreneurial Leadership at John F. Kennedy University in California, speaking at New Mexico Tech’s Inventors and Entrepreneurs Workshop

Importantly, he says “I was welcomed by everyone.”

Raul Deju gives back

so others can have the benefits that he had. His is a life example that should be emulated by all.

chemistry pentathlon prize established

melvin j. hatch, ph.d.

Emeritus Professor Melvin J. Hatch (*Chemistry Department 1966-1999*) has made a generous donation to establish, in perpetuity, a fund to award \$500 to the top scoring student in an annual Chemistry Pentathlon Prize named in his honor.

Each year’s winning student will also have his or her name engraved on a plaque to be displayed in the Chemistry Department.



Dr. Heagy accepting donation from Dr. Melvin J. Hatch

Dr. Hatch earned his B.S. in Chemistry at the University of Arizona and his PhD at UCLA under

the guidance of Nobel laureate Donald Cram. He worked at Dow Chemical for a number of years

carrying out advances in polymer chemistry before joining Tech as an assistant professor.

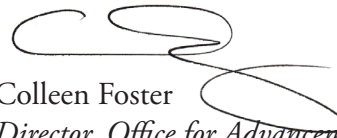
Along with his academic publications, his research efforts have garnered patents, the royalties from which make possible this prestigious prize.

The Chemistry Pentathlon exam will include five subject areas: Analytical, Biochemistry, Inorganic, Organic, and Physical.

role. Look for exciting new programs, trips, and educational and volunteer opportunities as Rachel gets her programs in place. Tech is a unique, very small family. There aren't many who can claim to be part of this greatness — we look forward to pulling the family closer and finding ways to help our youngest and newest family members succeed.

Tech has been in the midst of change for two years now. The Foundation has re-focused its mission from intellectual property to philanthropy. Entrepreneurship is now a priority of the newly created Office of Innovation Commercialization, and Tech has copyrighted the STE²M term to highlight Tech's focus on Science, Technology, Engineering, Entrepreneurship,

and Math. All of these changes are intended to provide the best support for Tech students, faculty, and alumni. We are always happy to answer any questions you may have about current and upcoming changes and we hope you'll join us in our enthusiasm for the future. Enjoy your summer!



Colleen Foster
Director, Office for Advancement and Alumni Relations
Executive Director, New Mexico Tech Research Foundation

winter 2018 archive challenge winner



Answers to the Winter 2018 Archive Challenge:

Who: Jarrod Lombardo
What: KTEK broadcasting office
Where: The former SAC
(now the Campus Police station)
When: 2001-2002

**Congratulations to the winner of the
Winter 2018 Archive Challenge!**

Daniel (Dan) Lyons

(B.S. Computer Science with Minor in Philosophy, 2004)



NEW MEXICO TECH CHILE COOKBOOK

Alumni Relations is putting
together a chile cookbook

Calling for all your
awesome green or red chile
recipes to share!

email to
rachel.montoya@nmt.edu





24th Annual

President's Golf Tournament

Thursday & Friday

September 13th & 14th

TITLE SPONSOR \$25,000 ONLY ONE PER YEAR

- Tagged recognition on all promotional material
- Company logo on NMT website
- Exhibit space at registration and award ceremonies
- Event banner recognition at the tournament
- Recognition at awards party
- Logo on each golfer's gift along with NMT logo
- Corporate banner signage
- All sponsorship signs will have company logo
- Special sponsor gift
- Four (4) complimentary foursomes with flight choice
- Exclusive entry for all major sponsors into the Cliff Cup
- Carts and range balls
- Two meals for each player
- Tee box gift for each player
- VIP Tour of the MRO with dinner at 10,000 feet for up to 16 people, hosted by Research & Economic Development (scheduled separately)

PLATINUM SPONSOR \$10,000

- Exhibit space at registration and award ceremonies
- Company logo on NMT website
- Event banner recognition at tournament
- Recognition at awards party
- Logo on tournament hat
- Three (3) complimentary foursomes with flight choice
- Exclusive entry for all major sponsors and their players into the Cliff Cup
- Carts and range balls
- Two meals for each player
- Tee box gift for each player
- Special sponsor gift
- Individual clinic with golf pro for up to 12 players (some restrictions apply)

GOLD SPONSOR \$7,500

- Exhibit space at registration and award ceremonies
- Event banner recognition at tournament
- Recognition at awards party
- Company logo on NMT website
- Two (2) complimentary foursomes with flight choice
- Exclusive entry for all major sponsors and their players into the Cliff Cup
- Carts and range balls
- Two meals for each player
- Tee box gift for each player
- Special sponsor gift

SILVER SPONSOR \$5,000

- Exhibit space at registration
- Event banner recognition at tournament
- Recognition at awards party
- Company logo on NMT website
- Two (2) complimentary foursomes with flight choice
- Exclusive entry for all major sponsors and their players into the Cliff Cup
- Carts and range balls
- Two meals for each player
- Tee box gift for each player
- Special sponsor gift

COPPER SPONSOR \$3,000

- Exhibit space at registration
- Event banner recognition at tournament
- Recognition at awards party
- One (1) complimentary foursome with flight choice
- Exclusive entry for all major sponsors and their players into the Cliff Cup
- Carts and range balls
- Two meals for each player
- Tee box gift for each player
- Special sponsor gift

Team Sponsor \$1,250

- Entry for foursome in morning or afternoon flight on Friday
- Carts and range balls
- Two meals for each player
- Tee box gift for each player

Individual Player \$325

- Entry for foursome in morning or afternoon flight on Friday
- Carts and range balls
- Two meals for each player
- Tee box gift for each player

Hole /Co-Hole Sponsor \$400/\$200

- Your name or company's name displayed at a tee box/Shared sign at a tee box

Logo Sponsor

- You can put your company name in front of 400 potential customers by donating items with your logo on them for our goody bags!

For more information contact:

Sandi Lucero

575-835-5618 or sandi.lucero@nmt.edu

2018 president's club reception

mad hatter's tea party

The President's Club hosts an elegant banquet each year to honor its members - this year on April 28th.



Mine Country Drifters Band

President Stephen Wells checks out the wonderful food provided by Chartwells



Georgette and Prescott Grey

Silver tea set donated by Sally Breeden in memory of her brother John Shipman



Reshonda Taylor (l) & Kristy Stephens (r) from Enterprise Foundation present Dr. Stephen Wells with a donation

Kristina Yu of McClain + Yu Architecture & Design

out(reach) and about

Contributors:

Faculty - Dr. Curtis O'Malley, Dr. Michael Hargather, and Dr. Kevin Wedeward

Students - Adriana Gallegos, Liam Hallada, Aaron Mislá, and Arjun Tandon

New Mexico Tech is dedicated to inspiring the next generation of scientists and engineers by sharing our love of science and technology at community and educational outreach events.

A New Mexico Tech K-12 Interactive Rocket Building Demo, supported by NASA and the New Mexico Space Grant Consortium, was designed and assembled in Fall 2017 by (mostly) Mechanical Engineering students. The display includes video monitors (to screen Tech student projects) and a compressed air “launch tube” for launching paper rockets constructed by K-12 student visitors. The display has subsequently been used at several events: Albuquerque Natural History Museum’s Dream Big, a Boy Scout troop visit to NMT, BBBS’ Discovery Festival, and at ¡explora! Museum in Albuquerque.



NMT students and faculty show the two awards they won at the 2017 BBBS Discovery Festival: **WOW! Factor** and **Most Inspiring**

Students and faculty from Biology, Physics, and five engineering departments (Chemical, Civil, Environmental, Materials, and Mechanical) participated in the **Big Brothers Big Sisters (BBBS) Discovery Festival** in November 2017 in Albuquerque. This event introduced K-12 students to STEAM (STEM + Art) using interactive exhibits. Tech’s students showed and discussed their student projects and demonstrated the paper rocket launch tube, firing off paper rockets designed and built by young event attendees.

Expanding Your Horizons at Santa Fe Community College in Fall 2017 was designed to get girls in 5th to 8th grade interested in pursuing a career in a STEM field. This conference had hands-on workshops to motivate young girls to become innovative and creative thinkers for the future. NMT had displays of a car axle and a frequency generator for the girls to learn about and spark their interest in science and engineering.

In January 2018 members of **Boy Scout Troop 174** (Albuquerque) visited NMT in Socorro and participated in several demonstrations hosted by Mechanical Engineering (8 students and Dr. Curtis O'Malley, Assistant Professor). The Boy Scouts observed the aftermath of damage sustained by micro-meteoroid shields (designed by Fall 2017 freshmen), learned how a body responds to a frequency input, used a shaker to excite a LEGO airplane wing to observe the effects of frequency excitation, and finally had a competition to see whose paper rocket design & build had the highest launch using the compressed air launch tube. They also enjoyed a hike led by Dr. Bruce Harrison, Associate Professor of Geology, E&ES Department



NMT student judges (l to r) Kimberly Haar, Brandon Lutz (group organizer), Nicholas Ellis, Liam Hallada, and Eiman Alheran

NMT students helped judge the **Alamo Navajo Science Fair** at the Alamo Day School in February 2018. Some of the K-12 student projects displayed innovative

excellence by using available resources to evaluate scientific questions, both in general and in regards to life on the reservation. The NMT student judges had the pleasure of recommending that some of the projects be advanced to the regional science fair.

There were two NMT engineering and science project demonstration events in February 2018 at **jexplora! Museum**, Albuquerque. Although these events drew modest crowds, this allowed New Mexico Tech students and faculty to provide more individual attention to those attending.

At **jexplora!**, Tech students showcased projects and demonstrations in civil engineering, Schlieren flow imaging, engineering management, vibration testing, anatomy, physics, materials engineering, and cutting-edge chemistry.



Schlieren flow visualization demonstration at **jexplora!** by (l to r) Rudy Morales, Calla Lang, and John Garcia (all Mechanical Engineering)

Super STEM Saturday, a first-time event in Albuquerque hosted by the Air Force Research Lab (AFRL) in February 2018, was a great success, drawing large crowds. Several New Mexico Tech departments participated:

- Materials Engineering and Sandia National Labs jointly conducted explosive and termite demonstrations and hands-on experiments
- Physics conducted a stage demonstration and hands-on experiments

- Biology had their own room for conducting demonstrations
- Chemical and Mechanical Engineering shared indoor and outdoor space for building and testing fuel cell cars and paper rockets

3D printing techniques, blast shields designed by NMT freshmen, and airplane physics using gliders were also exhibited.

NMT alumni were notified by the Office for Advancement of the event, and many came – some with their children, others to connect with current NMT students, and all participants enjoyed the day.



Paper rocket launch tube and admirers

new zealand alumni tour



Mt. Cook & glacier lake (photo by Lois Phillips)

Dr. Bruce Harrison (*Associate Professor of Geology, E&ES*) led a 10-day tour of New Zealand's South Island in May 2018, focusing on geology, landscapes, and wineries. Here are some highlights.



Lois Phillips and Bruce and Belinda Harrison



Multiple mining engineers and geologists . . . means multiple opinions



Photo ops were a favorite pastime (l to r) Fred Phillips, Stephen Wells, Mark Connolly

Whit Skaling (*black jacket*), Fred Phillips (*gray jacket*), Bruce Harrison (*blue shirt*), Stephen Wells (*blue jacket*)



Delicious meals enjoyed every day (l to r) Stephen Wells, Fred and Lois Phillips, Mark Connolly, and Jan Skaling

Congratulations



Top: President Wells leads VIPs to the podium

Middle: Keynote speaker Dr. Terry Wallace and Student Speaker Gabe Montoya (*former SGA President*) share a laugh as other dignitaries watch the student procession

Bottom: (*l to r*): Students ready for graduation; Library Director Dr. David Cox and former SGA President Gabe Montoya in commencement finery



Graduates 2018



Top: Full house of family and friends on a sunny day

Middle: The tradition of special commencement hats continues, with Samuel Montgomery (*B.S. Physics*) sporting a solar system (*second from left*)

Bottom: (*l to r*): Dr. Ivan Avramidi celebrates with newly hooded advisee Sam Collopy (*PhD Physics with Dissertation in Mathematical Physics*); Podium VIPs fire confetti cannons to send graduates off with a big BANG.



alumni spotlight

terry wallace, jr. ph.d.



Wallace says. Growing up in Los Alamos, he remembers collecting minerals at age four or five with his dad, the late scientist Terry Wallace, Sr. He was filled with a sense of wonder from that moment on, although the path forward would take unexpected turns.

His desire was to go to Caltech, so he arrived at New Mexico Tech with some reluctance. Coming from a large family with limited funds meant he would have to begin his academic career in-state. “But I found I was comfortable in the community, probably because I’d come from Los Alamos. And I would not have been as successful at Caltech later had I not attended Tech first.”

Wallace says the variety of classes he was encouraged to take and the availability of interdisciplinary programs helped to make him a broader person - an attribute he hopes every student would desire. “Tech gave me research and teaching opportunities that made me a better

(*Caltech*), Wallace is perpetually curious and passionate about his work and research. And he encourages today’s graduates to be the same.

“There is no question that I am not willing to ask,”

by Carla Bastos **Always ask WHY!**

Those are the words and the life mantra of newly appointed Director of Los Alamos National Lab (*LANL*) and President of Los Alamos National Security, LLC (*LANS*), Dr.

Terry C. Wallace, Jr. With two B.S. degrees (*Mathematics and Geophysics, 1978*) from New Mexico Tech, as well as M.S. and Ph.D. degrees in Geophysics from the California Institute of Technology

scientist.” He says gaining strong communications skills, and even an appreciation for the arts, also played an important role in his development.

Wallace’s appointment to the post of LANL Director in January 2018 is the culmination of a long tenure at the Lab, in positions that included Principal Associate Director for Global Security (*PADGS*) and Principal Associate Director for Science, Technology, and Engineering (*PADSTE*). In the midst of this distinguished career path he also dedicated an extended period to academia.

Having spent 20 years as a professor of math and geosciences at University of Arizona, Wallace has the unique perspective of student, teacher,

and researcher, further emphasizing the all-important broadness he often speaks of.

His wife, Dr. Michelle Hall, is an accomplished scientist and educator in her own right. The contrast in their academic and career journeys is stark, but with a few striking similarities. Hailing from an even larger family of 11 children, Hall grew up in the country and had to pay her way through school. She says she may have arrived less prepared for college, but she was much more determined than others. At University of Missouri College of Engineering, she found virtually no females on campus, but she had come in tough and her large family (including eight brothers) had made her competitive.

Dr. Hall’s career path



Dr. Hall and Dr. Wallace discuss STEM access

has also included both academia and research, with a number of prestigious positions in science and engineering. She began her career as a geological engineer in industry, then returned to graduate school in geophysics and ultimately became an academic. Along the way, she came to realize how little scientific inquiry was integrated into undergrad programs and how few skills students were acquiring for work outside of academia.

Dr. Wallace echoes his wife’s concerns. “Students are not being prepared for STEM at the lower grades. What is most important for our country is STEM literacy, not so much going into a STEM field necessarily. It is far more important to our nation’s well-being to increase our scientific literacy.”

Offering the example of climate change, Wallace says there simply isn’t enough general solid

understanding to make an argument on either side. “We have moved too much toward assessment outcome rather than just being literate.”

Both see access to STEM to be of paramount importance. “There is just not enough access,” Hall said. “We need the teachers and mentors to capture young people’s imagination.” She sees computer science and robotics as critically important but, although she believes there is more interest there, it is still not high enough.

The couple pointed to Science Cafes as effective vehicles to grow interest and literacy. Café Scientifique New Mexico (<http://cafenm.org/>) engages scientists and youth in discussion, debate, and hands-on exploration of hot topics in science and technology. Many distinguished scientists have participated, including Dr. Wallace



Dr. Michelle Hall and Dr. Terry Wallace

and a host of others from LANL, Air Force Research Laboratory, Sandia National Labs, and more. Thousands of teens have attended the ten-year-old program free of charge.

When asked what other attributes are important as young scientists find their footing, both readily agree: character. Dr. Wallace, a Distinguished Eagle Scout and recipient of the NMT Brown Award in 1978, reminds us, “The staff at LANL does what they do for the honor, not the glory, in service to the nation. Their slogan is Honor, Integrity, Service.” He adds, “As a society, we are sometimes reductionist in our thinking, and we tend not to accentuate the positive. We’ll take a whole and reduce it down to whatever negatives or debatable elements there may be, sometimes just for the sake of being negative or argumentative.”

Hall said it is easy to express oneself today through a path of vanity (social media, etc.) “It is most important in developing young peoples’ character to find out what their passion is and then light that in them.” They also addressed family and the unique dynamic of spouses in such similar careers. “Often in STEM you end up marrying someone in STEM,” said Wallace. “The difficulty is the ‘shadow effect.’ Your

only identity cannot be science. This cannot be your only measure of who you are.”

Hall was a grad student at University of Arizona when Wallace was a professor there. Her advice is to choose your spouse carefully, someone who understands your dreams and will support you in them. “That is what makes a two-career marriage work.” She says that in 30 years of marriage, she always supported what he wanted to do and vice versa, allowing both to be as much as they can be.

To illustrate the point,



IceCube, an astronomy project at the South Pole, is a telescope designed to detect subatomic particles called neutrinos that originate in far space and pass through the Earth, infrequently interacting with the Antarctic ice. *Credit: Dr. Kathie L. Olsen, NSF*

Wallace shared his excitement that Hall has been selected to spend three to four weeks at the South Pole later this year working on the Ice Cube

Neutrino Observatory detecting neutrinos coming into the Earth. Their discussion circled back to the importance of being well-rounded human beings, pointing to recreational, artistic, and other pursuits. Dr. Hall has run the Boston Marathon four times. She summed up the need to be one’s own person: “It is much easier to be infamous than famous. Young people share way too much and are looking at everyone else’s goals and accomplishments, undermining the opportunity to focus on themselves and where they are going.”



Dr. Wallace’s view? Always ask WHY!

people you know



Dr. Nikhilesh Chawla (B.S. Materials Engineering, 1993), the Director for the Center for 4D Materials Science and Fulton Professor of Materials Science and Engineering (MSE) at Arizona State University (ASU), is the recipient of

the 2018 Acta Materialia Silver Medal, awarded at The Minerals, Metals, and Materials Society (TMS) Annual Meeting in March 2018.

Professor Chawla received his Ph.D. in Materials Science and Engineering from the University of Michigan in 1997. Prior to joining ASU in 2000 he was a postdoctoral fellow jointly at Ford Motor Company and the University of Michigan, and a senior development engineer at Hoeganaes Corporation. He served as acting chair of the MSE program at ASU in 2010.

His research interests encompass the deformation behavior of advanced materials at bulk and small length scales, including Four Dimensional (4D) materials science, environmentally-benign metallic alloys, composite materials, and nanolaminates. He has published widely and his research is highly cited. He is the author of the textbook *Metal Matrix Composites* (co-authored with K.K. Chawla), published by Springer; the 2nd edition was published in 2013.

Professor Chawla is a Fellow of ASM International and past member of TMS Board of Directors. In 2016 he was awarded the following: New Mexico Tech Distinguished Alumnus Award, the TMS Structural Materials Division Distinguished Scientist/Engineering Award, and the TMS Functional Materials Division Distinguished Scientist/Engineering Award. In addition, he has received the 2013 Brimacombe Medalist Award from TMS; the 2011 Distinguished Lectureship given by Tsinghua University, China; the 2004 Bradley Stoughton

Award for Young Teachers, given by ASM International; and the 2006 TMS Young Leaders Tutorial Lecture. He also received the National Science Foundation Early Career Development Award and the Office of Naval Research Young Investigator Award.

He is editor of *Materials Science and Engineering A*, published by Elsevier, and serves on the Editorial Boards of *Advanced Engineering Materials*, *Materials Characterization*, and *Materials Chemistry and Physics*. He has served or is serving on several external advisory boards, including that of Naval Research Laboratory, the Advanced Photon Source at Argonne National Laboratory, and New Mexico Tech. His work has been featured on the show *Modern Marvels* on the History Channel, R&D News, Fox News, and the Arizona Republic. He also serves on ASU President Michael Crow's Academic Council.

Dr. Alan Cheetham, (B.S. Geology, 1950), was honored



on his 90th birthday by the editors of the *Annals of Bryozoology*, who dedicated Volume 6 (published in 2018), "With affection to Alan Cheetham, inspirational colleague and founder of the International Bryozoology Association." A publication of the

International Bryozoology Association, the *Annals* is based in the Department of Geology, Trinity College, Dublin, Ireland, and is edited by Patrick Wyse Jackson of that department and Mary Spencer Jones of the Department of Life Sciences, the Natural History Museum, London, England.

Dr. Cheetham is a Senior Scientist, Emeritus, of the Paleobiology Department at the Smithsonian Institution's National Museum of Natural History.



Dr. Catherine Clewett (*Ph.D. Physics, 2006*), an Associate Professor of Physics at West Texas A&M University (*WTAMU*) since 2010, is the recipient of a Fulbright Core Scholar grant that has provided her the opportunity to live and work in Prague, Czech Republic, for six months.

She is conducting research at Charles University, sharing ideas and research techniques with faculty and research scientists developing membranes for the oil and gas industry. She is also spending time learning how other countries promote women in the sciences.

“Spending six months in another country to work on research as well as to interact socially with students and colleagues on a project that is so important to the globe will be a hugely broadening experience for me and those I interact with when I return,” Clewett said. At WTAMU she conducts research using nuclear magnetic resonance (NMR) spectroscopy and is interested in helping find new clean water sources and materials to be used in renewable energy.

She is the first woman in the sciences from WTAMU to participate in the Core Scholars program. Her husband Don Clewett, (*M.S. Mathematics, 2006*) is an instructor of mathematics at WTAMU, and he and their son are accompanying her on her research trip. “I’m also incredibly excited that my husband and son will get to live in Europe,” Clewett said. “It’s the first time that they have come with me when I do research—usually I have to travel alone.”



Zoë Diener (*B.S. Biology, 2017*) has received a Fulbright U.S. Student Program award to Namibia in Public Health from the U.S. Department of State and the J. William Fulbright Foreign Scholarship Board. She will conduct research at University of Namibia as part of a project to

investigate the impact of the ephemeral streams in northern Namibia on the incidence of malaria.

Diener is one of over 1,900 U.S. citizens who will conduct research and provide expertise abroad for the 2018-2019 academic year through the Fulbright U.S. Student Program. Recipients of Fulbright awards are selected on the basis of academic and professional achievement as well as record of service and leadership potential in their respective fields.

While at Tech, Diener served as Student Body President of the Student Government Association (*2015-2016*) and worked as an undergraduate Research Assistant in the Biology Department (*2014-2017*), and a T.A. in the Biology Department (*2016-2017*).

In summer 2017, she volunteered as a research assistant at Katatura Hospital in Windhoek, Namibia, with a team (developed and led by Dr. E.R. Greene) from New Mexico Highlands University. The work included training local medical students in the use of hand-held, portable ultrasound used for diagnosing tuberculosis, a disease with a high prevalence and high mortality rate in Namibia.

Diener is currently pursuing graduate studies in Public Health at University of Utah, where she works as a research assistant in the Division of Family Planning. Following her Fulbright term, she will pursue a career in Global Health and Clinical Research.



Laura Graham (*B.S. Chemical Engineering, 2003*) was honored as a 2017 Modern-Day Technology Leader at the 31st Annual Black Engineer of the Year Awards (*BEYA*) STEM Global Competitiveness Conference. Honorees are recognized for demonstrating outstanding performance

in the course of their engineering, science, and technology work.

A project manager at Chemical Biological Application and Risk Reduction (*CBARR*), Graham was one of four employees from the U.S. Army Edgewood Chemical Biological Center recognized at the 2017 BEYA luncheon. Graham has worked at CBARR for 11 years.

in memoriam



William (Bill) Allen Averill (B.S. Metallurgy, 1971; M.S. Ceramic Engineering and M.S. Metallurgy, 1973) departed this life on December 27, 2017, after a challenging five-year battle with neuro-endocrine cancer.

He is survived by his devoted wife and soulmate of over 45 years, Jennifer Bates Averill (B.S. Biology, 1972). He is also survived by two sisters, Kathleen (Darryl) Erwin and Analisa (Michael) Martinez.

Others who mourn his passing include colleagues at Sandia National Laboratories, Los Alamos National Laboratory (LANL), and Colorado School of Mines and abundant friends and neighbors, who shared

his love of open spaces, muzzle loader shooting, trail riding, science fiction, world history, computer technology, learning about new things, anything that needed fixing or repair, and good New Mexico chile.

Comfortable with two first names, Allen/Bill was a generous, thoughtful, gentle, helpful, humorous, brilliant but humble, simply outstanding human being. After earning his degrees at New Mexico Tech, he finished his Ph.D. (Metallurgy) in 1976 at the University of Utah. He then taught for five years at the Colorado School of Mines and later worked at the DOE Rocky Flats plant, LANL, and Sandia National Labs. He was widely respected for his deep knowledge of metal and materials chemistry, and he was a world-class problem solver for his employers and colleagues.

Donations in his honor may be made to Northwest Chapter Back Country Horseman of New Mexico or the UNM Comprehensive Cancer Center.



Woodrow Morris (Sam) Bradley (B.S. Mining Engineering, 1954) passed away on March 8, 2018, due to complications from a heart attack he suffered on the preceding Tuesday. He was born May 28, 1932 in Canadian, TX.

While at NMT he joined the Order of Odd Fellows. After graduating, Sam worked in the Magma Mine in Superior, AZ, and the Highland Uranium Mine in Douglas, WY. He also worked as a self-employed farmer near Muleshoe, Texas, for 19 years.

He met his wife Hazel in March of 1962, and they were married six months later. Before their children were of school age, Sam and Hazel were

active with Lay Witness Missions in Texas, New Mexico, and Arizona. Sam was a member of the First Baptist Church of Hawkins, Texas, where he served as a deacon. He was a volunteer fireman for Hawkins from 1982-1988, and was mayor of Hawkins for three terms, from 2006-2012.

Sam served as R.A. counselor in three churches and sponsored boys in over 25 camps. He coached the boys' basketball and track teams; once the basketball team won first place in the association's tournament. He was active with International Crusades, witnessing in nine foreign countries and 26 missions, and he was an advocate of Compassion International. He and his wife Hazel sponsored nine Compassion children and witnessed two graduate from the Compassion program. They also sponsored four children from other programs, several of whom went to college.

He is survived by his

wife, Hazel Bradley; son, Alton Bradley; daughter, Jacqueline Worley; seven grandchildren and three great-grandchildren.

The family requests memorials in Sam's honor be made to The Gideons International or Compassion International.



Rosemary (Rosie) Williamson Colgate passed away peacefully in her White Rock home, surrounded by her family on April 19, 2018. She was married for 66 years to **Stirling A. Colgate** (President of New Mexico Tech, 1965-1974), who passed away in 2013.

Her early years were spent in New Mexico, Connecticut, Maine and New York. She is survived by two of her three children, daughter, Sarah Colgate Chase and son, Art. Her third child Hank Colgate died in 1997.

In Rosie's early years she was an avid sailor and outdoor girl, participating

in many regatta races throughout the northeast. Rosie enjoyed hiking, skiing, swimming and tennis, along with traveling, reading and politics. She taught herself to cross country ski when she was young and to cook incredible dishes as an adult. She was an avid reader of over 10,000 books. She also enjoyed The New Yorker and its cartoons, which brought her great pleasure. Rosie loved architecture, designing and having built four houses in her lifetime.

Rosie attended Vassar University for two years and continued her education at Cornell University, graduating with a Degree in Electrical Engineering in 1947, being one of the first women graduates in this program.

Following her husband's scientific career, Rosie lived in Ithaca, NY, Berkley and Livermore, CA, Socorro, NM, Aspen and Ward, CO and finally Los Alamos, NM, where she and Stirling lived for 43 years. Together, they traveled the world extensively.

Projects in her life included writing science articles for the Aspen Times newspaper, opening the first on-campus bookstore at New

Mexico Tech in Socorro and her involvement and success limiting height restrictions of buildings in Los Alamos.

At the age of 73 Rosie became Trustee of a family business and successfully ran it for 14 years. Other work endeavors included working at Electrolux in New York City and working at Livermore National Laboratory in California.

Rosie had a sharp wit and intelligence plus a warm and generous spirit. She will be greatly missed by her family and friends.



Alan Duvall (B.S. Physics, 1981) of Colorado Springs, CO, passed away on August 10, 2017, after a brief illness.

He is survived by his wife of 35 years, Aleta Basenfelder Duvall; son Robert with daughter-in-law Lindsay and grandson Benedict; daughters Eva and Angela; mother Jane; and brother Steven with

niece Jacklynn.

Alan's varied technical career included systems engineering roles with DynCorp, Nichols Research, Madison Research, bd Systems, Honeywell, and USAF. Alan was recognized for his work at NASA Marshall Space Flight Center on Gravity Probe B. He was a longtime member of the Association of Old Crows.

The family asks that donations be made in Alan's honor to one of the following: The Nature Program by PBS, Destroy Pancreatic Cancer, Pikes Peak Hospice Foundation, or Eye Bank Association of America.



Judy Floyd, (NMT Regent, 1977-1987) of Las Cruces died peacefully on April 5, 2018 surrounded by family at La Posada - Mesilla Valley Hospice. Judy is survived by her husband of 54 years, Mike Floyd; children Jonathan (Amy) Floyd; Jason (Rachel) Floyd; sister Betty Egbon; and five beloved

grandchildren.

Born in Texarkana, AR, Judy spent her childhood and youth in Carlsbad, NM. She attended New Mexico State University and graduated with honors, receiving a bachelor's degree in elementary education. After graduation, she served on the Board of Directors of the NMSU Alumni Association and remained a devout Aggie for the remainder of her life. Judy taught both kindergarten and second grade at Mesilla Elementary for six years. She was beloved as a teacher and had a profound impact on the children she taught.

Her background in education contributed to her appointment in 1977 as the first female regent of New Mexico Tech. She was the first female president of the University's Board of Regents and the first woman in New Mexico to head a major university's board. She served on the board at NMT for ten years. Her influence at NMT remains in the improved campus environment and in our national visibility.

Judy spent her lifetime involved in many civic and charitable activities. She was a member of the Junior Women's Club, President of the Board

of Directors at La Casa, a member of Jardin de Los Ninos Board of Directors, a founding board member at Tutti Bambini, and a member of the Friends of the Taylor Family Monument Board of Directors. She was devoted to her community, particularly to causes that improved life for children and families.

Donations in memory of Judy Floyd can be made to Mesilla Valley Hospice, 299 Montana Ave., Las Cruces, NM 88005.



Mitchell (Mitch) Goldberg (*B.S. Geology, 1985*) unexpectedly passed away on April 18th, 2018. Mitch was originally from Staten Island, New York City and started at NMT in 1977.

Soon after arriving at Tech, he met his wife, Shanon (*B.S. Geology, 1985*) and they were inseparable since then. Mitch's and Shanon's greatest gifts have been their two daughters, Selena (*Se*) and Samantha (*Sam*).

Both will be attending Tech starting Fall 2018 - Selena is transferring from NM State University and Sam will be an incoming freshman.

Mitch and Shanon made many friends in their time at Tech. Over the years they managed to stay in touch with a number of us who consider ourselves blessed. Some would say, we are more of an extended family.

Mitch and Shanon traveled the country after graduating from Tech, working in Oak Ridge TN, Ross OH, Portsmouth OH, Dallas TX, and (*for the past 13 years*) Los Alamos National Laboratory.

Mitch touched many lives during the course of his career, both as a colleague and mentor. Mitch had a passion for golf (*some might call it an obsession*) and there are many great memories of him on the fairways and greens of all the golf courses he played. In spite of being diagnosed with Parkinson's disease 10 years ago, he continued his active life, never complaining, and rarely ever allowing you to see the physical toll it took on him.

Mitch will be missed! No one will ever replace his positive outlook on life, his infectious laugh, his

wry sense of humor, and his drive to help others. A private memorial was held by the family soon after his passing, with several additional gatherings in Los Alamos to remember Mitch. There are tentative plans for a Celebration of Life later this summer (*his family and friends will let everyone know the date and location once it has been determined*). The family requests that any donations be made in his memory to the Parkinson's Foundation (<http://parkinson.org/>).



Joshua J. Hill
Editor's Note: Joshua J. Hill's obituary was published in the Winter 2018 Gold Pan. In this issue, NMT faculty, staff, and Joshua's peers shared their memories of him.

Clay Beevers, Class of 2010

Josh Hill was #142. Every Chemical Engineer that graduates from New Mexico Tech gets their number (it's written inside their graduation hardhat)

and like every engineer before him Josh had it proudly displayed in his home. But to those who knew him he was more than just a number, he was a colleague, classmate, and most importantly a friend. In the wake of his death many wondered how such a kind soul could go so soon. Josh was loved by everyone he knew from his earliest days at Tech.

The first time I met Josh we were freshmen playing dodgeball at New Mexico Tech. We didn't know each other but we knew we were friends from the start. The next thing I knew he convinced me to play rugby. In all honesty he was one heck of an athlete and he made his mark and I did not. I realized that rugby wasn't my thing and we went different ways, but we stayed friends throughout our freshman year. Before we knew it we were both enrolling as Chemical Engineers, and for the next four years we did everything together. We went to every class together for four years and we even went through Senior Design together.

At the time of his passing Josh was working at Sandia National Labs and he had already made an impression there. If you knew Josh that was no surprise - everywhere he went he made an impression.

He was an avid motorcycle racer and was quickly making his way to the top of the local circuit in Albuquerque. It's never easy to lose a friend but losing Josh will never fully sink in. Although we spent a few years apart we ended up working together at Sandia National Labs together, and I'll never forget getting him that job. I might have lost a friend but I'll never lose the memories.

Gil Martinelli, Class of 2010

Josh was one of the good ones.

Seth Price, Lab Assistant

Josh was one of the first chemical engineering students I taught. He always brought an active learning mindset and good questions to class. He was continuously working on something- his Mustang, the Chem-E Car, one project or another. I remember coming into my office late one night (long after midnight) to find Josh and a few other students in the lab, collecting more data from their Chem-E Car.

A few weeks before his passing, he stopped by Tech to visit the Chemical Engineering department, and I gave him a tour of our relatively new Unit Operations Lab. We

chatted about his job at Sandia National Labs and his motorcycles. His friendly and helpful personality had continued from his college days, and he had developed into a knowledgeable professional.

Josh was a colleague and a friend. His thirst for learning new things was an inspiration to us all. His passing has left the world a little colder, and he will be missed by all who knew him.

Dr. Michaelann Tartis, Associate Professor

Josh had a light, fun, and eager attitude and he was always involved in a variety of projects. I'll forever remember Josh's class, as he and his classmates were the first batch of students that I had the pleasure of teaching.

Two fond memories from that semester include an exam question that he wrote for extra credit and a short film he and a few classmates created, titled *A World Without Chemical Engineering*.

I used Josh's question as practice for exams for many years; it is one of many things Josh did to go the extra mile in chemical engineering. The short film showed his capacity for creativity and his ability to have fun while pursuing a rigorous degree - a quality

that many around him appreciated and enjoyed.

We'll miss you, Josh!

Joshua Hill passed away December 7, 2017. His family requests that contributions in his honor be made to the NMT Department of Chemical Engineering by selecting "Give" at <http://www.nmt.edu/>.

Susan McLafferty (M.S. Geology, 1979) passed away September 29, 2017 in Albuquerque. She grew up in Manchester, CT, and is survived by her brother Steven as well as her two cats, Waylon and Munchkin.

Sue received her undergraduate degree at Smith College before earning her M.S. at New Mexico Tech. She employed her love of science in several different occupations, including training astronauts for the Apollo-Soyuz Test Project, researching oil drilling locations for petroleum companies, and writing computer code for satellite tracking and seismographic. Her final job, prior to retirement, was with the Albuquerque Seismological Labs.

Sue was passionate about music. She played several instruments, including keyboards, fiddle, and – her favorite - the

hammered dulcimer. She led and taught tunes to the "Hit or Miss" hammered dulcimer practice group until about 2013 when she declared her job was done and continued with the group as a collaborator. However, she played a strong lead in most tunes the group practiced until the last week of her life. Sue's other passion was folk dancing. She organized and ran a folk dance group in Socorro, NM prior to moving to Albuquerque in 1989. After moving to Albuquerque she was heavily involved with an international folk dance group. She later focused on Scandinavian dance, traveling frequently to Santa Fe for dances, and attending dance workshops in Boulder, CO and Sweden.

It is requested that donations in her memory made to Animal Humane Society, New Mexico.



Lysandwr McNary (B.S. *Technical Communication*, 2013) passed away on April 25, 2018 after bravely battling cancer. She was born Lisa Gail Waterman on April 10,

1963 in Santa Barbara, California.

She was extremely intelligent and had an active fantasy life. She spent many happy days at Renaissance Faires around California and created the character of a medieval washer woman named Lysandwr. She was briefly married to Martin McNary in 1984. When she moved to Minneapolis to work as a concierge for Marriott, she legally changed her first name to Lysandwr. With her bookstore dividends from BookPeople, she traveled to Japan and climbed Mount Fuji.

She was a member of the Army Reserve from 1998-2008, serving two tours in Iraq in a PsyOp unit; at separation her rank was Specialist. She then moved to Socorro with her mother Brenda, where she completed her degree at NMT. She was active in the Socorro Unitarian Universalists.

Lysandwr was a strong, kind, and independent woman who cared for others even during her illness. She is survived by her mother, Brenda Gail Waterman, her uncle, Robert D. Waterman, her niece, Nicole Gail Waterman, and three beloved cats. Lysandwr's ashes will be interred in the Santa Fe National

Cemetery. Donations in her honor may be made to Animal Protective Association of Socorro.



Kenneth J. Van Etten (B.S. *University Studies with Minor in Math*, 1976), passed away on December 24, 2017. He was born in Madison, WI on March 15, 1946, to Edward Van Etten and Geraldine Milich.

Kenneth graduated from Los Alamos High in 1964 and began his studies at New Mexico Tech. In 1967 he enlisted in the Air Force where he served four years in Spain as an E5 Staff Sergeant. After returning, Kenneth met and married, in 1971, the love of his life, Linda Cohee. He then returned to New Mexico Tech to complete his bachelor's degree. During his career he worked at White Sands and Honeywell in Albuquerque in Quality Control Management.

Kenneth had an exceptional love for the

great outdoors; camping, hiking, and gardening were just a few of his favorites. But his heart was in fishing - that's where you would find him most of the time.

Kenneth is survived by daughter, Erin Martin; son, Richard Van Etten; daughter, Kelly and (Cody) Smith; brother, Tom Van Etten; brother, Don Van Etten; sister, Jeanne Holmes; seven grandchildren; and his beloved registered Yorkie Duke.

Kenneth will be greatly missed by all who knew and loved him.



Marcus Arthur Wiley (B.S. *Mining Engineering*, 1972) passed away on October 28, 2017, at the age of 67 after a hard-fought battle with cancer.

He is survived by his wife Kathy; son Kent (*Amy*); daughters Kari Curo (*Steven*), Kaci Cotton (*Adam*), and Kimberly Hensal (*Josh*); and two sisters, Lynda Wadsworth and Jenna Wiley.

Born in Gallup, New Mexico, his family moved to Farmington when he was 12. Even as a child, Mark was determined to succeed. When he was in the third grade he told his parents he was going to study at New Mexico Tech. He didn't apply to any other schools.

After graduation, he was hired by Consolidation Coal Company and the job took him to Ohio. Mark regularly received bulletins from the Church of Christ back home in Farmington. In 1972, a postal employee noticed the nature of Mark's mail and, playing matchmaker, introduced him to Kathy Mills of nearby Cadiz. Sparks flew and they were married six months later.

Mark founded Wiley Engineering in 1981, which later became Wiley Consulting, LLC. He was continuously learning, growing, and teaching others through his work.

Mark loved cars: working on them, driving them, and collecting them. He used this and other hobbies to build relationships and spend time with his friends. He was also an avid collector of gems and minerals. He especially enjoyed sharing these interests with kids.

Mark was an extremely generous man, and truly lived by the principle that

we are blessed in order to bless. His generosity has affected thousands of people all over the world. He invested in people; not because he wanted something from them, but because he loved them.

The family requests donations be made to Ohio Valley University Advancement (*please annotate Mark Wiley Memorial on your donation*).



Marvin L. Wolverton (*B.S. Mining Engineering, 1970*) passed away in Leander, Texas, on March 16, 2018 at the age of 73. He is survived by his wife of 49 years, Mimi (*nee Hiatt*); son Steve (*Lisa*); daughter Ann (*Misha*); two grandsons; and his sister, Vickie (*Mrs. Michael Boyd*).

Marv was born in Paintsville, Kentucky, and after service in the

U.S. Army, he attended New Mexico Tech. Marv married his wife Mimi in 1969, later moving from Illinois to Brainerd, Minnesota.

Marv held a Master's degree in economics from Arizona State University and earned a Ph.D. in real estate from Georgia State University. His varied career spanned college professor, realtor, commercial real estate appraiser (*MAI*), and, most recently, managing director of Cushman & Wakefield, where he provided analytical and advisory services and expert testimony. Among his significant professional achievements, Marv developed statistical models to estimate the market value and market rent of an 1,800-mile underground gasoline pipeline easement within a railroad corridor that spanned six states. He developed courses for the Appraisal Institute on the valuation of tangible and intangible assets and the application of statistical analyses to solve problems

related to real estate. He authored two books, "*An Introduction to Statistics for Appraisers*" and "*The Valuation of Billboards*," both published by the Appraisal Institute.

Marv will be remembered as a loving husband and father, avid outdoorsman, gifted woodworker, tai chi enthusiast, loyal Cubs and Packers fan, and generous donor of his time and skills. He was a nuanced practitioner of colorful language and liked to provoke heated discussion of the politics of the day. He had a great appreciation for things of beauty in the natural world. He instilled in his children the importance of living with integrity, working hard, and being the best person you can be. He is dearly missed.

Donations in memory of Marv can be made to the New Mexico Tech Marv and Mimi Wolverton Endowed Scholarship by selecting "Give" at <http://www.nmt.edu/> or by calling 575-835-5616.

*Your gifts further the academic and research goals of New Mexico Tech while allowing you to further your special interests. Visit our **Giving Site** to see the many ways you can contribute to Tech and the students. Endowed Scholarships, Endowed Chairs, Departmental Gifts, Special Gifts and Annual Giving and Non-monetary gifts are only a few of the ways of giving back.*

For more information about donating Tech please contact Colleen Foster, Director, Office for Advancement at colleen.foster@nmt.edu or call 575.835.5352.

the last word

Caleb Hightower



Since he was a small child, Caleb Hightower (five-year B.S./M.S. program in Mathematics, 2018) has loved learning about natural science phenomena and exploring the details: What explains how water behaves? Why do black holes form? At his local library he soon discovered books about another great love – space.

Born and raised in Rio Rancho, New Mexico, Caleb decided early on to focus on science, then refined his choice to mathematics in his sophomore year in high school. Over time, he chose his ultimate path - science education.

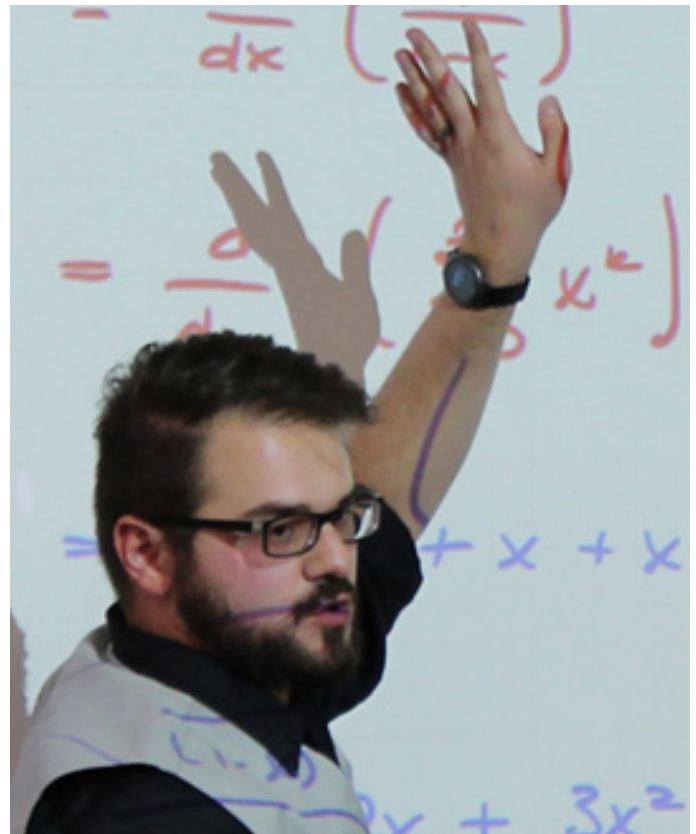
Caleb cites three things that have shaped his life since he started at Tech: meeting Garrett Massey, his fiancé; the long-lasting friendships he made when he joined the first-year-student Learning Community (LLC) program; and, finally, working as an LLC Learning Coach, and then tutor, in the Office for Student Learning (OSL). As an LLC Learning Coach, Caleb found that he could best help students with their math; as an OSL tutor he had a reputation as one of the top math tutors. Then, as a Master's student, he learned to appreciate teaching math classes.

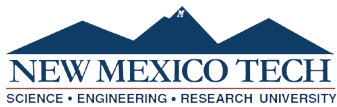
Caleb's thesis involved a branch of physics known as magnetic hydrodynamics. A lot of data and many complex models exist of the structure of magnetic fields within and between galaxies, but currently there are no simple systems to explain their evolution and development. With the guidance of his research advisor Dr. Paul Arendt (Physics), Caleb's thesis used a "coupled nonlinear system of eight PDEs" with the goal of "picking out key features and modeling them in a more

easily visualized and computationally efficient way." Along with his academic pursuits, Caleb found time for many extracurricular activities, including two years as head of the Student Government Association's Legislative Committee and several years as a member of NMT's "QuASAR," (a chapter of the national organization Out in STEM).

Post-graduation, he is working at RiskSense in Albuquerque (where's he worked the last two summers). Someday he may teach mathematics at a college or university.

At NMT, Caleb found that "people that the rest of the world view as odd or geeky come together and are willing to endure together." For him, the best part of Tech is its "unique and tightknit community of science-loving nerds."





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