

**CLEMSON UNIVERSITY**

**College of Engineering and Science**

**REQUESTING APPROVAL OF A NEW CENTER**

**Clemson University Center for Workforce Development**

Submitted to the South Carolina Commission on Higher Education

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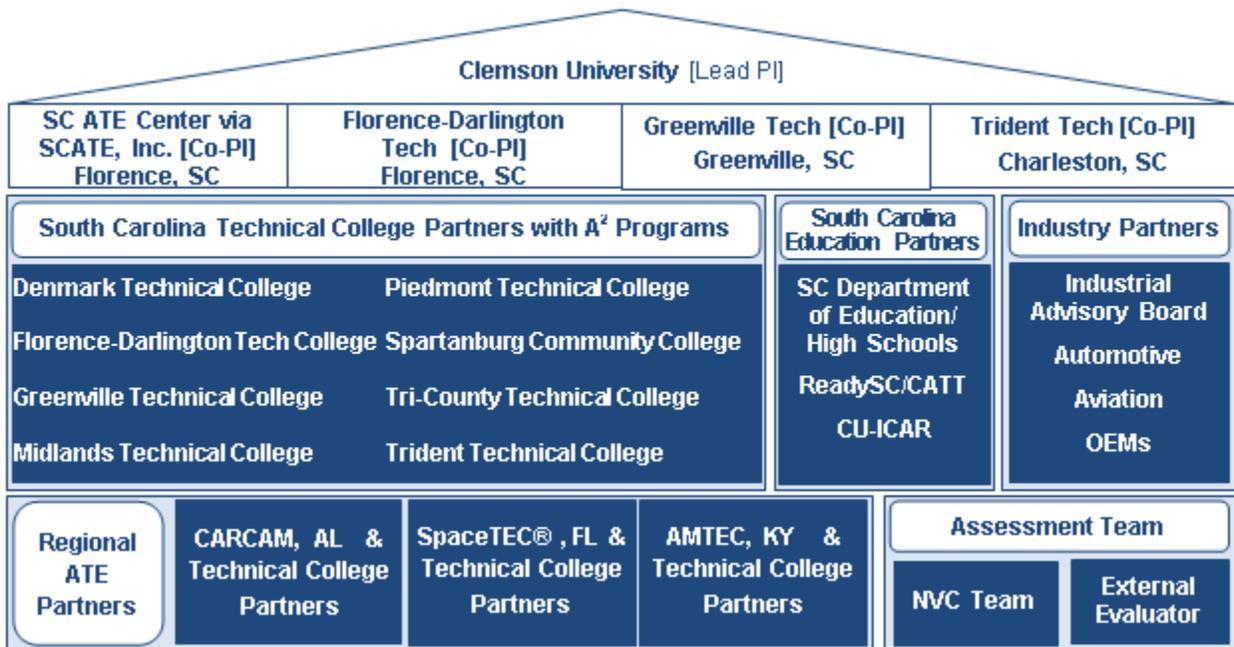
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## Program Planning Summary

### Clemson University Center for Workforce Development

With initial funding from the National Science Foundation (NSF) Advanced Technological Education (ATE) program, Clemson University proposes the creation of the CU Center for Workforce Development (CUCWD). The collaborative team, consisting of Clemson University, SC ATE National Center via SCATE, Inc. (501-c-3, not-for-profit), Florence-Darlington Technical College, Greenville Technical College, Trident Technical College; in partnership with SpaceTEC®, AMTEC, CARCAM, and the South Carolina automotive and aviation [A<sup>2</sup>] industry, proposes to develop a Regional Center for E-Learning to conduct advanced A<sup>2</sup> technical education using virtual classrooms, personalized learning and E-learning technologies. This effort focuses on industry clusters with significant investments in SC. Because the southeast is a hub of automotive and aviation industry, **CUCWD** emphasizes creating advanced curriculum delivery technologies, evaluating existing instructional material, and assessing teaching practices and workplace preparedness for the modern A<sup>2</sup> industry. **CUCWD** will work closely with other state-wide workforce development and educational entities including eight SC Technical College Partners, the SC Department of Education (K-12), the SC Equity Resource Center, the SC Department of Commerce, and the SC Center for Accelerated Training (CATT). Figure 1 presents **CUCWD** overall organizational structure.



**Figure 1. CUCWD Center Organizational Structure**

**CUCWD** will aim increase the quantity, quality and diversity of highly skilled technicians in these critical disciplines. Learning modules will be developed or adapted as “plug and play” to maximize

instructor and program flexibility in introducing/using E-learning. Modules may be coupled to create courses, and content may be used in many existing courses. The main goals and objectives of **CUCWD** include:

- (1) *creating a CUCWD Virtual E-School by expanding automotive/aviation technician education programs at technical colleges via innovative and cost-effective E-learning options to support the automotive/aviation curriculum. The focus is to develop/deliver E-learning modules with virtual reality or similar high-level visualization/simulation tools for A<sup>2</sup> fields for region-wide implementation/evaluation;*
- (2) *increasing access to support recruitment and learning for automotive and aviation students through this SC-A<sup>2</sup> Network. The PIs will make E-learning lessons available to high school teachers, use E-learning to increase the accessibility of A<sup>2</sup> technician education programs for students in programs at capacity enrollment, for students in remote schools and underrepresented groups/communities, for students that will benefit from alternate teaching methodologies, and for students facing challenges in attending courses on campus;*
- (3) *broadly disseminating advanced technology E-learning modules for use by automotive and aviation technician education programs and industry by implementing modules across SC via strategic partner networks to provide industry partners with options so that the CUCWD Regional ATE Center may develop learning modules for their training needs;*
- (4) *advancing the long-term sustainability of CUCWD*

**Broader impacts:** This innovative approach represents a much-needed first effort to extend tested E-learning technology integrating visualization and simulation tools to the A<sup>2</sup> technology curriculum in SC technical colleges. **CUCWD** will introduce and evaluate next-generation teaching/learning to replace existing multimedia approaches, which, while valuable, cannot accurately reproduce the complexity of today's processes and systems. **CUCWD** will provide alternatives for place-bound and capacity-constrained A<sup>2</sup> programs and for instructors facing significant challenges in teaching "legacy" technologies while introducing new and emerging technologies. **CUCWD** also provides solutions for meeting the diverse learning and scheduling needs of today's students. In addition to obtaining a better understanding of the use of visualization/simulation/VR as a pedagogical tool, the successful completion of this effort will fill a state and national need for well-prepared technicians entering the A<sup>2</sup> industry. Immersing students in this **CUCWD** E-learning environment will provide them with a more realistic and accurate perspective of the complex A<sup>2</sup> environment, that can be effectively internalized and transferred to the workplace. Research results will also greatly enhance a wide range of science, technology, engineering, and mathematics (STEM) vocations.

**Intellectual merit:** This Greenville, SC based ATE center, with satellite offices in Florence and Charleston, has the expertise and technology to support A<sup>2</sup> technician education across the geographically dispersed A<sup>2</sup> community in South Carolina. This research initiative will be led by Dr. Anand Gramopadhye, Clemson University; Mr. Carey Castle at Greenville Tech (automotive and aviation engineering and virtual school technology); Dr. Dale Doty, Florence-Darlington Technical College (distance learning, industry partnerships for technician education, and liaison with the college's EON Reality Center); Dr. Barry Franco, Trident Technical College (aviation manufacturing); and Ms. Elaine Craft, Florence-Darlington Technical College (experienced National ATE Center Director with focus on expanding excellence in technician education). Synergistic partnerships with existing regional centers will be leveraged to significantly enhance the recent regional A<sup>2</sup> curriculum development. Clemson University has been engaged in several previous NSF ATE initiatives with multiple SC Technical Colleges focusing on education and workforce preparedness of technical professionals. Participants have expertise in aviation, automotive and industrial technology education, virtual reality, simulation, human/machine systems design, computer supported collaboration, asynchronous learning technologies and curriculum assessment with demonstrable results from previous funded projects in the

aforementioned areas. They are experienced practitioners who possess a diversity of experience and test beds for integrating the virtual curriculum products. **CUCWD** will meet the regional need for automotive and aviation technicians, while elucidating a greater understanding of the use of virtual classrooms as a pedagogical tool.

**Outcomes:** **CUCWD** will aim to deliver the following outcomes:

- (1) an innovative, high-impact personalized learning virtual school curriculum model for training technical college students and industry employees in aviation and automotive maintenance;
- (2) an increased pool of skilled labor ready for immediate transition into industry;
- (3) development of recruiting and mentoring materials to attract under-represented groups to **A<sup>2</sup>** technology;
- (4) development of the virtual school as a standard pedagogical tool; and (5) creation of a national collaborative venture among Universities, community colleges, industry and high schools.

**Center Management and Launch:** The protocol center management and launch will be guided by the details outlined in NSF proposal #2010-001449.

### **Demand, Potential for Duplication:**

There is no duplication of this effort. It will be synergistic with existing centers and institutes on campus. Most importantly it places Clemson University as the lead institution in STEM education as it applies to aviation and automotive advanced manufacturing in partnership with Technical Colleges state-wide.

The need for this collaborative **A<sup>2</sup>** (aviation/automotive) Regional Center for E-Learning led by Clemson University, Florence-Darlington Technical College, Greenville Technical College and Trident Technical College is most apparent. Government, education and industry groups are beginning to address the deep and growing shortage of automotive and aerospace maintenance professionals.

While SC has 16 technical colleges serving 46 counties, the ability to prepare vast numbers of aviation and automotive maintenance professionals is seriously constrained through traditional face-to-face educational approaches. Whereas the need for these professionals in SC, has become acute, current approaches have yielded only a fraction of the necessary workforce. The great challenge involves attracting, educating and upgrading “**Next Gen**” automotive/aviation technicians well-versed in both current and future technologies [e.g., automotive fuel cells/hybrid vehicles in automotive, composite/systems integration issues]. The current “brick and mortar” approach of using the resources of only a single institution to deliver this education is untenable; we must work smarter and leverage the best available technology to prepare more and better graduates in a cost-effective way.

The opportunity we propose is **CUCWD**, a center that draws upon statewide and other existing ATE center expertise to deliver effective technology education through E-learning. **CUCWD** fills a state and national need for preparing aviation and automotive technicians while elucidating a greater understanding of the use of Virtual Classrooms as a pedagogical tool. **CUCWD** brings together the academic strength of three of the state’s largest technical colleges with significant **A<sup>2</sup>** programs: the 3-D visualization development capability of the Southeastern Institute of Manufacturing and Technology (SiMT) at Florence-Darlington Technical College; and the technical, research, engineering, and leadership strength of both Clemson University (CU) and CU- ICAR (International Center for Automotive Research). The state’s leading **A<sup>2</sup>** have participated in the planning process and enthusiastically pledge support to achieve the **CUCWD** vision. Because the automotive/aviation industries are vital to both SC and the southeastern economy, developing engaging computer-enhanced teaching techniques to meet diverse learning and scheduling needs for those pursuing **A<sup>2</sup>** careers is critical. Although E-learning opportunities have expanded greatly at SC colleges, options providing contextual learning in technology education are rare. E-learning in **A<sup>2</sup>** that provides content in the context of real-world applications, including hands-on

laboratory experiences, has yet to be developed. Technology and software advances now make this possible if we cost-effectively develop this resource collaboratively and not college-by-college (as is done with E-learning in general education).

The primary target for CUCWD E-learning is two-year technical and community college faculty and their students in associate degree, A<sup>2</sup> technician education programs. Working through partners within the South Carolina technical college system, CUCWD will also use the virtual teaching environment to encourage and assist high school students in choosing careers as either aviation or automotive professionals. The CUCWD initiative is innovative in that it *specifically targets the young and more technology-oriented, which is the ideal point for building the foundation for a rewarding career*. For example, the FAA-approved aviation training school at Greenville Technical College with 147 students can be made available statewide by expanding this comprehensive curriculum into virtual technologies and E-learning via the CUCWD initiative.

**Costs [items 1 through 6 are part of NSF budget; item 7 supported by Office of Sponsored Research]**

	<b>Annual Costs</b>	<b>Explanation</b>
<b>1. Director</b>	\$37,500	Supplement for director [2 blocks; 25% of 9 month salary] from grant
<b>2. Office Manager</b>	\$20,000	
<b>3. Administrative Assistant</b>	\$15,000	
<b>4. Events &amp; Forums</b>	\$5000	Outreach events
<b>5. Travel &amp; Supplies</b>	\$15,000	
<b>6. Web support</b>	\$10,000	
<b>7. Café Space at ICAR</b>	<b>\$36,000</b>	<b>VPR's Office</b>
<b>Total</b>	<b>\$138,500</b>	

## **Organizations and Institutions committed to CUCWD:**

**CUCWD** has received 35 letters of commitment from different organizations and institutions around the state. Below is a complete list of those that have commitment to advancing technical education through **CUCWD**.

### Primary Institutions

Clemson University  
 Greenville Technical College  
 Florence-Darlington Technical College  
 Trident Technical College  
 South Carolina Advanced Technological Education Center of Excellence / SCATE Inc.  
 Clemson University International Center for Automotive Research (CU-ICAR)

### Anchor Companies in Automotive & Aviation

BMW	Michelin
Boeing	Milliken
Bosch	Palmetto Nissan
GE	Proterra
Honda	Raceway Automotive Inc.
Honeywell	South Carolina Technology & Aviation Center (SCTAC)
JBE	Stevens Aviation
Lockheed Martin	

### South Carolina Technical Colleges

SC Technical College System	Piedmont Technical College
Denmark Technical College	Tri-County Technical College
Midlands Technical College	Spartanburg Community College

### NSF ATE Centers Letters of Commitment

AMTEC	CARCAM	SpaceTEC®
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### Other Institutions

Federal Aviation Administration (FAA)  
 readySC / CATT  
 South Carolina Department of Education [Greenville County School District, Charleston County School District, Darlington County School District]  
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### **People involved or interested**

Dr. Anand K. Gramopadhye, IE, COES  
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 Dr. John Wagner, ME, COES  
 Dr. Mary Beth Kurz, IE, COES  
 Dr. Imtiaz Haque, AuE, COES  
 Elaine Craft, Florence-Darlington Technical College  
 Dr. Dale Doty, Florence-Darlington Technical College  
 Cary Castle, Greenville Technical College  
 Barry Franco, Trident Technical College