IEP CATEGORY • TALENT

Building Next Generation Engineering Talent at the Clemson University International Center for Automotive Research (CU-ICAR)
AT CU-ICAR, TALENT IS PART OF AN ECONOMIC DEVELOPMENT ECOSYSTEM. CU-ICAR provides an example of a national best practice for public-private partnership focused on talent development aligned with industry research and education. The $250+ million innovation campus—founded in collaboration with Clemson University Foundation, BMW, Michelin, Timken, the state of SC and others—launched the first graduate program in automotive engineering (AuE) in the US in 2007 as a direct response to industry needs. CU-ICAR’s business model includes industry partnerships through the AuE graduate programs and a core economic development mission supported by CU-ICAR’s Partnership Office. The Partnership Office is charged with making connections between automotive companies within CU-ICAR and SC’s automotive cluster.

Twelve different partnership models exist to promote interaction with the campus, linking automotive companies to Clemson students, faculty and research expertise, and providing resources to connect industry throughout the region.

The need for MS and PhD programs in Automotive Engineering was originally identified by BMW Manufacturing and reiterated by Michelin and Timken, all major employers and investors in SC. These companies have since made significant monetary commitments to the program. Clemson’s Department of Automotive Engineering (AuE), is housed in the College of Engineering and Science and offers MS and PhD programs in Automotive Engineering focused on Systems Integration. This program is also part of the College’s national commitment to meet Grand Challenges through innovation and relevance.

AuE faculty are internationally recognized experts in Advanced Powertrains, Manufacturing and Materials, Vehicular Electronics, Vehicle-to-Vehicle and Vehicle-Infrastructure Integration, Vehicle Systems Integration and Vehicle Performance, including Human Factors and Human Machine Interface (HMI).

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4. BMW provided $25M, matched by the State through the Centers for Economic Excellence program, resulting in an endowment of $31M.
CAR cultivates engineering leaders with deep knowledge of a particular technical field, the ability to work in multi-disciplinary teams and a strong, holistic understanding of product development.

Students collaborate with cross-functional teams and learn to handle complex organizational functions and work with colleagues with differing perspectives. They are trained to understand systems, cultural, societal and political forces, are expected to tackle complex problems and are encouraged to be thoughtful about the impact of their work and product. A key element of this is the vehicle prototyping program known as the Deep Orange Initiative.

**DEEP ORANGE INITIATIVE.** Each year, AuE students develop a unique prototype vehicle with a specific market focus and technical objectives. Deep Orange participants create and manufacture the vehicle prototype in partnership with industry sponsors, giving students the chance to gain comprehensive technical knowledge as well as valuable “soft skills” including collaboration, conflict resolution, and creativity. Industry partners (entrepreneurs, suppliers, and OEMs) are offered a neutral open-innovation and proof-of-concept platform to develop, integrate, showcase and verify new innovations and technologies in a full-vehicle working product. Knowledge gained feeds directly back to both industry and academia.

The use of industry-relevant teaching and mentoring methods aligns academic and industry practices and prepares students to address the future challenges of the automotive industry. Deep Orange also supports the growing industry cluster in

Deep Orange 5 is designed for generations Y and Z (young adults) who will live in mega cities in 2020. “Deep Orange 5 is about creating a better value proposition for young adults that have little money to spare, less interest in vehicle ownership than previous generations, yet need a personal mobility solution that aligns with their complex lifestyle,” said Paul Venhovens, BMW Endowed Chair in Automotive Systems Integration in the department of automotive engineering at CU-ICAR.

Janet Goings, Associate Director of Research and Development at General Motors, said, “Our experience working with these students was exceptional. They came up with creative and innovative ideas for their defined target consumers. We were very impressed with their holistic approach and final result of this accelerated product development process.”
the southeast, connecting startups and medium sized companies with multinational OEMs like Toyota, Mazda, General Motors and BMW—all of which have sponsored Deep Orange. Deep Orange 5, the latest iteration of the project, was sponsored by General Motors and revealed at the GM world headquarters in Detroit in conjunction with the Society of Engineers (SAE) International World Congress. The value of this program for students and private sector partners has resulted in a recurring state funding allocation of $750,000.

**THE CENTER FOR MANUFACTURING INNOVATION (CMI)** is a facility and academic collaboration between CU-ICAR and Greenville Technical College focused on developing the pipeline of next-generation advanced manufacturing production and engineering technicians. Top AuE graduate students will research and investigate new manufacturing methods and approaches, working alongside advanced technical college students to organically “cross-pollinate” ideas, while also linking local high schools, recruiting programs and bridge programs to allow a student to move from associate’s to bachelor’s degrees. This represents a new model of education designed not to retroactively bridge the “valley of death” between laboratory research and commercialization, but rather to fill in the valley as technologies evolve. As a result, newly developed manufacturing processes and systems will be more practical and implementable, and there will be a trained workforce ready to support emerging technologies and approaches. Currently under construction at CU-ICAR, CMI has received strong support from manufacturing leaders such as BMW, Michelin, GE, Bosch Rexroth, ADEX Machining Technologies, League Manufacturing, JTEKT Koyo, and others.

**TALENT OUTCOMES AT CU-ICAR.** Since launching in 2007, the AuE MS and PhD programs have received national and international recognition, resulting in a record number of applicants. The growth in the graduate program has been immense, averaging about 200–210 students annually. For Fall 2015, 203 students from 18 different countries were registered for the AuE program (65 PhD and 138 MS students). Through May of 2015, AuE graduated a total of 28 PhD and 229 MS students, 95% of which are employed in the automotive industry, predominantly
in South Carolina and Michigan. Alumni have gone to work for Ford, Fiat Chrysler, General Motors, Toyota, Honda, Audi, Volvo, Mercedes-Benz, Daimler, BMW, Michelin, Tesla, Goodyear, Navistar, Caterpillar, Mitsubishi, Bosch, Cummins, John Deere and Magna, among others.