

**Final Report for Period:** 03/2011 - 03/2011

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**Principal Investigator:** Moore, Elliot .

**Award ID:** 0648584

**Organization:** GA Tech Res Corp - GIT

**Submitted By:**

Moore, Elliot - Principal Investigator

**Title:**

REU Site Proposal: Collaborative Research Experiences in Advanced Technology and Engineering (CREATE)

### Project Participants

#### Senior Personnel

**Name:** Moore, Elliot

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Name:** Sonnenberg-Klein, Julia

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Name:** Laszcz, Matthew

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

#### Post-doc

#### Graduate Student

#### Undergraduate Student

**Name:** Boullain, Laura

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Brown, Justin

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Dixon, Cheryl

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Harris, Dalton

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Knight, Kenneth

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Mitchell, Jeffrey

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Pope, Cody

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Sousa, Molly

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

**Name:** Swearingen, Colin

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Participated as part of the Engineering Alliance summer research program

#### Technician, Programmer

#### Other Participant

#### Research Experience for Undergraduates

**Name:** Bryant, Ernest

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior

**Home Institution:** Same as Research Site

**Home Institution if Other:**

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2007

**REU Funding:** REU site award

**Name:** Fiser, Andrew

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior

**Home Institution:** Same as Research Site

**Home Institution if Other:**

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2007

**REU Funding:** REU site award

**Name:** Tyson, Koya

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior  
**Home Institution:** Same as Research Site  
**Home Institution if Other:**  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Woldman, Alexandra

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Freshman  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Cornell University  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Dombrowski, Brian

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Clemson University  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Joiner, Jason

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Coastal Georgia Community College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Sawyer, Mark

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** South Georgia College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Mugisha, Odile

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Darton College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Hardin, Will

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Coastal Georgia Community College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2007  
**REU Funding:** REU site award

**Name:** Anderson, John

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** University of West Georgia  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2008  
**REU Funding:** REU site award

**Name:** Chu, Connie

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Middle Georgia College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2008  
**REU Funding:** REU site award

**Name:** Graves, Adam

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Johnson C. Smith University  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2008  
**REU Funding:** REU site award

**Name:** Hicks, Lisa

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Anoka-Ramsey Community College

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Kokocki, Jennifer

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Fulton-Montgomery Community College

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Lloyd, Fredrick

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Savannah State University

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Obashe, Omoniyi

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior

**Home Institution:** Other than Research Site

**Home Institution if Other:** Montgomery College

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Smith, Casey

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Savannah State University

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Haynie, Evan

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior

**Home Institution:** Other than Research Site

**Home Institution if Other:** Albany State University

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Spencer, Shakira

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior

**Home Institution:** Other than Research Site

**Home Institution if Other:** Savannah State University

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Ferguson, Briana

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Middle Georgia College

**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree

**Fiscal year(s) REU Participant supported:** 2008

**REU Funding:** REU site award

**Name:** Cato, Michael

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Armstrong Atlantic State University

**Home Institution Highest Degree Granted(in fields supported by NSF):** Master's Degree

**Fiscal year(s) REU Participant supported:** 2009

**REU Funding:** REU site award

**Name:** Dawood, George

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore

**Home Institution:** Other than Research Site

**Home Institution if Other:** Bergen Community College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2009  
**REU Funding:** REU site award

**Name:** Hicks, Robert

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Junior  
**Home Institution:** Same as Research Site  
**Home Institution if Other:**  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Doctoral Degree  
**Fiscal year(s) REU Participant supported:** 2009  
**REU Funding:** REU site award

**Name:** Maldonado, Leslie

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** University of Florida  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Doctoral Degree  
**Fiscal year(s) REU Participant supported:** 2009  
**REU Funding:** REU site award

**Name:** Matheiu, J.D.

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Broward College  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Associate's Degree  
**Fiscal year(s) REU Participant supported:** 2009  
**REU Funding:** REU site award

**Name:** Maxon, Sean

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Years of schooling completed:** Sophomore  
**Home Institution:** Other than Research Site  
**Home Institution if Other:** Armstrong Atlantic State University  
**Home Institution Highest Degree Granted(in fields supported by NSF):** Master's Degree  
**Fiscal year(s) REU Participant supported:** 2009  
**REU Funding:** REU site award

**Name:** Olguin, Hector

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

**Name:** Ranew, Jeffrey  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Williams, Fakeyma  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Bejar, Franz  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Bruce, Jonathan  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Carasik, Lane  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Ferroni, Joshua  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Hubers, Gregory  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Rico, Juan  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

**Name:** Schiltz, Drew  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**

### **Organizational Partners**

#### **Gulfstream**

Gulfstream has partnered with the CREATE program to provide presentations for the participants as well as a tour of their research facilities.

### **Other Collaborators or Contacts**

### **Activities and Findings**

**Research and Education Activities: (See PDF version submitted by PI at the end of the report)**



**Findings: (See PDF version submitted by PI at the end of the report)****Training and Development:**

That nature of the CREATE program is to foster an understanding of research in undergraduate students. Each student is provided with the opportunity to learn how to formulate research problems and investigate solutions. Additionally, students in the program build their professional speaking and writing skills through impromptu and prepared presentations on their research. Graduate students also benefit from the program as they can serve as mentors to the participants in the program. Graduate mentors learn how to manage undergraduate research assignments as well as have the opportunity to participate in panels and seminars to describe their research and experiences with graduate school.

**Outreach Activities:**

At the end of every CREATE program, a poster session is held where each participant presents their work for the summer. The poster session is advertised to the local community and is open to the public. In the summer of 2007 a local news crew did a local interest story on the research being performed by two of the CREATE participants and also made the public aware of the poster session. In 2009 and 2010, local high school camps attending campus tours were invited to attend. One purpose of the poster session is to provide the participants with experience in explaining technical concepts to the general public. However, another goal of the poster session is to raise community awareness of the science and technology research being conducted at Georgia Tech Savannah.

**Journal Publications****Books or Other One-time Publications****Web/Internet Site****Other Specific Products****Contributions****Contributions within Discipline:**

Many of the basic concepts of undergraduate engineering education have existed for many years. The textbooks for instruction are sometimes several years old because the core fundamental of engineering have changed very little. As a result, the academic experience for undergraduates in engineering can be based on heavy theory and fundamental concepts that rarely give a clear indication of applicability. Additionally, undergraduates can find it hard to appreciate the rapid development of technology and science that is the true nature of engineering. The pace at which engineering technology is advancing suggests that an undergraduate education alone may not be sufficient to adequately prepare the young engineer to appreciate his or her career options. Acquiring an advanced degree in engineering (i.e., M.S., PhD) can be very helpful to engineer but this fact is often missed in the undergraduate experience. In the book 'Educating the Engineer of 2020: Adapting Engineering Education to the New Century' recommendations included encouraging students to pursue advanced degrees. It is on this premise that CREATE has been established.

CREATE has been designed to stimulate the interest of undergraduate students in engineering disciplines beyond the basic fundamentals of textbook theory. In CREATE, students are forced to apply their basic engineering and science knowledge as well as learn new applications they may not have had exposure to. The cycle of applying old knowledge and acquiring new techniques continues throughout the 8-10 week program and expands the scope of possibilities for the participants. Research should be part of the training of every engineer, regardless of whether they will pursue a career as a researcher or not. Research helps the engineer to understand and appreciate the true sense of how discoveries accumulate and lead to advancement. The CREATE program contributes directly to this effort by providing each participant with and experience of the nature of research and discovery in a safe environment guided by a faculty and graduate student mentor. CREATE also engages participants in weekly development activities including: research seminars by faculty, workshops on graduate school and career planning, and tours of local industry research and development facilities.

Another significant contribution of the CREATE program to engineering is to instill a sense of confidence in its participants in delivering technical information. In addition to research and development activities, each CREATE participant is required to provide three presentations throughout about their research work. The first presentation is impromptu and designed to provide students the opportunity to think quickly

and clearly while presenting technical information. The second presentation is a short but formally prepared presentation designed to help students learn to prepare concise descriptions of technical research and present it clearly. The third presentation is a poster presentation where students are required to create a poster of their work for the summer and field questions from the general public. Each of these activities is designed to teach students how to compose and present themselves in a professional engineering environment.

CREATE has conducted three sessions during the summers of 2007-2010 where 46 undergraduate students have participated.

#### **Contributions to Other Disciplines:**

While the CREATE program is designed around research experiences in engineering, there is also a focus on how engineering relates to other STEM areas as well. In addition, the research students participate in often has societal impacts that broaden the scope of impact. Post survey results indicate that participants in the CREATE program have their interest in science and engineering increased as well as their desire to pursue advanced degrees. CREATE presents seminars on graduate school and the impact of attaining advanced degrees in a way that does not limit students to only consider engineering. Some of the students in the CREATE program desire to pursue graduate level degrees in medicine, law, or business. The beauty of the CREATE program structure is that it does not impose an 'engineering' mindset on the participants. Instead, CREATE is designed to open the minds of students to consider a bigger and broader world that what is contained in their undergraduate textbooks. It is difficult to specifically identify what specific disciplines other than engineering benefit from the CREATE program because it is nearly impossible to determine what aspect a participant will use to stimulate their interest. However, informal conversation with the students and interpretation of the exit surveys clearly indicate that the CREATE program has a profound impact on its participants. CREATE students leave the program with a greater sense of purpose and confidence in their abilities. Such a result is clearly of benefit to any discipline.

#### **Contributions to Human Resource Development:**

The very nature of CREATE (and any NSF REU Site) is human resources development. Each participant is provided with the opportunity to do research with a faculty member and a graduate student mentor. Additionally, CREATE participants are required to develop communication skills through impromptu and prepared presentations as well as poster sessions. Graduate mentors are also helped by the CREATE program in that they are often responsible for providing direct guidance to the undergraduate students in the program. This is an excellent opportunity for them to learn how to divide and assign research tasks as well as interact with those whose level of knowledge is not quite at theirs. The graduate mentors are also able to volunteer to be on a panel that answer questions from the CREATE participants about the life of a graduate student. For graduate mentors interested in academic careers, CREATE also gives them some taste of having a 'student worker' where you balance assigning tasks and collaboration, as every faculty member does with their graduate students. Additionally, many of the graduate mentors are asked to present their research during the weekly seminars giving them much needed practice at presenting their work.

#### **Contributions to Resources for Research and Education:**

The CREATE program represents the first and only NSF REU site at Georgia Tech Savannah (GTS). The existence of this program has provided infrastructure for GTS to host non-Georgia Tech students as undergraduate researchers with Georgia Tech faculty. This type of interaction is considered extremely important for exposing highly qualified students to the spectacular research being conducted by GTS faculty. Additionally, many of the students in the CREATE program choose to transfer to Georgia Tech as undergraduates or pursue the possibility of graduate school. A participant from the 2009 program moved to the Savannah area so he could work on a project with one of the faculty associated with the CREATE program even though the faculty member was not his CREATE mentor. Another student from the 2008 program moved to Savannah and now helps one of the Co-PI's with high school outreach activities in science and engineering. Several CREATE students have sent feedback indicating how CREATE has helped impact their academic career path with several either currently in graduate school or possessing the intent apply and pursue a Master's or PhD degree.

#### **Contributions Beyond Science and Engineering:**

The CREATE program does not contribute directly to public welfare in that it is unlikely that an undergraduate researcher will deliver a ground-breaking piece of technology in an 8-10 week period of research. However, the societal impacts of CREATE will be felt indirectly by those who will interact with CREATE participants. The participants in CREATE exit the program with a greater sense of confidence in their education, skills, and abilities as well as a clearer picture of their goals in life. While students may not feel like every plan of their life is in place upon leaving CREATE, they have clearly expressed a greater sense of understanding how to find the career path they want to be on. Though the general public may not feel the direct impact of CREATE on its participants, society is always helped by confident individuals who know what goals to set and how to achieve them.

### **Conference Proceedings**

#### **Categories for which nothing is reported:**

Any Journal

Any Book

Any Web/Internet Site

Any Product  
Any Conference

<b>NSF REU Site: CREATE (Collaborative Research Experiences in Advanced Technology and Engineering) Participant Demographics - Summer 2007, PI: Dr. Elliot Moore II, emoore@gtsav.gatech.edu</b>						
	last name	college name	gender	Ethnicity	Race	citizenship
Ernest	Bryant	Georgia Tech Savannah (Junior)	M	Not Hispanic or Latino	African-American	US
Andrew	Fiser	Georgia Tech Savannah (Junior)	M	Not Hispanic or Latino	White	US
Koya	Tyson	Georgia Southern University (Junior)	F	Not Hispanic or Latino	African-American	US
Alexandra	Woldman	Cornell University (Freshman)	F	Not Hispanic or Latino	White/Other	US
Brian	Dombrowski	Clemson University (Junior)	M	Not Hispanic or Latino	White	US
Jason	Joiner	Coastal Georgia Community College (Sophomore)	M	Not Hispanic or Latino	White	US
Mark	Sawyer	South Georgia College (Sophomore)	M	Not Hispanic or Latino	White	US
Odile	Mugisha	Darton College (Junior)	F	Not Hispanic or Latino	African-American	Perm Resident
Will	Hardin	Coastal Georgia Community College (Junior)	M	Not Hispanic or Latino	White	US

<b>NSF REU Site: CREATE (Collaborative Research Experiences in Advanced Technology and Engineering) Participant Demographics - Summer 2008, PI: Dr. Elliot Moore II, emoore@gtsav.gatech.edu</b>						
	last name	college name	gender	Ethnicity	Race	citizenship
John	Anderson	University of West Georgia	M	Not Hispanic or Latino	White	US
Connie	Chu	Middle Georgia College	F	Not Hispanic or Latino	Asian	US
Adam	Graves	Johnson C. Smith University	M	Not Hispanic or Latino	African-American	US
Lisa	Hicks	Anoka-Ramsey Community College	F	Not Hispanic or Latino	White	US
Jennifer	Kokocki	Fulton-Montgomery Community College	F	Not Hispanic or Latino	White	US
Fredrick	Lloyd	Savannah State University	M	Not Hispanic or Latino	African-American	US
Omoniyi	Obashe	Montgomery College	M	Not Hispanic or Latino	African-American	Perm Resident
Casey	Smith	Savannah State University	M	Not Hispanic or Latino	African-American	US
Evan	Haynie	Albany State University	M	Not Hispanic or Latino	African-American	US
Shakira	Spencer	Savannah State University	F	Not Hispanic or Latino	African-American	US
Briana	Ferguson	Middle Georgia College	F	Not Hispanic or Latino	Asian/White	US

In 2007, the Georgia Tech Savannah (GTS) campus received funding to establish its first NSF Research Experiences for Undergraduates (REU) site in the form of the CREATE (Collaborative Research Experiences in Advanced Technology and Engineering) program. CREATE was designed around the concepts of creating opportunities for highly motivated undergraduates at 2- and 4- year universities to collaborate on state of the art research with Georgia Tech faculty and graduate student research mentors. CREATE was established around two primary goals/objectives:

- (1) Encourage participants to complete a Bachelor's level degree in a STEM (Science, Technology, Engineering, and Mathematics) related area and pursue an advanced degree (Masters, PhD);
- (2) Encourage participants to pursue employment in STEM related areas.

To accomplish these goals, CREATE was designed to accomplish the following outcomes during each summer program:

- (1) Raise awareness of STEM disciplines and their practical impact outside of the classroom;
- (2) Raise awareness of the potential benefits of pursuing an advanced degree (Masters, PhD);
- (3) Increase confidence in setting up, performing, and explaining research; and
- (4) Raise understanding of the steps needed to pursue a career in STEM disciplines.

The outcomes of the CREATE program were addressed through scheduled activities that occurred through summer research experiences that lasted 8-10 weeks as follows:

- (Outcome 1 – Raise Awareness of STEM Disciplines) Weekly lunch seminars by GTS faculty in Civil & Environmental, Electrical, Computer, and Mechanical engineering; A one-day tour of the Gulfstream facility where they experience first-hand the engineering design of state-of-the-art private jets from drawing board to finished product;
- (Outcome 2 – Raise Awareness of Advanced Degrees) Panel discussion by GTS graduate students on their motivations and plans for pursuing advanced degrees; Presentations on Graduate Fellowships, different types of graduate schools, and the options available for going into industry with a Bachelor's degree;
- (Outcome 3 – Confidence in Research Presentation) Participants were required to give three oral presentations during the summer: (1) a 5-10 minute summary within the first week of the program to discuss what their research project will be; (2) a 15-20 minute PowerPoint presentation half-way through the program to discuss their progress and future work for the remainder of the program; (3) a Poster Presentation at a conference-style poster session that was opened to the public (an award was given for the best poster presentation);
- (Outcome 4 – Steps for pursuing a career) Each participant was required to create a resume that is professionally critiqued and then participate in a mock interview with real industry interviewers who volunteer their time and provide students with pointers for improving their chances of conducting a successful interview.

GTS is structured in such a way as to promote multidisciplinary interaction and communication by providing a mix of faculty in multiple engineering backgrounds within each research building. Participants will be exposed to cutting edge research in multiple engineering disciplines through their personal involvement in a specific research task and their interaction with other participants, faculty, and graduate students in other engineering domains. Table 1 shows an example of the research topics that past CREATE participants (2007-2009) have been involved in. (NOTE: a list of research topics for 2010 is still being compiled and will be available if necessary at a later date.)

For the summers of 2007, 2008, and 2009 CREATE hosted a total of 29 participants. At the conclusion of the original grant period from 2007-2009, the PI applied for and received an extension to use remaining funds to support an additional offering of the CREATE program in 2010. However, since funds were not sufficient for a full-program to be implemented, the director of the Georgia Tech Savannah (GTS) campus offered to supplement the CREATE program provided it could be integrated

with an existing program offered at GTS known as Engineering Alliance. The Engineering Alliance limited applicants to students attending a local partner school (Armstrong Atlantic State University). CREATE conducted its normal application process and accepted 7 students from 2- and 4-year universities outside of Georgia Tech Savannah. The Engineering Alliance program sponsored 10 students which brought the total number of student participants for Summer 2010 to 17. There were several differences between the “traditional” CREATE students and the Engineering Alliance students in the program:

- CREATE students were from 2- and 4- year universities outside of GT; Engineering Alliance students were all from Armstrong Atlantic State University
- CREATE students operated as 40-hour (full-time) employees while many Engineering Alliance students operated as 20-hour (part-time) employees due to their taking of some classes during the summer.

Despite these differences, all students were considered to be a part of the CREATE program and the implementation was largely unchanged from previous years including:

- Assigning a faculty and graduate student mentor
- Participation in all CREATE activities (lunch seminars, panel discussions, field trips, etc.)
- Participation in public poster session on their work

Exit surveys were issued at the end of each program to assess the outcomes and the results are presented in the project findings document of this report.

**Table 1: CREATE Research Topics (2007-2009) (Computer Engineering (CmpE); Mechanical Engineering (ME); Electrical Engineering (EE); Civil & Environmental Engineering (CEE))**

Year	Faculty Mentor	Research Topics	Area
2009	Dr. Bo Hong	Source Code Pre-processing in Software Transactional Memory Performance	CmpE
	Dr. Roger Jiao	Manufacturing Efficient Aircraft Cockpits	ME
	Dr. Ben Klein	Simulated Performance of Axially Doped GaN Nanowire LEDs	EE
	Dr. Fumin Zhang	Formation Control for Autonomous Underwater Vehicles	ME
	Dr. Hongwei Wu	Correlation between environment conditions and gene-pair functions	EE
	Dr. Fumin Zhang	Autonomous Exploration with Mobile Robots	EE
	Dr. Roger Jiao	Vehicle Interior Optimization for Customer Satisfaction	ME
	Dr. Doug Yoder	Transistor Design and Simulation	EE
	Dr. James Tsai	Critical Assessment of Waterway Activity Detection Algorithms	CEE
2008	Dr. Hermann Fritz	Introductory Research in Arabian Sea Tropical Cyclones and Storm Surge Modeling	CEE
	Dr. Fumin Zhang	Embedded Control of Legged Robots	ME
	Dr. Elliot Moore	Blind Source Separation of Stereo Music Signals	EE
	Dr. Ghassan Alregib	Multi-View Imaging: Compression and Mosaicing	CmpE
	Dr. Jongman Kim	Robot 101	EE
	Dr. Hongwei Wu	Identifying Binding Motifs for Alternatively Spliced Genes Related to Melanoma	CmpE
	Dr. Kevin Haas	Tidal Currents for Energy Production in Georgia: Is it Possible?	CEE
	Dr. Elliot Moore	Pitch Manipulation for Voice Conversion	EE
	Dr. Benjamin Klein	Discretization of Laser Structures	EE
	Dr. Douglas Yoder	Parameter Optimization of an Equivalent Circuit for the AlGaIn/GaN High Electron Mobility Transistor	EE
	Dr. Douglas Yoder	Noise Parameters for Avalanche Photodiode using Differential Equations	EE
2007	Dr. Elliot Moore	Detecting Deception through Speech Analysis	EE
	Dr. Elliot Moore	Real Time Voice Conversion	EE
	Dr. Paul Work	Design and Fabrication of Artificial Turtle Carapace to Estimate Structural Response of Real Turtle shells to Impact	CEE
	Dr. Ben Klein	Simulations of Semiconductor Laser Diodes	EE
	Dr. Kevin Haas	Monitoring and Evaluating Beach Morphology	CEE
	Dr. Randy Abler	Data Analysis Techniques for Internet Security	CmpE
	Dr. Francesco Fedele	The Prediction of Rogue Waves through Stereo Video Imagery	CEE
	Dr. Doug Yoder	Creation of a MATLAB Interface C++ Program for Modeling and Simulation of Semiconductor Devices	EE
	Dr. David Scott	Short and Long Term Effects of Thermal Cycles on Fiber Reinforced Polymers	CEE

## Project Findings

### Introduction

In 2007, the Georgia Tech Savannah (GTS) campus received funding to establish its first NSF Research Experiences for Undergraduates (REU) site in the form of the CREATE (Collaborative Research Experiences in Advanced Technology and Engineering) program. CREATE was designed around the concepts of creating opportunities for highly motivated undergraduates at 2- and 4- year universities to collaborate on state of the art research with Georgia Tech faculty and graduate student research mentors. CREATE was established around two primary goals/objectives:

- (1) Encourage participants to complete a Bachelor's level degree in a STEM (Science, Technology, Engineering, and Mathematics) related area and pursue an advanced degree (Masters, PhD);
- (2) Encourage participants to pursue employment in STEM related areas.

To accomplish these goals, CREATE was designed to accomplish the following outcomes during each summer program:

- (1) Raise awareness of STEM disciplines and their practical impact outside of the classroom;
- (2) Raise awareness of the potential benefits of pursuing an advanced degree (Masters, PhD);
- (3) Increase confidence in setting up, performing, and explaining research; and
- (4) Raise understanding of the steps needed to pursue a career in STEM disciplines.

The outcomes of the CREATE program were addressed through scheduled activities that occurred through summer research experiences that lasted 8-10 weeks as follows:

- (Outcome 1 – Raise Awareness of STEM Disciplines) Weekly lunch seminars by GTS faculty in Civil & Environmental, Electrical, Computer, and Mechanical engineering; A one-day tour of the Gulfstream facility where they experience first-hand the engineering design of state-of-the-art private jets from drawing board to finished product;
- (Outcome 2 – Raise Awareness of Advanced Degrees) Panel discussion by GTS graduate students on their motivations and plans for pursuing advanced degrees; Presentations on Graduate Fellowships, different types of graduate schools, and the options available for going into industry with a Bachelor's degree;
- (Outcome 3 – Confidence in Research Presentation) Participants were required to give three oral presentations during the summer: (1) a 5-10 minute summary within the first week of the program to discuss what their research project will be; (2) a 15-20 minute PowerPoint presentation half-way through the program to discuss their progress and future work for the remainder of the program; (3) a Poster Presentation at a conference-style poster session that was opened to the public (an award was given for the best poster presentation);
- (Outcome 4 – Steps for pursuing a career) Each participant was required to create a resume that is professionally critiqued and then participate in a mock interview with real industry interviewers who volunteer their time and provide students with pointers for improving their chances of conducting a successful interview.

This report documents the findings from the execution of CREATE during the summers from 2007-2010. The report is presented in two parts. The first part summarizes data as collected for the three summer years (2007-2009) under the original proposal timeline. The second part summarizes data from an extended version of the CREATE program conducted during summer 2010 that used remaining funding from the original grant to combine CREATE's activities with a newly formed summer research program at the GTS campus for students attending a partner school.

A summary evaluation based on the two parts (2007-2009 and 2010) of the CREATE program using exit surveys is provided below on the following factors: (1) Participant Demographics (2) Participant Motivation to take part in CREATE, (3) Effect of CREATE on participant research skills/confidence, (4) Effect on future academic/career goals, and (5) overall program satisfaction. The questions are based on a Likert scale (e.g., 1 to 4, 1 to 5, etc.). Additionally, responses from the 2007-2009 implementations were



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rank-ordered and subjected to pair-wise Mann-Whitney statistical tests to examine if any statistically significance differences existed among of the groups of students for any of the years. The 2010 implementation is not included in the tests because of several changes that occurred in the program implementation that made 2010 an indirect comparison to the 2007-2009 implementations. There was a 100% response rate on all exit surveys as the participants were required to complete the survey before receiving their final check.

### Part 1 – Original grant period (2007-2009)

During the period of 2007-2009 CREATE supported a total of 29 participants with the following applicants/participants ratio (admission rate):

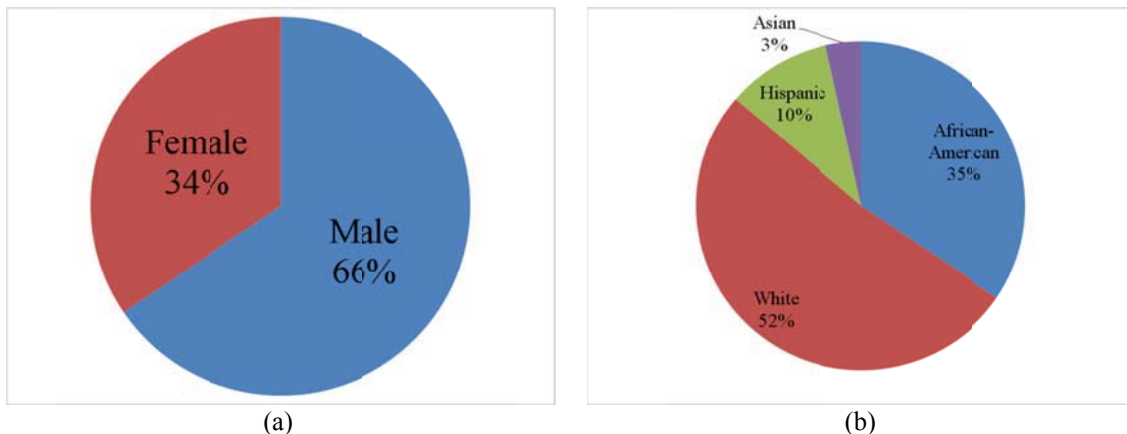
- 2007 – 15 Applicants / 9 Participants (60% admission rate)
- 2008 – 25 Applicants / 11 Participants (44% admission rate)
- 2009 – 38 Applicants / 9 Participants (24% admission rate)

The first implementation of CREATE was during the summer of 2007 and involved a shorter recruitment period than subsequent years resulting in fewer applicants and a higher admission rate. However, the number of qualified applicants improved each year as the reputation of the program continued to build.

### Participant Demographics

The participant demographics are shown in Fig. 1 and the participant home school information is shown in Table 1. Fig. 1 shows that CREATE has been moderately successful at attracting women (34%) and ethnic minorities (45%) to the program. Recruitment efforts are constantly being evaluated to improve the number of qualified women and minority applicants to CREATE as well as the total number of applicants as a whole.

Table 1 shows the percentage of CREATE participants from various types of schools based on the Carnegie classification (as of 2009) of institutes of higher education [1] . Table 2 shows the specific home institutions of the CREATE participants. Based on this information, CREATE has been successful at targeting and recruiting students from 2-4 year schools to participate in the program as nearly half of the participants each year during the 2007-2009 periods were from 2-4 year schools (only 6 of the 29 CREATE participants came from research-type schools).



**Figure 1: Gender and Ethnicity Breakdown (2007-2009)**

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**Table 1: Carnegie Classification of Participant Home Schools (2007-2009)**

	Research	Masters/Doctor	Bachelors	Associate
2009 (N=9)	22.2%	33.3%		44.4%
2008 (N=11)		45.5%	9.1%	45.5%
2007 (N=9)	44.4%	11.1%	0.0%	44.4%

**Table 2: Home Institutions of CREATE Participants (2007-2009)**

Research	Masters/Doctor	Bachelors	Associate
Georgia Tech	Georgia Southern University	Johnson C. Smith University	Coastal Georgia Community College
Cornell	Armstrong Atlantic University	Albany State University	South Georgia College
Clemson	Savannah State University		Darton College
University of Florida	University of West Georgia		Middle Georgia College
			Anoka-Ramsey Community College
			Fulton-Montgomery Community College
			Montgomery College
			Bergen Community College
			Broward College
			Abraham Baldwin Agricultural College

Participant Motivation

Table 3 shows the responses of the participants on several key factors that are common motivator's for students seeking research experiences. In regard to motivations for getting into graduate/medical school,

**Table 3: Participant Motivation (2007-2009)**

(N=29)	Not Important (1)	Somewhat Important (2)	Fairly Important (3)	Extremely Important (4)	Overall Mean Value (*)
Help me get into graduate/medical school or get a job	7%	10%	28%	55%	3.3
Wanted to know if going to grad school in science or engineering was for me.	3%	14%	45%	38%	3.2

\*No statistically significant difference between the three groups using a Mann-Whitney Test

(a)

I wanted to learn more about what it's like to be a researcher.	Not Important (1)	Somewhat Important (2)	Fairly Important (3)	Extremely Important (4)	Overall Mean Value
S2009 (N=9)	0%	11%	33%	56%	3.4
S2008 (N=11)	0%	45%	36%	18%	2.7 (**)
S2007 (N=9)	0%	0%	22%	78%	3.8 (**)

\*\* Indicates a statistically significant difference (p<0.05) using a Mann-Whitney Test (2007/2008)

(b)

## Project Findings

seeking a job, or deciding if graduate school in science and engineering was a good option for them, the three groups did not possess statistically significant differences in their responses (Table 3a). However, in regards to wanting to know what being a researcher was like, a significant gap occurred in that the summer 2007 and 2009 groups found this to be an extremely important part of their motivation for most of the participants (78% and 56%, respectively) while for the summer 2008 group it was only somewhat or fairly important (45% and 36%, respectively). Part of this difference is likely explained by seeing that summer 2007 and 2009 both had participants from research-type institutions where the summer 2008 group did not (see Table 5). However, while this may not completely explain the differences, the fact that different motivations existed in some way for the three groups validated the need to examine the exit surveys for similarities and differences among the three groups of CREATE participants.

### Effect On Research Skill and Confidence

Table 4 shows the extent to which the participants felt their knowledge and confidence increased in several factors. Table 4a shows the responses that showed no significant differences between the three

**Table 4: The extent to which CREATE helped increase the following factors (2007-2009)**

(N=29)	Not At All (1)	Somewhat (2)	A Fair Amount (3)	A Great Deal (4)	Mean Value (*)
... how to conduct a research project	0%	3%	31%	66%	3.6
...how scientific knowledge is built	0%	7%	55%	38%	3.3
...how to deal with setbacks, "negative results," etc.	0%	0%	41%	59%	3.6
...working collaboratively with others	3%	17%	41%	41%	3.2
...working independently	0%	10%	24%	66%	3.6
...what graduate school is like	0%	7%	34%	59%	3.5
...career options in science/eng	3%	21%	41%	34%	3.1
...confidence in your ability to succeed in grad school	0%	7%	45%	48%	3.4
...qualifications for jobs in related fields	0%	10%	48%	41%	3.3

\* No statistically significant difference between the two groups using a Mann-Whitney Test

(a)

	Not At All (1)	Somewhat (2)	A Fair Amount (3)	A Great Deal (4)	Mean Value
... how to formulate a research question (*)					
<i>S2009 (N=9)</i>	11%	56%	33%	0%	2.8
<i>S2008 (N=11)</i>	18%	9%	55%	18%	2.7
<i>S2007 (N=9)</i>	0%	0%	44%	56%	3.6
... how to plan a research project (**)					
<i>S2009 (N=9)</i>	3%	21%	31%	45%	3.2
<i>S2008 (N=11)</i>	9%	27%	36%	27%	2.8
<i>S2007 (N=9)</i>	0%	0%	22%	78%	3.8
... confidence in your research skills generally (**)					
<i>S2009 (N=9)</i>	0%	17%	41%	41%	3.2
<i>S2008 (N=11)</i>	0%	27%	55%	18%	2.9
<i>S2007 (N=9)</i>	0%	0%	33%	67%	3.7

\* Indicates a statistically significant difference ( $p < 0.05$ ) using a Mann-Whitney Test for all years

\*\* Indicates a statistically significant difference ( $p < 0.05$ ) using a Mann-Whitney Test for 2007/2008

(b)

summer groups. Generally, all of the participants felt like their understanding of how scientific knowledge is formed, their ability to work collaboratively, and their overall confidence in their abilities to succeed in graduate school or at a job increased by at least a fair amount. The highest marks were for the

## Project Findings

participant responses related to their understanding of how to conduct a research project, how to deal with setbacks, and their ability to work independently. However, factors related to how to formulate a research question, how to plan a research project, and confidence in their research skills in general showed some disparity among the three groups. Table 4b shows that the majority of the summer 2007 group felt like their overall research skills and confidence had increased by a great deal while this was not true for the summer 2008 and 2009 group. It is not clear why these numbers are so different across the groups, however, it is possible that faculty participating in the program began to assign students to existing tasks as opposed to allowing the students to formulate new questions and directions. This is sometimes necessary to facilitate the fairly short stay of CREATE participants (8-10 weeks) in relation to the grand scope of research. The PI and program coordinator are now aware of this potential issue and are still examining it further with faculty to determine how and if it can be corrected.

### Effect On Future Goals

Tables 5 and 6 provide an indication of how CREATE may have affected participant intentions regarding their future goals. The Mann-Whitney test revealed no significant difference between the three group responses in regard to the intention to pursue an advanced degree at some point in the future or to pursue a job directly after graduation (i.e., not attend graduate school immediately). Table 5a indicates that the participants felt their participation in the program had generally increased their desire to pursue an advanced degree at some point and the majority felt like the program had no effect on their intention to

**Table 5: The extent to which CREATE increased interest in the following factors (2007-2009)**

(N=29)	Decreased a Lot (1)	Decreased Somewhat (2)	No Effect (3)	Increased Somewhat (4)	Increased a Lot (5)	Mean Value (*)
Pursuing an advanced degree at some point in my career (i.e., not necessarily right after graduation)	3.4%	0.0%	34.5%	27.6%	34.5%	3.9
Pursuing a job directly after graduation	0.0%	24.1%	34.5%	17.2%	24.1%	3.4

\* No statistically significant difference between the two groups using a Mann-Whitney Test

(a)

Pursuing an advanced degree directly after graduation	Decreased a Lot (1)	Decreased Somewhat (2)	No Effect (3)	Increased Somewhat (4)	Increased a Lot (5)	Mean Value (**)
S2009 (N=9)	0.0%	0.0%	11.1%	11.1%	77.8%	4.7
S2008 (N=11)	0.0%	0.0%	18.2%	63.6%	18.2%	4.0
S2007 (N=9)	0.0%	0.0%	0.0%	33.3%	66.7%	4.7

\*\* Indicates a statistically significant difference ( $p < 0.05$ ) using a Mann-Whitney Test for years 2008/2009 and 2007/2008

(b)

**Table 6: The extent to which CREATE increased interest in the following careers (2007-2009)**

(N=29)	Decreased a Lot (1)	Decreased Somewhat (2)	No Effect (3)	Increased Somewhat (4)	Increased a Lot (5)	Have No Idea (0)	Mean Value (*)
Science or Engineering	0%	0%	7%	45%	48%	0%	4.4
Research	0%	3%	10%	38%	45%	3%	4.3

\* No statistically significant difference between the three groups using a Mann-Whitney Test

\*\* The (Have no idea) category was not included in the mean value calculation

## Project Findings

pursue a job directly after graduation. Table 5b indicated a significant difference in the responses regarding the pursuit of an advanced degree immediately following graduation with the majority of the summer 2007 and 2009 group (66.7% and 77.8%, respectively) indicating their intention had increased a lot while the majority of the summer 2008 group (63.6%) indicated that their intention had increased only somewhat. However, it was clear that CREATE had impacted nearly all of the participants in some positive way to pursue an advanced degree sooner rather than later in their careers. Additionally, the participants of each group were asked about the effect CREATE may have had on their interest in careers in science and engineering (S&E) as well as in research (Table 6). Interestingly, there was no statistically significant difference between the three groups and overall their interests in a career in S&E or research had increased somewhat or a lot for 93% and 83% of the participants, respectively.

### Overall Program Satisfaction

Table 7a indicates that there were no significant differences between the three group responses regarding their satisfaction with the majority of program activities. The highest rated activities overall were the poster session, the presentation on graduate school funding, and the graduate student panel followed by the faculty research seminars and the presentation on career skills (e.g., CV writing, etc.). The lowest rated activities were the mock interviews and the 5-minute summary required at the beginning of the program. Informal discussions with the participants on the 5-minute summaries indicated this was their least favorite of the presentations they had to give due to the time constraint and general uncertainty that still existed about their project. The mock interviews were designed to reflect a realistic job interview session with an industry representative. The CREATE participants appeared to have “mixed” feelings

**Table 7: Overall Participant Satisfaction (2007-2009)**

(N=29)	Very Dissatisfied (1)	Somewhat Dissatisfied (2)	Somewhat Satisfied (3)	Very Satisfied (4)	Don't Know (0)	Overall Mean Value (*)
Graduate Student Panel	0.0%	6.9%	24.1%	69.0%	0.0%	3.6
Career presentation	0.0%	3.4%	34.5%	62.1%	0.0%	3.6
Mock Interviews (**)	0.0%	10.3%	31.0%	34.5%	24.1%	3.3
5 minute summary	0.0%	3.4%	62.1%	34.5%	0.0%	3.3
Presentation on funding graduate school	0.0%	0.0%	20.7%	72.4%	6.9%	3.8
Faculty Research Seminars	0.0%	0.0%	37.9%	62.1%	0.0%	3.6
Poster session	0.0%	3.4%	10.3%	72.4%	13.8%	3.8
Overall Experience	0.0%	0.0%	10.3%	89.7%	0.0%	3.9

\* No statistically significant difference between the two groups using a Mann-Whitney Test

\*\* The 2009 CREATE Program was not able to have this activity due to funding constraints

(a)

	Very Dissatisfied (1)	Somewhat Dissatisfied (2)	Somewhat Satisfied (3)	Very Satisfied (4)	Don't Know (0)	Mean Value (***)
15 minute presentation						
S2009 (N=9)	0%	0%	22%	78%	0%	3.8
S2008 (N=11)	0.0%	9.1%	63.6%	27.3%	0.0%	3.2
S2007 (N=9)	0.0%	0.0%	11.1%	88.9%	0.0%	3.9

\*\*\* Indicates a statistically significant difference ( $p < 0.05$ ) using a Mann-Whitney Test for years 2008/2009 and 2007/2008

(b)

## Project Findings

about the effectiveness of the sessions. The PI intends to address potential concerns in future implementations to determine if the mock interviews should be discontinued or if there are ways to improve their effectiveness. The CREATE 2009 group was unable to participate in mock interviews due to state budget constraints for our partners in this process. Table 7b shows a difference in the three groups in regards to the 15 minute PowerPoint presentations with the summer 2008 group expressing the least enthusiastic response to the activity. There is not a clear indication as to why this one activity would show a disparity between the three groups as informal observation by the PI did not observe any immediate differences in the way the activity was conducted from one implementation to the next. However, given the information in Table 4b regarding the summer 2008 groups lack of confidence in their research skills, it is possible that this lack of confidence made the formal setting of the presentation more uncomfortable. Overall, the program was very well received as 89.7% of the participants indicated they were very satisfied with the program overall.

An alumni survey of past participants from the 2007-2009 implementations was sent during the Spring 2010 semester to determine their current status and any potential lasting impacts of CREATE on their academic or career paths. Another alumni survey was sent in the Spring 2011 semester but responses had not yet been received as of the time of the writing of this report. Table 8 shows the responses from several alumni. All of the students whose home institution was an Associate level degree indicated that their academic goals had been extended to at least a Master's degree because of their participation in CREATE. Participants whose home institutions already offered advanced degrees (Master's or higher) indicated that CREATE's impact on their academic goals was not significant as many of them had already intended to pursue advanced degrees. However, it has been noted that many students who pursue undergraduate research opportunities already have an intent to pursue a graduate degree making it difficult to evaluate the true impact of a research experience on academic career goals [2].

**Table 8: Alumni Responses to the question: “Did the CREATE summer internship program affect your academic and career plans or paths? If so, how?” (2007-2009)**

Year of participation	Statement	Home Institute (At time of participation)
2007	Create definitely was responsible for opening up the world of academic research and making it something real to me, instead of abstract. The graduate parel(s) also helped me decide that I wanted an advanced degree.	Associate
2007	The CREATE summer program encouraged me to pursue a higher education and look into doing research with professors.	Research
2007	Yes, made me want to go to Grad school more.	Research
2007	I've decided to continue with my education beyond a Bachelor's degree to receive a Master's degree.	Associate
2007	No	Research
2008	CREATE showed me that there are a lot of interesting careers out there. I was feeling a little dead ended but seeing all the projects helped me to realize I can find something I really enjoy.	Associate
2008	The CREATE summer internship affects my academic path by making me to pursue a master degree. Also, I learned a lot about how grad school function in the summer internship.	Associate
2008	The CREATE program didnt really affect my career path, because upon entering the program I had already had plans to attend grad school.	Master's
2009	Definitely, yes. My professors and friends are impressed with the work I have done. Academicly, I am considering to work again on the project I did during the summer (Manufacturing Better Aircraft Cockpits). CREATE increased my interest in achieving PHD or Masters degree.	Associate

### Part 2 – Extended grant period (2010)

At the conclusion of the original grant period from 2007-2009, the PI applied for and received an extension to use remaining funds to support an additional offering of the CREATE program in 2010. However, since funds were not sufficient for a full-program to be implemented, the director of the Georgia Tech Savannah (GTS) campus offered to supplement the CREATE program provided it could be integrated with an existing summer research program being offered at the GTS campus. The existing summer research program was specifically designed for students in a program known as Engineering Alliance. The Engineering Alliance (EA) program is designed for freshmen and sophomore students who are accepted to attend Georgia Tech but spend their first two years of schooling at Armstrong Atlantic State University (AASU) in Savannah, GA. AASU has served as a partner to GTS in providing transfer students into the Engineering disciplines offered through GTS. The Engineering Alliance program serves as an extension of this partnership allowing the students to receive some entry level courses directly from GTS professors. Since research is a critical element of the undergraduate engineering experience at Georgia Tech, the director of GTS provided funding for students in the EA program to work with faculty at GTS during the summer in research related activities. The previous structure of the research program through EA only provided a pairing of faculty and students with no other organized activities or requirements on graduate student mentorship. The existence of CREATE provided a clear example of the benefit of additional structure in an undergraduate research experience and 2010 provided the first time the two programs were combined. CREATE conducted its normal application process and accepted 7 students from 2- and 4-year universities outside of Georgia Tech Savannah. The Engineering Alliance program sponsored 10 students which brought the total number of student participants for Summer 2010 to 17. There were several differences between the “traditional” CREATE students and the Engineering Alliance students in the program:

- CREATE students were from 2- and 4- year universities outside of GT; Engineering Alliance students were all from Armstrong Atlantic State University
- CREATE students operated as 40-hour (full-time) employees while many Engineering Alliance students operated as 20-hour (part-time) employees due to their taking of some classes during the summer.

Despite these differences, all students were considered to be a part of the CREATE program and the implementation was largely unchanged from previous years including:

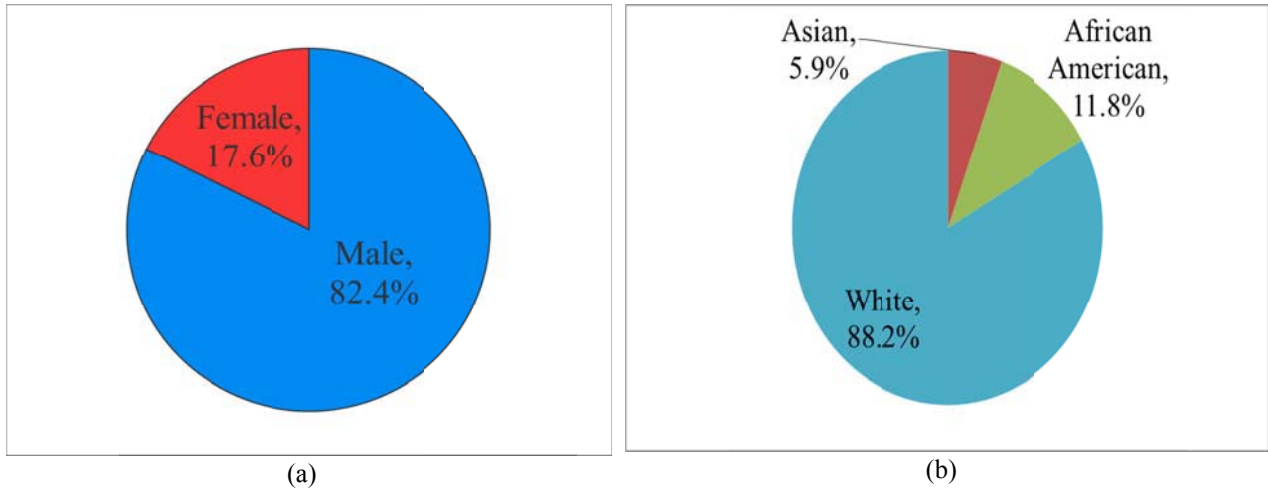
- Assigning a faculty and graduate student mentor
- Participation in all CREATE activities (lunch seminars, panel discussions, field trips, etc.)
- Participation in public poster session on their work

Due to the number of differences in the 2010 implementation of this project, the survey was altered slightly and the results from this year are presented separately from the results of previous years. At this time, survey responses are not divided by affiliation (i.e., “traditional” CREATE students vs. Engineering Alliance students). The report below therefore documents all student responses as being part of a single CREATE program implementation.

#### *Participant Demographics*

The participant demographics for the 2010 implementation are shown in Fig. 2. In 2010, CREATE provided a structured research experience for 17 total participants (3 females (17.6%), 14 males (82.4%)). Fig. 1b shows the breakdown of participants by ethnicity. The 2010 implementation had a smaller participation of under-represented groups than previous implementations but this was due in part to the inclusion of students from the Engineering Alliance summer program where no specific recruitment of underrepresented groups was conducted.

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**Figure 2: Gender and Ethnicity Breakdown (2010)**

Tables 9 shows the percentage of home institution types represented by the students participating in CREATE during the 2010. They high percentage of students from Master’s level schools is directly related to the fact that 10 of the participants were from the Engineering Alliance program which is run by Armstrong Atlanta State University. Table 10 shows all of the schools represented in the 2010 implementation of CREATE.

**Table 9: Carnegie Classification of Participant Home Schools (2010)**

	Research	Masters/Doctor	Bachelors	Associate
2010 (N=17)	0.0%	70.6%	5.9%	23.5%

**Table 10: Home Institutions of CREATE Participants (2010)**

Research	Masters/Doctor	Bachelors	Associate
	Armstrong Atlantic University Southern Polytechnic State University Winona State University	Hope College	Miami Dade College Middle Georgia College Cuesta College Abraham Baldwin Agricultural College

Participant Motivation

Table 11 shows the responses of the participants on several key factors that are common motivator's for students seeking research experiences. In the 2010 implementation, participants were most highly motivated by the desire to get “hands-on” experiences to reinforce the material they learned in the classroom (3.24/4 rating). This was not a surprising find as the purpose of research experiences has always been to broaden the scope of learning of students beyond the classroom. Participants were also highly motivated by the following: desire to learn more about graduate school in science/engineering (3.18/4 rating); the thought that research would be better than doing other jobs unrelated to engineering (3.12/4 rating); and a desire to learn more about what a researcher does (3.06/4 rating). The least motivating factor was a feeling of obligation from the institute to perform research (1.47/4 rating) which



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is not surprising since none of the participating schools in this program require research experiences of their undergraduates even if it is encouraged.

**Table 11: Participant Motivation (2010)**

(N=17)	Not Important (1)	Somewhat Important (2)	Fairly Important (3)	Extremely Important (4)	Overall Mean Value
I wanted to know if science or engineering was for me.	18%	29%	41%	12%	2.47
I wanted to learn more about what it's like to be a researcher.	6%	18%	41%	35%	3.06
I wanted to know if going to grad school in science or engineering was for me.	6%	24%	18%	53%	3.18
I wanted hands-on experiences to reinforce what I learned in class	0%	24%	29%	47%	3.24
Doing research was more appealing than other kinds of jobs.	12%	12%	29%	47%	3.12
I needed to fulfill my school's/my scholarship's requirements for research.	76%	12%	0%	12%	1.47
I thought it would help me get into graduate/medical school or get a job.	12%	18%	29%	41%	3.00
I thought it would be fun.	0%	29%	35%	35%	3.06

### Effect On Research Skill

Table 12 shows the results of a set of survey responses designed to determine how (if at all) CREATE was able to help students understand more about the purpose and implementation of research. The responses suggest that in 2010, CREATE was most successful at aiding students in dealing with setbacks and negative results in research (3.12/4 rating) as well as understanding the nature of a researcher's job (3.06/4 rating). However, similar to the 2007-2009 implementations, the results show that several students felt their understanding of how to formulate (2.53/4 rating) and plan (2.71/4 rating) a research project was not improved as much. Anecdotal feedback from student participants suggested a reason for this may have been that faculty/graduate students have the tendency to assign parts of ongoing projects to students in the program. As a result, the formulation and planning of the research is already underway when the CREATE student joins the program giving them little insight into how the research has developed. Based on the feedback across all implementations, it would appear that the participation of participants in the formulation and planning of research directions is still an area that may need improvement in future implementations. It is possible this issue can be addressed with better training of graduate mentors to help them understand their role in explaining the research process to the CREATE participants as time allows.

**Table 12: The extent to which CREATE helped increase the following factors (2010)**

(N=17)	Not at all (1)	Somewhat (2)	A fair amount (3)	A great deal (4)	Have no idea	Mean Value
...how to formulate a research question	18%	12%	47%	18%	6%	2.53
...how to plan a research project	0%	35%	35%	24%	6%	2.71
...how to conduct a research project	0%	41%	24%	35%	0%	2.94
...how to deal with setbacks, "negative results," etc.	0%	18%	29%	47%	6%	3.12
...how scientific knowledge is built	6%	29%	29%	35%	0%	2.94
...The nature of the job of a researcher	0%	18%	59%	24%	0%	3.06

### Effect On Future Goals

Tables 13 and 14 highlight responses from participants regarding the effect of CREATE on their potential career and education paths, respectively. CREATE was designed to help students explore options that are available to them in STEM careers as well as the pursuit of STEM advanced degrees. The responses in Table 13 suggested that CREATE was successful in helping students understand potential paths of faculty, graduate school, and their career options in science/engineering (3.12/4 rating or higher). Aside

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from pursuing careers in STEM, CREATE also stresses the important of lifelong learning through the pursuit of advanced degrees (not necessarily in STEM only). The sequence of questions in Table 14 was designed to specifically determine if students were more (or less) inclined to pursue advanced degrees upon completing CREATE. The responses indicated that the student participants as a whole felt CREATE had generally increased their desire to pursue an advanced degree either directly after graduation (4.06/5 rating) or at some point in their career (3.88/5 rating).

**Table 13: The extent to which CREATE increased the following factors (Potential Careers)**

(N=17)	Not at all (1)	Somewhat (2)	A fair amount (3)	A great deal (4)	Have no idea	Mean Value
Career paths of the faculty in the program	0%	35%	18%	47%	0%	3.12
What graduate school is like	0%	24%	41%	35%	0%	3.12
The variety of science/engineering fields you could specialize in	6%	12%	41%	41%	0%	3.18
Career options in science/engineering	0%	35%	18%	47%	0%	3.12

**Table 14: The extent to which CREATE increased the following factors (Post Graduation)**

(N=17)	Decreased a Lot (1)	Decreased Somewhat (2)	No Effect (3)	Increased Somewhat (4)	Increased a Lot (5)	Have No Idea	Mean Value
Pursuing an advanced degree directly after graduation	0%	6%	18%	41%	35%	0%	4.06
Pursuing an advanced degree at some point in my career	0%	6%	29%	35%	29%	0%	3.88
Pursuing a job directly after graduation	12%	6%	47%	12%	24%	0%	3.29
Pursuing a professional license in engineering	0%	0%	41%	24%	35%	0%	3.94

### Overall Program Satisfaction

Table 15 presents the overall participant satisfaction for the events of the CREATE program during the 2010 implementation. Overall, the students indicated a positive experience with the highest rated activity being the public poster session (3.76/4 rating) held at the end of the program. Additionally, the presentation on how to find funding for graduate school offered by the PI and the weekly faculty research seminars received the second highest ratings (3.18/4 rating) among the activities. The lowest rated activities for the 2010 implementation were the career based presentations (2.76/4 rating). There was no direct feedback from the students regarding this particular set of activities (aside from the survey responses) but the decrease in participant satisfaction from previous years could be related to the method in which the career based presentations were conducted in the 2010 implementation of CREATE. Due to budget and time constraints at the institute, the “face-to-face” mock interviews and resume preparation were not able to be conducted. Instead, a representative from the Georgia Tech Atlanta campus conducted a video conference session with the students in the program. While the session was live and

**Table 15: Overall Participant Satisfaction**

(N=17)	Very Dissatisfied (1)	Somewhat Dissatisfied (2)	Somewhat Satisfied (3)	Very Satisfied (4)	Don't Know	Mean Value
Faculty Research Seminars	0%	6%	47%	41%	6%	3.18
Graduate Student Panel	0%	12%	29%	47%	12%	3.00
Presentation on funding graduate school	0%	6%	24%	59%	12%	3.18
Career presentation (i.e., resume writing, etc.)	6%	12%	59%	18%	6%	2.76
5 minute summary, 1st week	0%	18%	53%	29%	0%	3.12
10 minute presentation	0%	6%	53%	35%	0%	3.12
Poster session	0%	6%	12%	82%	0%	3.76
Overall Experience	0%	6%	29%	65%	0%	3.59

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students were able to ask questions, it is likely that they found this method of interaction to be less satisfying. The PI will look to consider alternative options for this presentation in the future, with the hope of re-establishing “face-to-face” interactions. Overall, the program still performed well (3.59/4 rating) but it was clear that the integration of the Engineering Alliance program with CREATE will require additional modification.

### Student Feedback

The exit survey for 2010 also requested that students respond to the question of “What was the most important thing you learned about yourself as a result of your experience this summer?” The responses from the 17 participants are included in Table 16.

**Table 16: Most important thing you learned about yourself as a result of your experience in CREATE (Statements from the Exit Survey for 2010 Participants)**

<i>How to follow guidelines and rules set for Research, but also to be open to accept new methods and standards of research.</i>
<i>I learned that when I sit down and actually apply myself without getting distracted, I can get a lot more things done.</i>
<i>This program helped me figure out the areas of engineering I was interested in and helped me decide on the major I wanted to pursue.</i>
<i>One of the things I had to deal with is working on a project that I had no previous experience in. I learned that I could handle and understand new theories fairly quickly.</i>
<i>I learned how I am able to add my part to research. I learned how do take things in steps and to just jump into research without a set plan.</i>
<i>...I do not only have the capabilities to work on my own, but I can also function very well in a group. It was great to be able to work in a real life project, and actually complete it.</i>
<i>I learned that I am able to solve problems and teach myself new things which asked. I am a hardworker and am able to overcome any project given to me.</i>
<i>I realized that I can make errors, retrace my steps, and end with respectable findings...I've also experienced the feeling of a good day's work for a just purpose.</i>
<i>I think I learned that I have a lot more potential than I give myself credit for. I also learned that I cannot achieve any realistic goals without putting time and interest into it.</i>
<i>I really want to get a PhD.</i>
<i>That I can easily work in areas unrelated to my own major. I was an ME doing CompE research and after the initial weeks, had little problem doing the work.</i>
<i>...I've learned ..that when an assignment was given to me i was able to accomplish the task...I've also...become more aware of my attitude toward school.</i>
<i>Learning to make big life decisions and being ok with the repercussions they insue.</i>
<i>...I learned about...my confidence level to be able to give scientific presentations to a large corporation as well as a group of faculty members...</i>
<i>...I felt the passion of going deep with the field of engineering. I did not know I was a fast learner on things that I really did not like before I came to this great program</i>
<i>The most important thing I learned about myself was my confidence level to be able to do research and give scientific presentations...</i>
<i>Don't always depend on others to find that answer you need. Look for it yourself.</i>

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The comments strongly suggest that the student participants felt the experience was helpful, with many students expressing a sentiment of fulfillment in being able to participate in and complete a project in an engineering field. General feedback from the students suggested that the CREATE program left many of them more confident in their ability to succeed in STEM related fields.

Additionally, several participants from the 2010 implementation of CREATE have replied to alumni surveys. A sample of their response is shown in Table 17.

**Table 17: Alumni Responses to the question: “Did the CREATE summer internship program affect your academic and career plans or paths? If so, how?” (2010)**

Year of Participation	Statement	Home Institute (At time of participation)
2010	The CREATE program at GaTech Savannah did directly affect my academic career plans by way of giving priceless research experience. This experience along with current research helped, I believe, allow me to get into a highly respected graduate program.	Masters
2010	CREATE affected my plans for the future. My plans swayed towards continuing my education till completing a PhD. Afterwards I plan on seeking out a research and development position with companies such as Avera, Bechtel, AMS, or government entities such as Oak Ridge National Labs, Idaho National Labs, or the Nuclear Regulatory Commission.	Associates
2010	Yes, working with the photonic crystals research with Prof Klein got me very interested in other nanotechnology areas. I hope to focus on that throughout the rest of my education.	Masters

### Conclusion

Currently, the CREATE program has fully integrated the Engineering Alliance summer research program into its structure for the foreseeable future. A funding renewal will be sought to extend NSF support for potential CREATE participants from outside of GTS starting in 2012. As the original grant has expired, the summer 2011 implementation of CREATE will continue with only participants from the Engineering Alliance program. Based on the survey evaluations, the following modifications will be assessed:

- Graduate mentor “training”: While the PI has met with all graduate mentors to discuss the expectations for CREATE, a greater emphasis will be placed on the time spent in teaching/training undergraduate participants in understanding the project they are working on.
- Alternative means of career presentations: The PI will investigate methods of making the presentations on career preparation (e.g., resume writing, interviewing, etc.) more interactive given the current budget limitations.

Overall, CREATE has been a success and highlight of GTS summer activities and it is the intent of the PI to seek for ways to continue its presence on campus.

- [1] (October 2009). *The Carnegie Classification of Institutions of Higher Education*. Available: <http://www.carnegiefoundation.org/classifications/index.asp>
- [2] K. Findley, *et al.*, "Re-evaluating the Objectives for Undergraduate Research," in *Frontiers in Education*, 2007, pp. F1D/18-23.