The deadline for automakers to nearly double fuel efficiency standards inched closer as Dr. Robert Prucka opened the door to a Clemson University lab and began work on an engine that bristled with sensors. The sensors are providing the data that could help solve some of the auto industry’s toughest engineering challenges. Prucka is sharply focused on one sensor in particular that he said could improve fuel economy by 1 to 2 percent at a relatively low cost to manufacturers. “These changes can sound small, but 1 percent of the fuel used in the country is a lot of fuel,” he said. “It’s a lot of money. It’s a lot of CO₂ emissions.”

The time crunch that automakers face is helping turn the spotlight on Prucka, an assistant professor who shares his passion for automotive engineering in the lab, classroom and beyond.

What drives his research now is the 2025 deadline that automakers face to sell a portfolio of cars and light trucks that average 54.5 miles a gallon. At the same time, the companies are under pressure to give buyers what they have come to expect from their cars: safety, performance, fun and affordability.

“When Prucka digs into the wires connected to the engine in the lab, he pays special attention to the EGR sensor. EGR stands for exhaust gas recirculation. The sensor measures how much recycled exhaust gas is mixing with fresh air in the engine. The information is fed into a computer, called the engine controller, which acts as the brains of the car. The computer can then use the data to control the EGR valve, making the engine run more efficiently.”

“Fuel economy is the No. 1 driver of our research,” Prucka said. “We’re trying to figure out how to control these complicated engines, so we can gain that extra fuel economy.” The research is funded by Bosch and the U.S. Department of Energy.

Prucka is a faculty member in the Department of Automotive Engineering, which is part of the College of Engineering and Science. He and his team are based at the Clemson University International Center for Automotive Research.

Prucka said that what excites him most is continued on pg 4
Dear Colleagues,

As a faculty member with an active research group, I appreciate the work and commitment required to produce consistently high quality research and scholarly effort. I also understand the value of helping each other with our goals. For this reason, I believe the main role of the Office of the Associate Dean for Research and Graduate Studies (ADRGS) is to support and enable the research and scholarly activities of our faculty, post-docs, and students. In this letter, I would like to take this opportunity to share several resources that the hard-working team of the CES Dean’s office, departmental faculty, staff, and students has made available to you.

We encourage large research proposal submissions and two of our resources are focused on this effort. The Transformative Initiative for Generating Extramural Research (TIGER) grants program is a seed program designed to provide financial support for interdisciplinary collaborations to develop competitive large proposals. To date, we have supported 30 teams. We have also recently hired Ms. Meghan Mullaney as a Large Research Proposal Coordinator (see below).

Two new searchable electronic resources are available to faculty and staff as we encourage a collaborative research environment. The CES Expert Database (www.clemson.edu/experts) is a researcher profile system designed to support interdisciplinary collaborations, help researchers find partners, and improve research visibility. The CES Equipment Inventory tool is now available (equipment.ces.clemson.edu) and provides a detailed listing of all CES equipment in the College. Special thanks to the lab managers in each department for their invaluable support in refining the equipment inventory.

The ADRGS Seminar Series continues to bring key speakers to campus this year from different funding agencies and to identify select CES faculty to share their experiences, and recommendations for working with different agencies. Many thanks to those CES faculty who have taken time to participate in this important activity. The annual CES Research Symposium also continues to provide a platform for faculty across the College to tell their stories and find research partners. Drs. Marcus, Ogale and Powell have provided exemplary leadership in organizing this valuable event. The 2nd annual symposium was held on March 12th.

The CES Post-Doctoral Support Office, enters its second year, providing resources to post-docs in departments across the College. Our post-docs have formed a Post-Doc Association, which is leading efforts in post-doc development at Clemson.

The CES Graduate Studies Office continues to support and coordinate many activities across the college. Specifically, the Dean’s Graduate Scholarships program is intended to encourage outstanding scientists and engineers to enroll in any Ph.D. degree program in the College of Engineering and Science. This award amounts to $3,500 per year for four years for certain students. Resources are made available to fund up to 10 positions for a given year. Please see your department graduate coordinator for details.

The CES Pre- and Post-Award Offices continue to provide high quality support for your research proposals and funded projects. Each office has a page on the CES Research Website with news, updates, and even proposal templates and sample budgets. With the implementation of the InfoEd electronic proposal submission system, I would like to ask you to promptly provide the proposal materials for uploading to the systems, and avoid submitting proposals by email. In addition, close oversight of your grant accounts with the Post-Award staff is much appreciated.

I also currently meet monthly with three groups who represent all of our departments and who have helped guide the initiatives above. The CES Research Infrastructure Committee consists of department lab managers and college staff and addresses timely and important topics related to College infrastructure, resources, and health and safety. The ADRGS Advisory Faculty Committee has been providing important support and guidance to me for the functions over the college research enterprise. I also meet monthly with the departmental Graduate Coordinator. There have been several beneficial exchanges in the group on the procedures and policies related to our graduate programs. This group has drafted proposals on parental leave and reduced graduate student application fees that are currently under consideration by the Graduate School.

Finally, Convergence, the newsletter you are holding, serves as an important communication to showcase the research and graduate studies activities across the College as we raise awareness across departments.

In my opinion, this list is a testament to the teamwork and support from many people from different corners of the College to create a strong and supportive environment for research and scholarship in the College. I hope, you find these resources instrumental. If you have any questions or suggestions for new ideas, please do not hesitate to send me a message (tkaranf@clemson.edu).

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working with the students who will become the next generation of engineers. His pas-
son helps explain why a 1991 Mazda Mi-
ata was sitting on a lift without tires near his
lab. The car was near the end of its life on the
road until it was given to Prucka and his new
student autocross team, CU-Racing.
They are taking apart the whole vehi-
cle, installing safety features and figuring out how to make it faster.

"Fuel economy is the No. 1
driver of our research" 
-Dr. Robert Prucka

But it isn’t enough to drop a massive en-
gine under the hood of the compact car.
Acceleration and handling win autocross
races, which are typically held in parking
lots and rarely go over 50 mph according to
Prucka. He tries to replicate what students
will face in the real world by making them
reach into the body, and in most of them an MRI contrast
agent is used. These MRI contrast agents
are a metal, gadolinium, which is made
non-toxic using a ligand, or a molecule
that binds to the metal. Though tiny, these ligands
are produced through a complex and messy
process. These ligands are also used with nearl
every metal for many applications and
just one specific version (cyclen) has been
in use for more than 5000 scientific papers.
They have also brought in business stu-
dents to help with the marketing.
When Prucka joined Clemson in 2008, the
automotive engineering program was two
years old. The department has grown to about
200 students and sends 94 percent of its
alumni into the automotive industry
or academia.

One of those students is Victor Gallas, a
Ph.D. student with Prucka. Gallas was on a team of students working with a
car strapped to a chassis dynamometer, which
is like a treadmill for cars. "At the end,
when you start seeing the data on the com-
puter and you start to understand the whole
system, that’s pretty cool," he said. “With
a lab like this you can quickly identify prob-
lem areas and develop plans to fix them.”

"The project is a pretty overwhelming task,
but it’s going to generate leaders in this
industry," Prucka said. “That’s why we do it.
It makes them a better engineer all around.
If you’re good with the hands-on activities
and you’re good in the classroom, you’re
going to get hired really quickly." About
dozen automotive engineering students
joined the team and were working to get the
Miata entered into a race before June.

The basic problem is the disconnect between the
types of chemists. Organic chemists are skilled at making molecules, but the inorganic
chemists who specialize at working with
metals are often not as skilled at making the
ligands that bind the metals. Matt, a transfer student to Clemson from Tri-
County Technical College (TCTC) started his academic career as a psychology major at
TCTC but soon switched to Chemistry. Matt
initiated a project to look for better ways with Dr. Modi Wetzler in the department of
chemistry.

"I realized from the beginning that this
would be an essentially graduate-level
project," said Dr. Wetzler, "and I was
originally hesitant to team up with an
undergraduate student. However, Matt’s
tenacity and clear commitment to the
project convinced me!"

To control the reactivity of the molecules
and force them to react in certain ways
frequently protecting groups - compounds
that protect the molecule from being
destroyed or reacted - are used. The
protecting group used in the synthesis of
these ligands is a byproduct of making the
artificial sweetener in Sweet’N Low.

"Chemists rely on this molecule because
it does a few things very well, and it’s very
cheap," said Dr. Wetzler. "But it’s a terrible
protecting group for these molecules
because it’s almost impossible to remove
at the end of the day.

"These advances could make a
real impact on human health!"
- Matt Wetsliewski

Matt thoroughly investigated a variety
of protecting groups. These protecting
groups have very diverse behaviors.
The original sulfonamide ones from 1974 go
very easily but never want to come off.
Another class of protecting groups, called
silyl ethers, come off when they interact with
water. "You’d think that would be a
real advantage, but imagine the difficulty
of working with these sensitive groups in
the humid South Carolina summers," said
Matt.

In addition to balancing the ease of putting the protecting
groups on and removing them, the
protecting groups also need to direct the
reactivity of the molecule.
It was here they found a
breakthrough. Historically chemists thought the problem
was a competition between the pieces forming the desired
acyclic compounds versus
reacting uncontrollably. Since 1974 chemists thought the protecting groups used in
the forty-year-old synthesis
prevent the polymerization,
but because Matt investigated a wide variety of protecting
groups very thoroughly he
found another process
was responsible for the low yields.

Everyone has been thinking it’s a
shape that favored forming the macrocycle you want, but
instead we discovered it’s an
electronic effect and specifically one that
is discussed in every first-semester organic
chemistry class," said Matt.

"By then accounting for that effect we
have been able to take the yields for the
oligomerization step, which have hovered close
to 50% for 40 years, to about 100% for
the first time! These advances could make
a real impact on human health!
Matt’s hard work led to an Innovation and
Creativity fellowship from the Atlantic
Coast Conferences, as well as several
departmental awards. His initial work also
opened up an entire Creative Inquiry project
with the Wetzler lab, with three other students
(Will Sharpe, Rebecca Pontius, and Matt
Church) working under his tutelage. This
work has been submitted to the Journal of
the American Chemical Society. Matt plans
to graduate this summer and apply to Ph.D.
programs in chemistry next year.
Dr. Julie Martin’s research shows educators play a key role

Engineering courses challenge even the brightest students, but they don’t have to do it alone. Dr. Julie Martin is on a quest to figure out what resources students need to pick the right engineering major and to stick with it until a degree is in hand. Her focus, in particular, is on how students’ social connections to parents, teachers, university officials and others can help them succeed.

And the results of her research might be surprising. She has found that Mom and Dad may not be as important as once thought, particularly once students pick their majors.

Educators play a key role, especially for first-generation college students, Martin and her collaborators found. In some of her latest research, Martin and her collaborators asked whether first-generation college students have less access to information, resources and opportunities than students from college-educated families. The researchers found that students from college-educated families had a broader access to information, resources and opportunities than students from college-educated families.

The results underscored how important it is to adequately fund and staff university engineering programs that help recruit, retain and reach out to students, researchers found. The programs have a greater benefit for first-generation college students but help all students build networks.

“Including parents is still important so they can provide whatever support and resources possible,” Martin said. “All of it helps.”

It is also important to reach students in community college or even earlier, researchers found. Middle- and high-school teachers can be particularly influential to first-generation college students. “Even a small gesture can have a big impact on a student’s future,” Martin said.

Researchers surveyed 1,410 engineering undergraduate students at five U.S. universities. They reported their findings in the International Journal of Engineering Education.

Martin served as the lead author. Matthew K. Miller, also of Clemson, and Denis R. Simmons of Virginia Tech collaborated. Miller is currently a General Engineering Instructor at Clemson. Simmons is in a tenure-track position at Virginia Tech.

Dr. Tanju Karanfil, associate dean for research and graduate students in the College of Engineering and Science, said that Martin’s work is shedding light on an important topic.

“The next generation of engineers will need an education before entering the workforce,” he said. “Dr. Martin’s work is helping us better understand what it takes to recruit and retain them. The state and nation will need them to remain competitive.”

Martin is an assistant professor in the Department of Engineering and Science Education with a joint appointment in the Department of Materials Science and Engineering. She is an NSF CAREER award winner for her research, “Influence of Social Capital on Under-Represented Engineering Students’ Academic and Career Decisions.”

Contacts: Julie Martin: jlmartin@clemson.edu
Paul Alongi: palongi@clemson.edu

“Even a small gesture can have a big impact on a student’s future.”

-Julie Martin

Her advisor, Dr. Alexis says “Ms. Petukah is the best Ph.D. student I ever had. She is so advanced that currently she is performing at a level of a postdoctoral researcher.” Matharya will be graduating this year and planning on pursuing a research and teaching career.

Academic Achievement Award for the best doctoral dissertation. This award includes a $3000 cash prize and will be presented at the annual meeting in Anaheim, California. Selbes’ advisor, Dr. Tanju Karanfil, says “This award is a great honor and truly recognizes the exceptional quality and outstanding effort that Meric put into conducting and reporting his excellent research.” Meric has recently started working as a consulting engineer at Hazen and Sawyer in Fairfax, Virginia.

Top Graduate Students Win Awards

Four graduate students receive top college honors

Each year, the College of Engineering and Science names two graduate students as Outstanding Graduate Research Assistants, and two students as Outstanding Graduate Teaching Assistants. This year’s awards in teaching went to Sarah Anderson, a Ph.D. student in Mathematical Sciences and Christine Duval, a Ph.D. student in Chemical and Biomolecular Engineering. Each of these graduate students has had tremendous impact in the classroom and been recognized by both faculty members and students.

Meric has recently started working as a consulting engineer at Hazen and Sawyer in Fairfax, Virginia.

Student to study in Australia

Mr. Ben Fellows, a Materials Science and Engineering graduate student working with Prof. Thompson Meford, has been selected to receive the prestigious and competitive NSF EAPSI (East Asia and Pacific Summer Institute) Fellowship. This award will allow Ben to conduct part of his research at the University of Western Australia this summer testing next generation metal oxide based MRI contrast agents.

Congratulations to each of these students!

For more graduate student news and awards visit: www.clemson.edu/ces/research/graduate-studies/
Making Regenerative Medicine a Reality

Team at Bioengineering’s CUBEInC works toward the future

According to the most recent statistics released by the American Heart Association, approximately 84 million people in this country suffer from some form of cardiovascular disease. Many patients undergo surgery to replace their dysfunctional heart valves, blood vessels or the whole heart.

The goal of Dr. Agneta Simionescu and the Cardiovascular Tissue Engineering and Regenerative Medicine Lab (CTERM Lab) is to develop novel strategies to translate the latest medical advancements to clinical settings to serve as scaffolds capable of directing adult stem cell differentiation into functional tissue. Biocompatible materials and 3D printing processes are being utilized to create tissue engineered heart valves and vascular grafts.

Together with graduate and undergraduate students, Dr. Simionescu develops compact three dimensional scaffolds to serve as scaffolds capable of directing adult stem cell differentiation into functional tissue. The ultimate goal of this research is to translate tissue engineering solutions to the patient and together with scientists and surgeons involved in CUBEInC research, the mission of the CTERM lab is to demonstrate that regenerative medicine is not something of the future, but it is actually here and now.

For more information, contact: agneta@clemson.edu

Dr. Liang Dong conducts ground-breaking research

Just as the Navy was deploying a laser weapon to the Persian Gulf, a Clemson University researcher already was thinking about how to make it more powerful.

Liang Dong said the laser aboard the USS Ponce has a range of less than three miles, but the Department of Defense would find that one that strikes targets more than 60 miles away.

Dr. Dong’s team is focusing its research on how to go into lasers that are designed to produce a wide variety of medium-energy laser beams that are often used in the medical treatment of cancer, for example, are used to cut Gorilla Glass that covers smartphones.

“We see the military application, but there is also industry revolution going on at the same time,” Dong said. “This is taking machining — cutting and drilling — to a different level.”

The Optical Society’s board of directors recently elected Dong a Fellow in recognition of his contributions to optics and photonics.

The society, which has 18,500 members, allows no more than 10 percent to be fellows.

Dong is an associate professor of electrical and computer engineering. His research funding comes from a variety of sources, including the Army, Air Force and the Clemson University Research Foundation.

Creating a powerful laser for either the military or industry starts with making highly specialized glass. Dong and his team combine various elements that are formed into a rod and put into a two-story “dumbbell.” The tower strings the molten hot glass into a fiber that looks like fishing line. As seen through a microscope, cross-sections of the fibers show they have symmetrical patterns, some resembling honeycombs. As many as six different types of glass are embedded within each cross-section.

“It becomes a very complex puzzle to put together,” Dong said. “Everything in it has to be just right so that it will be able to support a very well defined beam.”

Dong’s work carries on a proud Upstate tradition in lasers. Charles Townes, whose research led to the development of the laser, graduated from Greenville High in 1931 and went on to win a Nobel Prize for Physics in 1964.

In lasers used as weapons, a low powered laser goes through several amplifiers to increase the power. Dong and his team are developing a “last stage amplifier,” which does the most demanding work.

“It becomes a very complex puzzle to put together.” — Liang Dong

In manufacturing lasers are already surpassing conventional machining tools, Dong said. The global market for lasers used in the optical processing grew from 1.7 billion euros to 2.4 billion euros from 2005 to 2012, according to Optech Consulting.

In the same period, the market share of optical laser-gas lasers grew from 4 percent to 18 percent.

The “Holy Grail” that Dong and other researchers are chasing is using lasers to create a more efficient fuel-injection system in a car engine, he said. A fuel-injection nozzle is a tube drilled with very fine holes. Fuel is pressurized to form a spray into the engine. The finer the spray, the more efficient the engine.

“The key here is to drill those small holes, a large number of them in a production process in a consistent fashion,” Dong said. “If you can do this, you can make billions of dollars.”

Contacts:
Paul Alongi: palongi@clemson.edu
Liang Dong: dong4@clemson.edu
Updated risk policy enacted

A proposal must be received, evaluated, and signed off on by the Office of Sponsored Programs or the appropriate certified office prior to requesting a risk project.

All required compliance protocols (Human Subjects, Animal Subjects, Biohazard/Chemical, and or Recombinant DNA) must be approved or have developmental approval prior to initiation of the risk request. All risk project requests must be evaluated by the Export Control Officer.

The snapshot from InfoEd, and internal budget for the requested amount, and the sponsor approval if required, must be included with the Risk Project Request/Approval Form. This packet can be emailed to the Director of Grants and Contracts Administration.

A risk project number is valid for 90 days and up to $50,000 or the amount proposed, whichever is less. If a project is not awarded within 90 days and more time/money is needed, approval by the Director of Grants and Contracts Administration is required.

Change to pooled fringe benefit rates for 2015-2016

Please use the following pooled fringe benefit rates for FY2015-2016

<table>
<thead>
<tr>
<th>Employee Type</th>
<th>FY2016</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 month</td>
<td>29.6%</td>
<td>+1.4%</td>
</tr>
<tr>
<td>Administrator</td>
<td>36.2%</td>
<td>+2.2%</td>
</tr>
<tr>
<td>Students</td>
<td>7.3%</td>
<td>+2.0%</td>
</tr>
<tr>
<td>Part-time/Temporary</td>
<td>16.2%</td>
<td>-6.6%</td>
</tr>
</tbody>
</table>

Uniform guidance update

The Following are changes included in the new Uniform Guidance:

- **Publication Costs** - Allowable up to 90 days after project end date if included in proposal
- **Administrative & Clerical Costs** - Allowable as a direct cost if all of the following conditions are met:
  1. Services are integral to the project,
  2. Individuals can be specifically identified with the project,
  3. Costs are explicitly included in the budget or have the prior written approval of the Federal awarding agency,
  4. Costs are not also recovered as indirect costs
- **Computing Devices** - Allowable with sponsor approval even if not solely dedicated to project

For complete policies and all updates, please visit www.clemson.edu/research/grants-contracts/policy/

CES Faculty Experts system

www.clemson.pure.elsevier.com

The College of Engineering and Science has purchased a faculty profiling system through Elsevier. The system pulls publications and output from SCOPUS and other databases as well as current research projects to generate a researcher profile. This profile can be used to share research information, identify past and future collaborators and increase the visibility of College of Engineering and Science faculty researchers.

CES Searchable Equipment Inventory

equipment.ces.clemson.edu

The searchable inventory is a tool that catalogs all inventoried equipment in the college. This tool is designed to promote collaborative research efforts across the departments and to increase awareness of the resources already in place. If you have any questions about this project, please contact Phil Landreth at lralph@clemson.edu