



UNIQUE AUTOMOTIVE R&D CAMPUS

As a cornerstone for the auto industry, BMW, the state of South Carolina, and Clemson University formed a partnership to establish a premiere automotive / motorsport research center in Greenville. The Clemson University International Center for Automotive Research (CU-ICAR) is located on a 250-acre campus along I-85. CU-ICAR is the home to the Clemson University Graduate Engineering Center that offers advanced degrees in automotive engineering and motorsport technology.

ALTERNATIVE ENERGY VEHICLES

Proterra

In 2010, Proterra, an electric and hybrid bus manufacturer, announced its plans to relocate from Denver, Colorado, to build a full-scale, state-of-the-art research and development center and manufacturing plant on the campus of CU-ICAR (Clemson University International Center for Automotive Research) in Greenville.

- Investment of \$68 million and 1,300 new jobs
- Capacity to create 2,500 EcoRide™ Battery Electric-35 buses annually

AUTOMOTIVE

BMW Driving Growth

With the decision to locate in Upstate South Carolina in 1992, BMW Manufacturing Co. has created momentum for overall growth in the Southeastern automotive region. Since then, the Spartanburg plant has produced a total of 1.6 million units and has contributed an estimated \$4.6 billion to South Carolina's economy. Currently, BMW is responsible for 23,000 jobs in South Carolina and generates \$1.2 billion in annual wages and salaries.

- This plant exports 70% of their throughput to BMW's other world markets, making the facility truly a substantial "world plant"
- 1,600 new jobs are being created at the Spartanburg plant as a result of a fifty percent increase in production capacity set for 2011

BMW Suppliers

- With BMW's decision to locate in the Southeast, forty of its suppliers are now located within a few hours of the Spartanburg County plant
- The rippling effect from these moves has resulted in the creation of more than 10,000 jobs for the state

CASE STUDY

Deep Orange

Deep Orange is a graduate engineering vehicle prototype design program at CU-ICAR that focuses on an open-architecture approach to simplify engineering and integration of key automotive components. A new vehicle prototype is engineered and manufactured each year through the collaborative efforts of the students, faculty, and participating partners. Deep Orange currently has over twenty technology partners that assist in this program. The focus of each project is to nix industry norms and effectively utilize the latest vehicle technologies by eliminating these constraints. Each year is unique, with different problems to overcome and different parameters for success.

Focus Areas for Deep Orange include:

- Vehicle Architecture
- Alternative Powertrain Integration
- Infotainment Integration
- Safety
- Flexible Supply and Lean Low-Cost Manufacturing Concepts



COMPANY SUPPORT

Greenville County automotive companies participate in an industry cluster group. The cluster is focused on utilizing the combined resources and strengths of the participating companies in combination with local and state agency resources to address workforce development, supply chain, and public policy needs.

SELECT AUTOMOTIVE COMPANIES

Alfmeier: Fuel tank and Gauge Systems
Bosch Rexroth: Hydraulic Fluid Pumps
Caterpillar: Mid-range Diesel Engines
Eberspaecher North America: Mufflers
JTEKT: 4WD couplings
Kolektor TKI: Motors and Generators
KS Bearings Inc.: Fuel Pumps and Auto Components
KS Gleitlager USA Inc.: Motor Vehicle Bearings
Magna / Drive Automotive Industries: Major Body Panels and Assembly
Michelin North America Inc: Car and Light Truck Tires
Nissan: Automotive Parts Distribution
Pierburg: Hydraulic Fuel Systems
PRETTL North America: Wire Harnesses
Proterra Inc.: Advanced Battery-Powered Vehicles and Systems
Safety Components: Air Bags
Sage Automotive Interiors: Automotive Fabric
Standard Motor Products Inc.: Ignition Coils and Fuel Injectors
Stueken LLC: Fuse Caps
TBMC Inc.: Timing Belts

CLEMSON UNIVERSITY INTERNATIONAL CENTER FOR AUTOMOTIVE RESEARCH (CU-ICAR)

Clemson University International Center for Automotive Research (CU-ICAR) is an advanced-technology research campus located in the City of Greenville that focuses on automotive research and innovation. CU-ICAR offers the nation's only doctoral program in automotive engineering via Clemson University and holds some of the most heavily endowed chairs in the nation. These include:

- BMW Endowed Chair in Systems Integration
- BMW Endowed Chair in Manufacturing
- Michelin Endowed Chair in Vehicular Electronics Systems Integration
- Timken Endowed Chair in Automotive Design and Development

There are currently a number of existing on-site partnerships with select companies, such as BMW, SIMPACK, Ozen Engineering Inc., CADFEM, EnginSoft, JTEKT Group, and

Proterra. Funding includes \$50 million from public partnerships and \$200 million from private partnerships. Companies have access to the research facilities at no cost.

Center for Emerging Technologies (CET)

- Located on the Clemson University International Center for Automotive Research (CU-ICAR) campus
- Three-story, multi-tenant, 60,000 SF Class-A facility
- Funded in part by a \$3 Million Economic Development Administration Grant from the Federal Department of Commerce
- The CET will house smaller, separate work areas to benefit multiple tenants that desire a position on campus but with a smaller footprint



CU-ICAR'S UNIQUE R&D LABS

- Renk Labeco 4-Wheel 500 HP Chassis Dyno and Faist Semi-Anechoic Chamber
- MTS 320 Tire Road Simulator and Weiss Climate Test Chamber
- Zeiss Pro T Select Dual Column Vehicle CMM
- FEV 580 HP Engine Dyno Test Cell
- ETS Lindgren Electromagnetic Compatibility Chamber



SPECIALIZED AUTOMOTIVE TRAINING FOR OUR WORKFORCE

Greenville Technical College Automotive Engineering

Greenville Technical College Automotive Engineering programs cover virtually all aspects of engineering and design for automotive components:

- Greenville Tech-Street Rods and Customized Care Program
- Motorsports Technology Program
- Mechanical Engineering Technology with Auto Focus
- Welding Program
- Machine Tool Technology
- CATIA Software Training
- Lean Manufacturing and ISO Programs

Mechatronics Program at Greenville Technical College

- Five Upstate technical colleges, including Greenville Tech, have collaborated to offer training in the field of mechatronics
- This area of high-tech problem-solving covers the disciplines of control systems, electronic systems, and computers and mechanical systems
- Professionals in this program will gain knowledge in the following:
 - Systems integration
 - Machinery placement and installation
 - Preventive and predictive maintenance

readySC

readySC provides customized pre-employment training at no cost to new and expanding industries in the state via technical colleges such as Greenville Tech.