

MECHANICAL ENGINEERING

Spring 2014

Industrial Advisory Board

Casey Allen, BSME94, MSME01,
H.F. Webster, Rapid City, SD

Wayne Baumberger, BSME96,
Caterpillar Inc., Rapid City, SD

Dave Berg, BSME73, Rapid City, SD

Pete Birrenkott, BSME71,
Rapid City, SD

Pete Chikos, BSCE79,
Boeing Co., Seattle, WA

Randy Clarksean, BSME83, Kevin
Kennedy & Associates, Inc., Ottertail, MN

Don Cuperus, BSME95,
Raven Industries, Garretson, SD

Dennis Deinert, BSME70,
Tessier's, Inc., Mitchell, SD

Paul Gnirk, MINE59, Table Top Ranch
Inc., New Underwood, SD

Brian Goetsch, BSME98,
Lockheed Martin Space Systems Co.,
Littleton, CO

Patrick Hallauer, BSME76,
EAD Incorporated, Omaha, NE

Steven Henning, BSME89,
Boeing Co., Kent, WA

Tim Holleman, BSME71,
Medtronic Inc., Ham Lake, MN

Chris Kruschke, BSME93,
USAF, Beabercreek, OH

Ritch Larsen, BSME75,
Caterpillar Inc., Chillocothe, IL

Mike Mueller, BSME85,
Douglas School District, Rapid City, SD

Larry Pearson, BSME72,
Bennington, NE

Scott Reisenauer, BSME94,
SR Solutions, LLC, Rapid City, SD

Mike Rizor, BSME90,
Cargill, Inc., Iowa City, IA

Matthew Schulte, BSME09,
Burns & McDonnell, Overland Park, KS

Paul Sheets, BSME91,
Mechanized Design, LLC, Wichita, KS

Ralph Wagner, BSCE75, Las Vegas, NV

Daniel Weinacht, BSME84,
Ares Corporation, Richland, WA

Dale Wilen, BSME85,
Cheyenne, WY

Mike Wood, BSME03, Halliburton
Wireline and Perforating, Midland, TX

Cargill and DFM

Cargill Corp has committed to support undergraduate Mechanical Engineering education through student support and company involvement in developing new ME curriculum. Kathleen Brown (below left) and Tasha Timm (below right) are the first two ME students selected as Cargill Scholars. Both young women are incoming freshman. Kathleen is from Long Pine, NE, and Tasha Timm is from Grover, CO.



In addition to the financial support that Cargill provides, representatives from the company are working with the department in developing innovative curriculum, such as the new freshman class titled Design for Manufacturing (DFM). DFM is a course established to help

advance effective ME engineering design. Lab Coordinator Aaron Lalley, Lab Specialist Jay Bestgen, and Lab Technician Chuck Shilling were involved with developing this course, along with input from Cargill. The course includes hands-on training in the use of general shop equipment, mills, lathes, and 3D printers, as well as classroom lectures. There is a heavy emphasis on the integration of engineering training with industrial, real-world settings. Assignments include safety policies, zero tolerance, GD&T, Lean manufacturing, resource planning, and work order systems.

Cargill became a part of this effort this spring (2014). Brandon Anderson (ME07), of Cargill's GOSCNA Wichita, KS, site, delivered a lecture to the DFM students that detailed the importance of safety and how it applies to the role of the engineer at Cargill. His lecture was well-received by the students, convincing them of the importance of safety in the work place. There are plans to increase the level of Cargill's participation during their regular visits to campus, such as career fairs and Industrial Advisory Board (IAB) meetings.

In addition to their classroom input, Cargill is supplying personal protective equipment for the students while they are working in the machine shop. It's the active involvement of industrial partners such as Cargill that makes the mechanical engineering students' education at SDSM&T distinctive and promotes our tradition of excellence.

ME Program Statistics

20% Undergraduate growth from Fall 2012-13
615 undergrads in Fall 2013
514 undergrads in Fall 2012

33% Women undergraduate growth from Fall 2012-13
42 women undergrads in 2012
56 women undergrads in 2013

Fall 2013 Graduate Student Count: 25
14 MS graduate students
11 PhD graduate students

Accepted Graduate Students for Fall 2014
5 MS graduate students
8 PhD graduate students

41.2% Increase in prospective students visiting
ME department

Faculty Additions



Ali Heydari (assistant professor) received his PhD degree in mechanical engineering from the Missouri University of Science and Technology in 2013. He was the recipient of the Outstanding M.Sc. Thesis Award from the Iranian Aerospace Society, the Best Student Paper Runner-Up Award from the AIAA Guidance, Navigation, and Control Conference, and the Outstanding Graduate Teaching Award from the Missouri S&T. Dr. Heydari is a co-author of a book chapter and the author of more than ten journal papers in his research field, i.e., optimal control, nonlinear control, and control of hybrid systems. He is a member of IEEE, ASME, AIAA, and Tau Beta Pi.



Albert Romkes (assistant professor) was born and raised in Urk, a small fishing town and former island in the Netherlands. He received his MS in Aerospace Engineering with an emphasis on computational mechanics from Delft University of Technology, the Netherlands. He then moved to the United States and obtained a PhD degree in Aerospace Engineering from The University of Texas at Austin. Since then he has been a postdoctoral fellow at the Institute for Computational Engineering and Sciences of The University of Texas at Austin from 2003-2005. Subsequently, from 2005 to 2012, he was an assistant professor of mechanical engineering at the University of Kansas in Lawrence, Kansas. He finally joined the mechanical engineering department at SDSM&T in August of 2013. Dr. Romkes' research interests and expertise are in computational and applied mechanics and mathematics. His research efforts focus on the development of numerical approximation methods (particularly FE-type methods) for solving the response of physical phenomena arising in engineering applications, as well as their implementation into computer simulation tools.

ME IAB Holds Pre-M-Day Meeting on Campus



The Mechanical Engineering Industrial Advisory Board (ME IAB) met on September 19-20, 2013, for the first of two meetings during the academic year. The meeting included constructive discussion regarding department growth over the last three years and the accompanying challenges that this growth presents. Other topics included multidisciplinary engineering design and the new Stensaas Endowed Chair in STEM education. Members in attendance (*pictured l to r*) included: Larry Pearson (ME72), Mike Rizor (ME90), Tim Holleman (ME71), Dale Wilen (ME85), Don Cuperus (ME95), Paul Gnirk (MinE59), ME Department Head Mike Langerman (ME72), Randy Clarksean (ME83), Daniel Weinacht (ME84), Pat Hallauer (ME76), and Dave Berg (ME73).

Advanced Modeling Using Powerful Computers

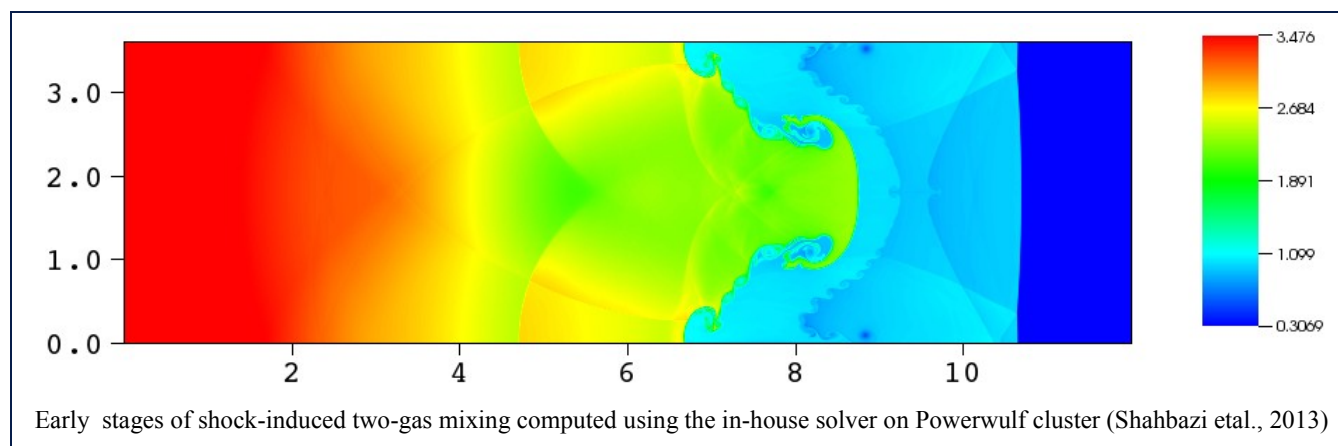
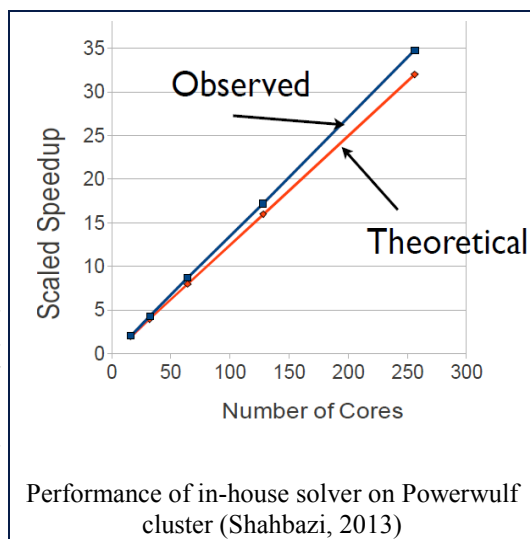
The mechanical engineering department has recently acquired a powerful, high-performance computing cluster, named Powerwulf, comprising of 256 compute cores of Intel E5 Xeon processors, with computing power of higher than 2 Tera FLOPS (floating points operations per second), with a total of 512 GB of RAM.

Facilitated by the Powerwulf cluster, Dr. Khosro Shahbazi's group



and collaborators develop advanced mathematical models, numerical algorithms, and software to understand and simulate complex fluid-flow systems with broad applications in design, energy, and biomedical engineering. Particular example applications include achieving shock-

induced, high-speed, fuel-air mixing for scram-jet engine design, limiting shock-induced, premature, fuel-oxidizer mixing and cooling in inertial confinement fusion for power generation, improving biodiesel production using high-intensity ultrasound and bubble collapse, and investigating targeted cancer drug delivery, using bubbles guided to the tumor site and excited using ultrasound waves. Excellent performance of the in-house compressible flow solver on the Powerwulf cluster in computing early stages of shock-induced two-gas mixing (relevant to scram jet engine) is shown in the figure.



Remember Your Alumni Association

The South Dakota School of Mines & Technology Alumni Association promotes communication and interaction among alumni, students, faculty, and administrators of the South Dakota School of Mines and Technology, with the objective of strengthening the school's academic, research, and service roles. Whether through the *Hardrock* or the *Hardrock E-News*, area meetings or reunions, the Alumni Directory or award programs, they are here to help you and to help our alma mater. So please consider supporting your Alumni Association with your contributions and your time. Learn more via <http://alumni.sdsmt.edu>.

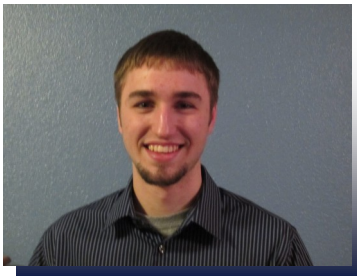
Outstanding Recent ME Graduate (Jeremy Banik)



As a program manager for the U.S. Air Force Research Laboratory Space Vehicles Directorate in Albuquerque, NM, Jeremy Banik (BSME '04, MSME '05) currently directs a \$15M research portfolio in spacecraft structural systems. He has authored 27 publications and holds 3 U.S. patents documenting deployable space structures inventions: solar sails; booms; solar arrays; and antenna platforms, some of which have been launched into space. Recently, he defended his doctoral dissertation in pursuit of a PhD in engineering from the University of New Mexico. As an associate fellow of AIAA, he co-founded the Spacecraft

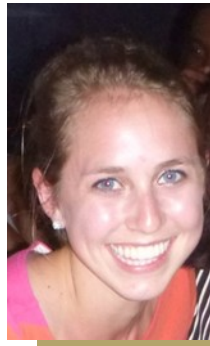
Structures Technical Committee and is currently serving as chair-elect. He has also served as the Structures' subject matter expert for DARPA and NASA programs. Jeremy enjoys the opportunity to mentor students through the Summer Space Scholars internship program at AFRL, and he actively serves on the leadership board at his local church and on the leadership board for a Rapid City-based, non-profit organization, Know the Covering Ministries.

Outstanding ME Juniors



Chase Ketterling is one of two recipients for the 2014 ME Outstanding Junior award. He is a second-year mechanical engineering student, intending to graduate in the spring of 2016. After graduation, Chase

plans to obtain employment in the automotive or heavy equipment industry. This summer, he will be completing an internship with Raven Industries Aerostar Division in Sioux Falls, SD. At SDSM&T, Chase is a member of the Baja SAE team, Society of Automotive Engineers, Tau Beta Pi, and the Newman Club.



Rebecca Ceremuga is one of two recipients of the 2014 ME Outstanding Junior award. She is slated to graduate in the fall of 2017 with a BS in ME and minors in applied biological sciences and Spanish. Following her graduation from SDSM&T, Rebecca will attend graduate school to earn a PhD in biomedical engineering. Her dream career would involve using her knowledge of biomedical engineering to help those less fortunate that are in

desperate need of medical attention. Ideally, her work will primarily be done abroad, where Rebecca can utilize her ability to communicate in Spanish. She is currently studying abroad in the Dominican Republic, where she has immersed myself in another culture to learn Spanish. Rebecca is also an undergrad research assistant in the Experimental and Computational Mechanics Laboratory, where she researches the distribution of bacteria in projectile wounds.

Outstanding ME Seniors



Luke Wilson is one of two recipients for the 2014 ME Outstanding Senior award, graduating in May 2014. Luke has accepted a full-time position with Flint Hills Resources at the Pine Bend Refinery in Rosemount, MN. For the past two summers, Luke interned with Caterpillar in the Peoria, IL,

area. In addition to his studies at SDSMT, he has been active with the SAE Mini Baja team, intramurals, and a swing dance group on campus.



Matthew Hochhalter is one of two recipients for the 2014 ME Outstanding Senior award, graduating in May 2014. Matthew has accepted a full-time position with Hutchinson Technology, Inc., in Hutchinson, MN. He has had internships with Western Biomass Energy and South Dakota State University REU.

Outstanding Graduate Student, 3rd Place (Joshua Hammell)



Josh Hammell is in his fifth year of PhD research in the mechanical engineering program at SDSM&T. For his academic success, Josh was awarded 3rd place Outstanding PhD Graduate Student at the 2014 Honors Convocation.

Over the past seven years, Josh has demonstrated his commitment to intellectual inquiry and to the advancement of the state-of-the-art in engineering. His passion for learning is inspiring to people around him, including many K-12 students who have attended his Additive Manufacturing demonstrations. In the fall of 2008, Josh joined the Laser Powder Deposition (LPD) research team under Dr. Langerman's guidance. Additionally, in the spring of 2009, he began conducting research under mentorship of Dr. James Sears in the Additive Manufacturing Laboratory (AML). In the summer of 2012, Dr. Sears stepped down from his position as director of AML. With the absence of Dr. Sears, Josh has been managing ongoing and new AML projects and partnerships.

These projects raise money for maintaining existing equipment in the lab, and for supporting his research and that of other graduate and undergraduate students working in the AML. He is also overseeing experimental LPD research, which has led to two peer-reviewed publications and several technical presentations at international conferences:

- **“Pragmatic Radiometry for Applications in Laser Powder Deposition”**
Abstract accepted for technical presentation, MPIF Event; Orlando, FL, May 2014
- **“Radiometric and Metallurgical Analysis of Zone Formation in Elementary Laser Deposited Thin-Wall Structures”**
Author; ASME Technical Publication; Presented in San Diego, CA, in November 2013
- **“Replacement of Chromium with Laser Clad WC Cermets”**
Presenter; TMS Event; Moline, IL, in April 2012
- **“Thermal Imaging of Laser Powder Deposition for Process Diagnostics”**
Author; ASME Technical Publication; Presented in Denver, CO, in November 2011
- **“Thermal Imaging for LAM Process Diagnostics”**
Presenter; LIA Event; Houston, TX, in February 2011

This research is also the basis for his PhD dissertation, which is focused on radiometric analysis of LPD components for feed-forward path and parameter planning. This research also served as the ground work for two grant proposals, totaling ~\$4million, submitted in October 2013 and January 2014. In addition, Josh obtained his Additive Manufacturing Certification, sponsored by the Society of Manufacturing Engineers (SME), in Youngstown, OH, in October of 2013. While in Youngstown, he also participated in the second National Additive Manufacturing Innovation Institute Program Management Review.

Over the past six years, Josh has mentored and helped support four graduate students and twelve undergraduate students, while conducting AML and LPD research. He is a natural leader and works well in groups. For these reasons and others, he has been called upon to serve on several search and screen committees formed to fill important vacancies in the mechanical engineering department. Additionally, he has participated in meetings of the Mechanical Engineering Industrial Advisory Board, offered several demonstrations in the AML for K-12 youth during Engineers Week (E-Week) and Youth Engineering Adventure (YEA), participated in department public relations photo shoots and meetings, and given countless tours of the facilities to prospective students and their families. Without question, he will continue to be a superb student and an asset to those he works with. After graduation, he plans to continue Additive Manufacturing research while teaching; there is no doubt he will continue to be a great ambassador for this institution.

Mechanical Engineering adds Kent 1440 lathe to manufacturing lab resources (Aaron Lalley)

In order to support the growing demand of undergraduate and research projects, the ME department has added a Kent RML-1440 manual lathe. This lathe replaced the Acer 1340 lathe, which was reallocated to the advanced material processing expansion in the business incubator. The Kent lathe complements our existing lathe resources, consisting of a Trak TRL 1630 CNC turning center and a precision Kent 1020 collet tool-room lathe. Tooling selection maximized interchangeability between the Trak and the new Kent to support our ongoing Lean Manufacturing initiative. The manual manufacturing lab is

focused on undergraduate training and project support, but also assists research. ME maintains a full complement of fabrication resources, including Vertical Machining Center, Manual Milling, Surface Grinding, various saws, smaller equipment, as well specialty equipment for composite material machining.

Professor Stensaas (Dr. Michael Langerman)

In 1946, Elden Russel (Stens) Stensaas became the first Professor and Head of the newly-approved Department of Mechanical Engineering. Under his leadership, undergraduate enrollment grew and the department went on to become the largest department on campus and has remained so over the years. In terms of enrollment, the ME department is over twice as large as the second largest department on campus, the Department of Civil & Environmental Engineering.

The Stensaas family has been a strong supporter of the department, beginning with the E. R. Stensaas Memorial Scholarship that was created upon his death in 1986. In the 1990s, the Stensaas Laboratory Endowment was established with significant financial support from the Stensaas family and, since then, with support from alumni and friends of the department. Their latest gift to the department, made possible by Jane (daughter of Professor Stensaas) and Gary Fick, is the Stensaas Endowed Chair in STEM Education.

I graduated in 1972, while Stens was still the mechanical engineering department head here at the School of Mines, and I remember him first and foremost as a teacher. Therefore, it is fitting that the Stensaas chair endowment focus on engineering education, with earnings from the endowment going toward support for a new faculty with an expertise in the science, technology, engineering, and mathematics (STEM) arena. A new ME faculty member with the desire to study the scholarship of teaching is not only a testament to Stens' legacy, but it is an expertise sorely needed in the department, for us to stay abreast of the changing trends in engineering education. Again, on behalf of the department, alumni, and friends, I would like to thank the Stensaas family, and in particular Jane and Gary Fick, for all the support they have provided the mechanical engineering department.

American Society of Mechanical Engineers (ASME) Student Chapter

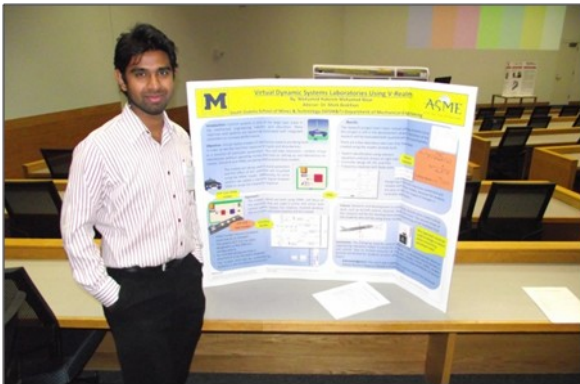
Tyler Nack (ME senior; Sioux Falls, SD) chaired the ASME student section for the 2013-14 academic year. The section was awarded an ASME Diversity Action Grant for K-12 outreach activities and the 2014 ASME Lucy and Charles W. E. Clarke Scholarship to award to incoming first-year ME students for the upcoming Fall 2014 semester. At the ASME Student Professional Development Conference in Madison, WI, the ASME Student Design Competition Team (Grubby) placed 5th out of 26 registered teams with their remote-controlled Unmanned Aerial Vehicle. Mohamed Hakeem M. Nizar (ME senior; Sri Lanka) placed 1st in the Old Guard Poster Competition, and Jerald Farke (ME senior; Armour, SD) placed 2nd in the Old Guard Oral Competition. Megan Frager (ME senior; Peoria, IL) was recognized with the District C nomination for the ASME Charles T. Main Award, which is the most prestigious award that can be conferred to an ASME student member.



2013-2014 ASME Officers and Active Members



Emerson Process Management Tour in Marshalltown, IA



Mohamad Hakeem M. Nizar Placed 1st in the ASME Old Guard Poster Competition



ASME Student Design Team L to R: Megan Frager, Eric Larsen, Jared Johnson, Steve Sobania, and Dan Bickett



Megan Frager Recognized with ASME Charles T. Main Nomination from Thomas Wendt, ASME District Leader



Steve Sobania flies the UAV at the 4th Grade Wilson Elementary Outreach Activity



ME Department Head's Message



Dear ME Alumni and Friends,

Eldon Russel Stensaas: Founder of the SDSM&T Department of Mechanical Engineering and the head of the department from 1947-1974.

I can remember when I was a senior back in 1971, running into Stens in the hall of the Civil/Mechanical building, and him taking me aside, saying, "Langerman, you are never going to get a job with your hair that long. Get a haircut." Back then, we were a rather rebellious, independent, anti-authoritarian lot, ready to break rules we deemed unnecessary. Well maybe, but the next day I showed up in Stens' IC engine class with my hair cut. Stens had a way about him, and you listened and did what he asked. He was the definitive model of an engineer and educator. He led the mechanical engineering department at SDSM&T from 1947 until his retirement in 1974. Although he saw enrollment in the ME department grow during his tenure to become one of the largest programs on campus, I believe even he would be surprised to see a program with approximately 100 students at the time he left become a program with over 600 students today. Although a

growing enrollment is a good thing, it brings with it the need to find additional resources to support the student numbers. In this regard, the Stensaas (and Fick) families have certainly stepped forward. The newly endowed Stensaas Chair in STEM education will allow the department to hire a faculty member whose focus is in engineering pedagogy and who will help lead our department forward and keep us at the forefront of engineering education.

Our undergraduate enrollment last fall climbed to a new record of 614 students, up about 20% from the previous year, including an increase of about 36% in our women enrollment. One forecast of our upcoming fall enrollment is the number of department tours given to prospective students and their families. So far in 2014, we have given 30% more tours than at this same time last year, so we are anticipating another record year this fall.

As always, our students represented the department well at national and international competitions and conferences. Dr. Ash should be commended for his dedication to the student section of ASME. His leadership has resulted in our section being consistently recognized for excellence in the region and nation.

Other news over the last year includes the hiring of two new faculty members. Additionally, we have three more faculty searches currently underway (including the Stensaas Chair), due in part to our enrollment growth.

As discussed in this newsletter, active industrial partners like Cargill are very important to the success of our program. We depend upon their input regarding how our curriculum offerings may better align with their needs. The DFM course, developed with input from Cargill representatives, is a good example of successful collaboration between industry and the ME program.

Finally, we anticipate sending the newsletter out via email in the future. So this may be the last newsletter in hard copy, unless there is a significant outcry from our constituents telling us otherwise. If you would rather continue to receive the newsletter in hard copy form, send an email to Leslee.Moore@sdsmt.edu so stating.

On behalf of the department, I want to thank you all for your support. Go Hardrockers!

Mike Langerman, PhD (ME 72, MS ME 74)
Professor and Head
Mechanical Engineering Department
SDSM&T