



Transportation Institute

North Carolina Agricultural and Technical State University

CATM Holds Third Annual Symposium

The third annual Center for Advanced Transportation Mobility (CATM) Symposium was held at Embry-Riddle Aeronautical University in Daytona Beach, Florida on Nov. 4, 2019. The symposium was an opportunity for students, faculty and researchers from the three consortium member institutions, North Carolina Agricultural and Technical State University (lead), Virginia Polytechnic Institute and State University and Embry–Riddle Aeronautical University, to share transportation research and activities occurring within the University Transportation Center (UTC) over the previous year.



CATM is a UTC funded by the U.S. Department of Transportation in 2016 under the FAST Act. The consortium's research efforts concern improving mobility for people and goods with a specific focus on transportation issues faced by vulnerable road users (VRU), which include people with disabilities and, or socioeconomic challenges, the elderly, youth, bicyclists and pedestrians.

The keynote speaker for the event was Ken Graham, director of the NOAA National Hurricane Center in Miami, Florida. Graham has extensive experience working with emergency managers and local officials to coordinate and oversee response efforts in high impact events. He has been deployed to emergency operations, provided official communications briefings, and delivered numerous trainings on preparing for and responding to tropical weather emergency situations. Graham has been instrumental in leading emergency response efforts to Hurricanes Katrina, Gustav, and Ike. He also played a key leadership role in the crisis management of the Deepwater Horizon oil spill.

In his keynote address, Graham stressed the importance of citizens taking the advance emergency weather alerts seriously and acting accordingly. He said that the very people who do not are the ones who end up stranded and in dangerous, often life-threatening, situations. Not adhering to the advisories also leads to traffic congestion and transportation problems in emergency situations. Other speakers at the symposium included affiliate researchers from each university detailing the status of their current research. The morning research presentation sessions were:

- Automated Last Mile Connectivity for Vulnerable Road Users: Andy Aldin (Virginia Tech Transportation Institute) (VTTI)
- Travelers' Rationality in Online Anticipatory Emergency Response Model: Hyoshin Park (N.C. A&T)
- Dynamic Routing of Unmanned-aerial and Emergency Team Incident Management: Hyoshin Park (N.C. A&T)
- VRU–Personalized, Optimum, and Dynamic Routing: Hyoshin Park (N.C. A&T)
- Multiscale Model for Hurricane Evacuation and Fuel Shortage: Sirish Namalae (Embry-Riddle Aeronautical University) (ERAU)

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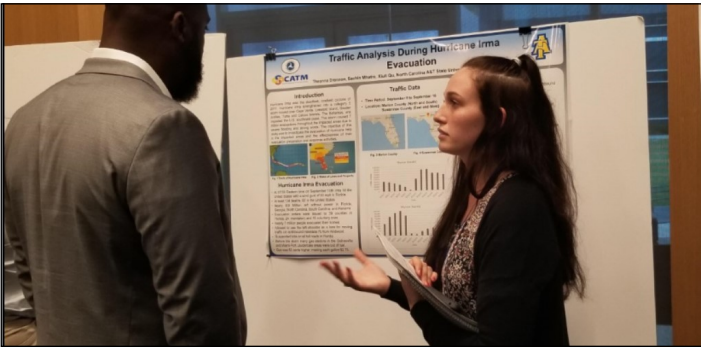
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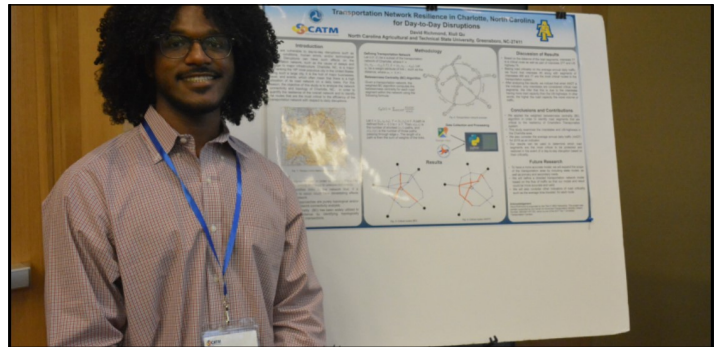
Third Annual CATM Symposium continued

After lunch and the keynote address, the afternoon research presentations were as follows:

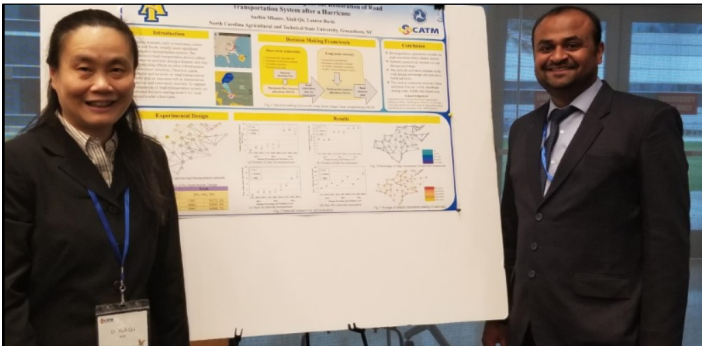
- Analysis of Non-Driving Mobility Needs of People with Disabilities: Justin Owens (VTTI)
- Development, Design, and Calibration of Vulnerable Road User Mobility Assistance Platform: Justin Owens (VTTI)
- Real-Time Recommendations for Traffic Control in an Intelligent Transportation System during an Emergency Evacuation: Xuili Qu (N.C. A&T)
- Assessing Pedestrians' Perceptions and Willingness to Interact with Autonomous Vehicles: Scott Winter (ERAU)



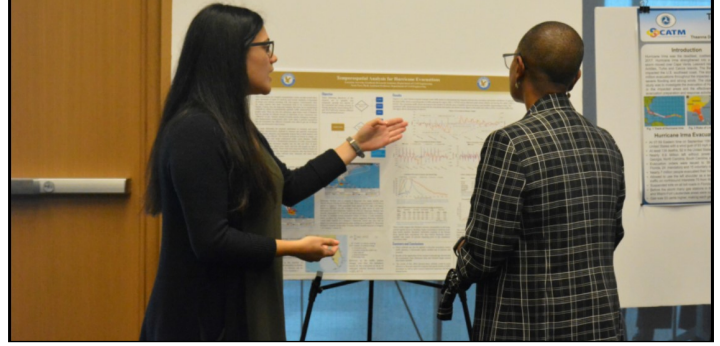
Theanna Drennon, a senior industrial and systems engineering student at N.C. A&T, discusses her research and poster on "Traffic Analysis During Hurricane Irma Evacuation" with Trey Curtain, a CATM EAC member.



David Richmond, Ph.D. candidate in industrial and systems engineering at N.C. A&T, presents his research poster on "Transportation Network Resilience in Charlotte, N.C. for Day-to-Day Operations."



From the Department of Industrial and Systems Engineering at N.C. A&T, Dr. Xiuli Qu, associate professor, with Sachin Mhatre (right), a Ph.D. student, in front of his poster on "Optimization Based Decision Making for the Restoration of Road Transportation System After a Hurricane."



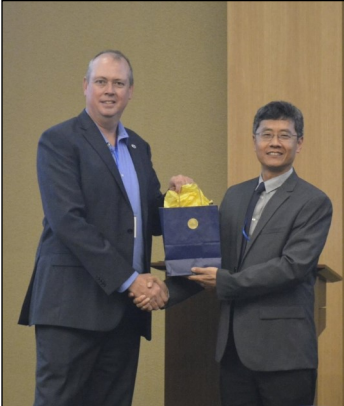
Lorraine Acevedo, a civil engineering student at ERAU, explains her research on "Temporospatial Analysis for Hurricane Evacuation" to Carletta Dudley, education and outreach coordinator for CATM at N.C. A&T.

Director of CATM and the N.C. A&T Transportation Institute, Dr. Maranda McBride welcomes attendees to the symposium.



Dr. Lon Moeller, provost of ERAU, opens the CATM Symposium by welcoming attendees to the Embry-Riddle Daytona Beach campus.

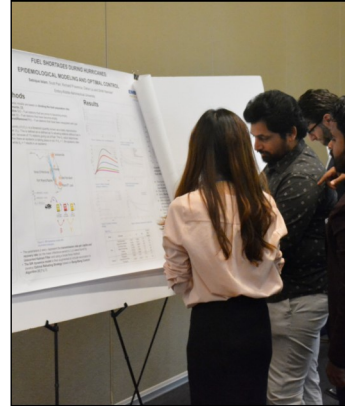
Third Annual CATM Symposium continued



Ken Graham, keynote speaker and director of the National Hurricane Center, with CATM Aviation Research Coordinator and Symposium Chair, Dr. Dahai Liu.



Dr. Scott Winter, ERAU, discusses research on "Assessing Pedestrians Perceptions and Willingness to Interact with Autonomous Vehicles."



Graduate students inspect research presentation posters.



Dr. Dahai Liu, aviation research coordinator for CATM at Embry-Riddle Aeronautic University and the CATM symposium chair, speaks to attendees.

CATM Research Spotlight

Dr. Justin Owens:

Analysis of the Non-Driving Mobility Needs of People with Disabilities



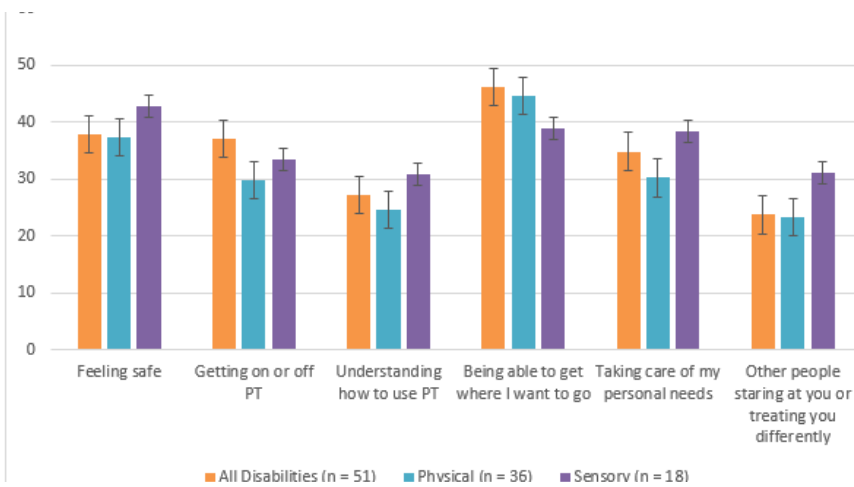
Justin Owens, Ph.D., is a human factors research scientist in the Center for Vulnerable Road User Safety at the Virginia Tech Transportation Institute. His research focuses on ways to improve safety for all road users, particularly child passenger safety, pedestrians, bicyclists and people with disabilities, in the current transportation paradigm and as our vehicle fleet shifts to automated control. Owens has conducted a significant amount of research on driver performance in the real world including work on driver distraction, drowsiness and interactions with in-vehicle electronic devices. He earned his Ph.D. in 2008 from Brown University, where his dissertation examined the role of visuospatial attention in the control of anticipatory locomotion and his M.S. in Applied Psychology from Clemson University in 2003.

One study Owens concluded in December 2019, sponsored by CATM, was titled "Analysis of the Non-Driving Mobility Needs of People with Disabilities." The research, beginning in February 2018, had the goal of identifying and prioritizing specific barriers and transportation needs facing people with disabilities (PWD). The researchers pinpointed several high-priority needs for each disability type, including:

- structural barriers to movement for people with physical disabilities
- sensory barriers precluding people with perceptual disabilities from accessing needed information
- informational barriers to travel for people with intellectual and developmental disabilities

Analysis of the Non-Driving Mobility Needs of People with Disabilities continued

To complete the research, a nationwide survey was conducted via the internet. Recruitment assistance was provided by many established disability advocacy and educational groups across the country. In response, 160 individuals ages 18-81 participated. The majority of respondents were white (91%), female (68%) and between the ages of 36 and 65 (58%). Disabilities varied widely, including 77% physical, 26% sensory, 13% intellectual/developmental and 40% multiple disabilities.



Barriers faced by people with disabilities using public transportation.

Participants reported a wide variety of barriers to transportation. In general, PWD found it hard to get where they needed to go using public transportation. Many reported difficulty with public transit, particularly those with sensory and intellectual and developmental disabilities, for whom obtaining and understanding information was difficult. People with physical disabilities reported issues with traversing physically challenging areas, like broken/slippery sidewalks, and entering and exiting transit vehicles.

Overall, the study provided valuable insight into the broad range of challenges facing PWD as they traverse the established physical environments of our society. PWD are a varied population with diverse functional impairments living in a wide range of geographic areas. Each area has different access to public transportation and paratransit. The findings of the research underline that it is imperative that technology and transportation advancement be accomplished with significant input from all parts of the disability community. Only then can equity in transportation be assured as part of the future societal infrastructure.

Dr. Xiuli Qu:

Integrated Decision Making Model for the Restoration of Air and Road Transportation Systems after a Hurricane

Xiuli Qu, Ph.D., is an associate professor in the Department of Industrial and Systems Engineering at N.C. A&T. She received her M.S. and Ph.D. in Industrial Engineering from Purdue University. Qu has expertise in optimization modeling and data mining of complex systems and experience in the development of simulation and optimization models for planning and scheduling in transportation system restoration, emergency response systems and healthcare delivery systems. Her recent research focuses on developing decision making models and tools for road protection and restoration and emergency evacuation during a natural disaster while considering the detection and predictive models of cyber disruptions to transportation systems during emergency evacuations. Qu has authored/co-authored over 50 peer-reviewed journal or conference papers.



Integrated Decision Making Model for the Restoration of Air and Road Transportation Systems after a Hurricane *continued*

Over the past decade, the frequency and intensity of natural disasters has increased, causing significant losses and disruptions to infrastructure, businesses and communities across the nation. Critical transportation systems are also significantly disrupted by natural disasters, such as hurricanes, winter storms and floods. The interruptions in transportation systems directly impact humanitarian activities responding to a disaster which may then trigger cascading effects on other vital services and associated industries. Therefore, quick restoration and recovery of transportation systems play an important role in humanitarian operations and community recovery after natural disasters.

However, being able to anticipate, prepare for and respond to a disruption in transportation systems is a complex decision-making process incorporating many factors ranging from system use to system preparation. To address these challenges, Qu’s research team developed decision-making models for flight rescheduling and road restoration after a hurricane and integrated the models to create a visual decision-making tool.

The framework was tested using the impact data of Hurricane Matthew on North Carolina. Hurricane Matthew was a category five hurricane occurring in late September through early October of 2016. Matthew caused catastrophic damage and a humanitarian crisis in Haiti, and widespread devastation in the southeastern U.S. Following the storm, more than 600 roads closed, some for as long as 21 days and more than 5,000 flights were cancelled in the U.S. with some airports closing completely between Oct. 5 –9.

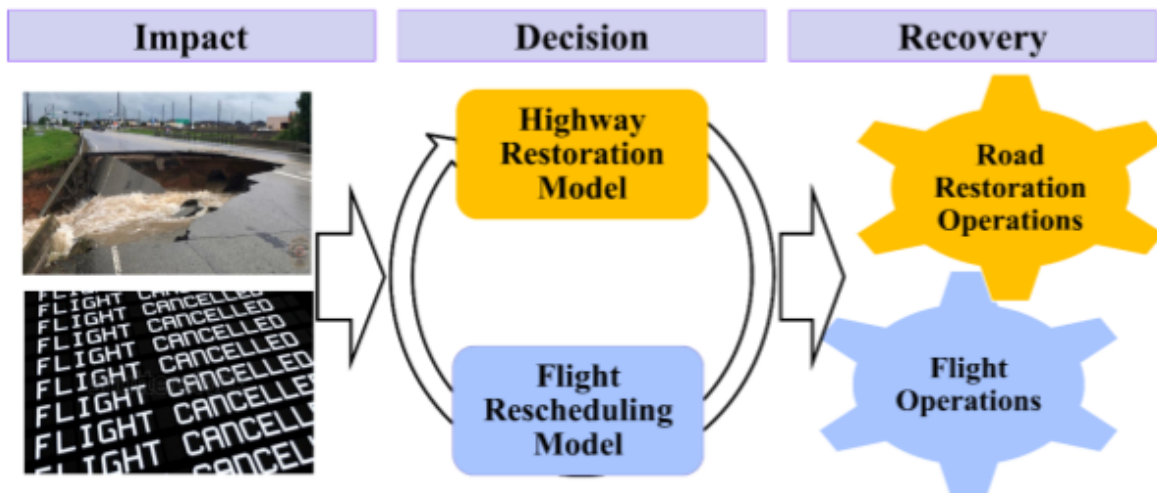


Diagram of the recovery process of air and road transportation operations after a natural disaster.

The computational time of decision making for road restoration and flight schedules recovery was within five minutes in the case study. The results show that for flight rescheduling 65% of passengers and flights can be rescheduled within 24 hours, and all canceled flights can be rescheduled within 48 hours. For short-term road restoration, the road transportation network can be reconnected within 52 hours. Using the framework proposed in the study, an emergency manager could prioritize the restoration activities to minimize the negative impact of natural disasters on the transportation system.

The resulting integrated model and visual tool will serve to improve the effectiveness and efficiency of response activities in local and regional transportation systems during an emergency event, such as a hurricane. Deploying effective response activities to a hurricane can aid the mobility of people and disaster relief efforts during and after a hurricane, which ideally means better safety and more lives saved.

Dr. Hyoshin Park to be Awarded a Patent for Traffic Sensor

N.C. A&T Assistant Professor Hyoshin (John) Park, Ph.D., has received notification that a traffic sensor resulting from his research will be granted a U.S. patent. The patent application, which was filed in January 2019, has not been awarded at the time of publication, but has been approved.

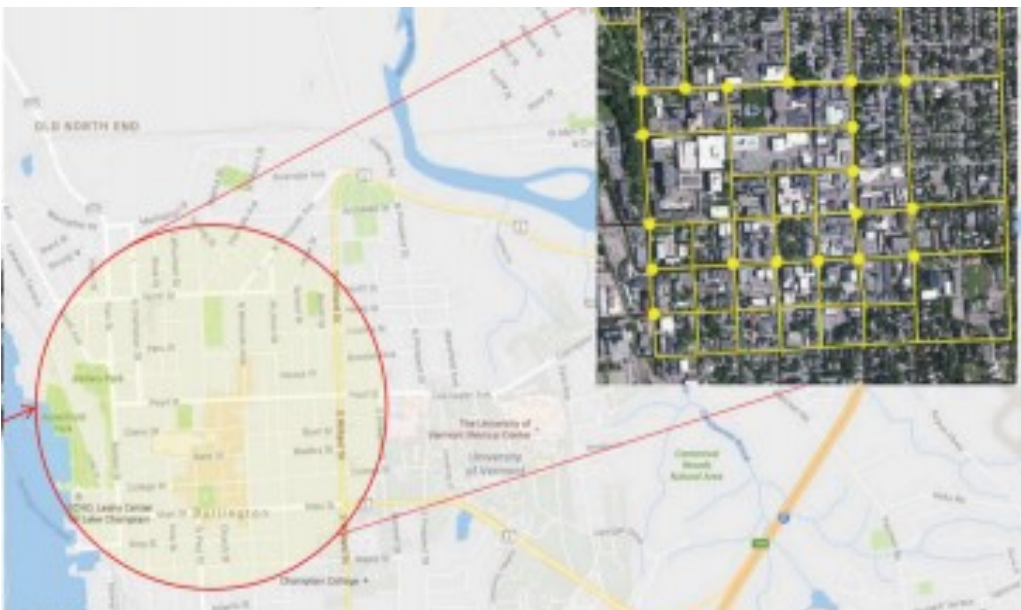
The research project titled, “Anticipatory Traffic Sensor Location Problems (SLPs) with Connected Vehicle Technologies,” was conducted by Park and colleagues Ali Haghani, Song Gao, Michael A. Knodler, Siby Samuel and sponsored, in part, by CATM.

Park’s research expertise is in the area of decision making under uncertainty in transportation system analysis and network modeling. His current projects span several multidisciplinary areas in transportation engineering, including technologies in roadside sensors, emergency response, safety, focusing on operational learning in stochastic and dynamic systems and developing artificial intelligence (AI)-based decision tools. His AI algorithms have been applied to connected and autonomous vehicle operations sponsored by federal and state/local agencies including NSF, NASA, USDOT, VDOT, DOE, I-95 Corridor Coalition, Maryland Coordinated Highways Action Response Team (CHART) and NCDOT.



This research sought to offer a solution, responsive to uncertain and changing demand, to urban traffic congestion via the dynamic relocation and control of traffic sensors using wireless technology and portable devices. The basic idea was to have onboard equipment in vehicles transmitting data to roadside sensors integrated with traffic signal controllers. In response, the timing of traffic lights could be adjusted real-time to significantly reduce delays.

The research utilized two dynamic algorithm models to find solutions. The model framework was based on portable sensors that can be repositioned within the same day and from day-to-day to new locations so that locations of sensors and time stages of traffic lights are maximized. To tackle this problem, budget constraints on the sensor costs and relocation costs as well as various demand profiles and penetration rates of an urban transportation network had to be taken into account.



The results showed that the flexible relocation model achieved the same maximum savings with fewer sensors than the fixed sensor location model. The gap between two dynamic models decreased when more sensors were available.

An example of a subarterial network in Burlington, N.C. where different numbers of sensors were tested in a total of 19 candidate locations.

Student Awards and Activities

2019 Dwight D. Eisenhower Transportation Fellowship Program Awarded to Three N.C. A&T Students

N.C. A&T students, Kiana Williams, Joseph Smith and Tyler Huggins were awarded grants from the Administration of the Dwight David Eisenhower Transportation Fellowship Program (DDETFP). The purpose of the DDETFP local competition is to stimulate interest among students attending a minority serving institution of higher education or community college to conduct transportation-related research, pursue transportation-related degrees, enter the transportation workforce and enhance the breadth, scope and diversity of knowledge of the entire transportation community in the United States. The local DDETFP competition provides funding for students to pursue associate, bachelor, master and doctoral degrees in transportation-related fields. The awards are given on the basis of merit including: academic records, class standing, GPA, transcripts, transportation work experience and recommendations.



Kiana Williams is a senior supply chain management student from Columbus, Ohio. From the beginning of her time at N.C. A&T, she has been active with Housing and Residence Life by becoming the vice president of Civic Engagement of Vanstory Hall. As a resident assistant, Kiana has been a mentor to many fellow students. She has also served as a mentor for the Honors College at N.C. A&T and an Aggie M.E.N. mentor. She was selected as a Class of 2020 Career Prep Fellow by Management Leadership for Tomorrow (MLT). Kiana chose to major in supply chain management to be able to pursue her business career goals from a more focused angle. She has interned with Lbrands, Zoetis LLC and Chick-fil-A, Inc. and completed a five-month co-op with Georgia Pacific. Kiana lives by the Bill Nye quote:

“Everyone you will ever meet knows something you don’t.”



Joseph Smith, a senior supply chain management student at N.C. A&T, is from High Point, North Carolina. He was a Summer Transportation Institute participant in 2014 and credits that experience with influencing his educational focus. Joseph has had transportation internship experience with Volvo Truck Group where he was responsible for making sure all the suppliers who send parts for Volvo or Mack trucks were compliant across all standards. As a CATM scholar, he has attended the CATM Symposium and TRB conference for the last three years. Joseph aspires to have a career in supply chain management in the United States Air Force and said:

“Supply chain management has so many different career path options available to me.”



Tyler Huggins, a civil engineering senior from Columbia, South Carolina, has been engaged in transportation activities throughout her years at N.C. A&T. She has been an active executive board member for the Institute of Transportation Engineers for the past four years. To start, Tyler was the treasurer and went on to act as president for the next three years. She has also been involved with the Summer Transportation Institute program activities, volunteered at a CATM meeting and participated in the first Transportation Awareness Day. Over her collegiate years, she worked three internships in the transportation field - two summers with NCDOT and one summer with NV5, formerly known as CALYX. Tyler said:

“All of my experiences have not only pushed me to further explore my passion for transportation, they’ve also been great tools for shaping leadership skills for the future.”

2019-2020 Center for Advanced Transportation Mobility Scholars



Tyreak Carr is a senior supply chain student from Riverdale, Georgia. He is the director of marketing and programs for the N.C. A&T State University campus chapter of APICS, the Association for Supply Chain Management. He is a mentor for three first generation college students and an active member of the Blue and Gold Marching Machine.



Quadir Donaldson, from Greensboro, North Carolina, is a CATM incentive reward recipient and a freshman this year at N.C. A&T. He was a participant in the Summer Transportation Institute program in 2018 which ignited his interest in the transportation field. Quadir plans to study supply chain management and still is evaluating his career options in that area. He is currently in the N.C. A&T honors program and has worked at an electrical company and United Parcel Service in the past.



Marvin Edge is a senior supply chain student from Cerro Gordo, North Carolina. He is an active member of N.C. A&T student chapter of APICS, the Association for Supply Chain Management. Marvin is a cadet in the N.C. A&T Campus Air Force ROTC. He will commission as a 2nd Lieutenant in the U.S. Air Force upon graduating where his career goal is working as a logistics readiness officer. He is an Apple HBCU and Thurgood Marshall College Fund Scholar.



Aliya McCray is a junior supply chain management student from Raleigh, North Carolina. As an honor student, she is a member of the N.C. A&T chapter of the Association for Supply Chain Management and holds the executive board position for marketing and recruitment. Aliya participated in the third annual CATM Symposium held at Embry-Riddle Aeronautical University in Daytona Beach, Florida. She is also an active member of the N.C. A&T Blue and Gold Marching Machine. During the summer of 2019, she interned in the procurement department at Altria located in Richmond, Virginia where she learned the procurement process for tobacco products.





Amanda Gray is from New Brunswick, New Jersey and is currently a junior studying supply chain management. Last year, she completed an internship with the Environmental Health and Safety Department at N.C. A&T. It is Amanda's goal to one day start her own motor carrier logistical company.



Gregory Stewart graduated from N.C. A&T in December 2019 with a degree in finance and supply chain management. He immediately started his career in the transportation industry as a commercial sales analyst for ExxonMobil in Houston, Texas. Gregory was a Dwight D. Eisenhower Transportation Fellowship program award recipient during the 2018-2019 school year.



Jacob Smith is a senior supply chain student from High Point, North Carolina. Jacob participated in the first annual CATM Research Symposium held on the campus of N.C. A&T State University in October, 2017. He attended the fifth annual University Transportation Center (UTC) Conference for the Southeastern Region held on the campus of Embry-Riddle Aeronautical University in November 2017. He was also chosen to present at the 2020 Transportation Review Board Conference in Washington, D.C. in January. Jacob is a graduate of the N.C. A&T Summer High School Transportation Institute.



Joseph Smith is a senior supply chain student from High Point, North Carolina. Joseph was awarded the Dwight D. Eisenhower Transportation Fellowship for the 2019-2020 academic year. He participated in the first annual CATM Research Symposium held on the campus of N.C. A&T in October, 2017. He attended the fifth annual University Transportation Center (UTC) Conference for the Southeastern Region held on the campus of Embry-Riddle Aeronautical University in November 2017. Joseph is a graduate of the N.C. A&T Summer High School Transportation Institute.



Kiana Williams is a junior supply chain student from Columbus, Ohio. Kiana served as a procurement intern for Lbrands from May-August 2017. She is a member of APICS, the Association for Supply Chain Management, Aggie Toastmasters, and Alpha Lambda Delta Honors Society. Additionally she is an Honors College mentor, resident assistant and serves as an executive student leader for N.C. A&T Greek Life.

Transportation Conferences

Jan. 12-15, 2020 six N.C. A&T students and CATM scholars traveled to Washington, D.C. to attend the 99th Annual Transportation Research Board conference.



From left: Marvin Edge, Tyler Huggins, Kiana Williams, Tyreak Carr, Joseph Smith and Amanda Gray.



On Nov. 4, seven N.C. A&T students attended the third annual CATM Symposium held at Embry-Riddle Aeronautical University in Daytona Beach, Florida.

From left: Joseph Smith, Kiana Williams, Jacob Smith, Gregory Stewart, Tyreak Carr, Aliya Mcray and Amanda Gray.



Summer High School Transportation Institute “has completely changed my son’s outlook on school”

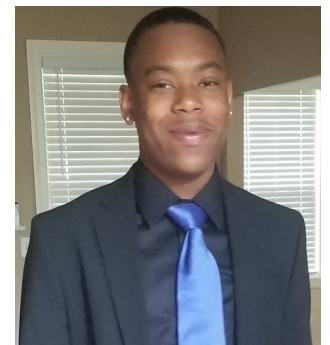
Makari Vann, currently a junior at T. Wingate Andrews Aviation Academy in High Point, North Carolina, heard about the Summer High School Transportation Institute (STI) from his mother, Yvette Ingram-Golden. Makari was already very focused on having a future career in transportation after high school. He was determined to bypass college and get trained to do airframe aircraft work. His mother wanted him to gain a broader understanding of the scope of the transportation industry and many other career opportunities available to him. According to Yvette, the program more than succeeded in doing that.



“This program has completely changed my son’s attitude about school and his future. The STI experience really opened his eyes to all the possibilities available to him, helped him see himself differently and envision a different future. After attending the program, Makari is talking about going to college and the different educational and career paths he could take. While he certainly received valuable knowledge from the activities and speakers in STI, he also gained confidence in himself and his abilities. I see him working harder on setting and achieving goals. He’s even budgeting his spending money better. I definitely saw my son transition to being more open about his education and career choices.”

Makari’s favorite part of the program was the out-of-town trips. Along with several local outings, the class traveled to Washington, D.C., Wilmington, North Carolina and Tampa, Florida. The trips allowed Makari to experience new things while learning and having fun. Makari feels like he benefitted the most from the college level English class because it helped him build his reading comprehension and writing skills.

“This program helped me see myself and my abilities differently. I had the chance to travel and become more of an independent thinker. I also learned to think outside of the box about my options for the future. I am more open minded now and considering other jobs and careers.”



The five and a half week STI program for high school juniors and seniors is the beginning of a pipeline that can end in lucrative transportation and supply chain management jobs after college. STI participants have gone on to careers with Fortune 500 firms, federal and state agencies and public and private companies. To qualify for the STI program, students need a minimum 2.5 GPA on a 4.0 scale and submit a typed 250-word essay expressing their interest in attending and how they feel it would advance their education and career goals. They also have to commit to attend every day of the summer program. Each student receives a weekly stipend and certificate of completion. The Federal Highway Administration, North Carolina Department of Transportation and Center for Advanced Transportation Mobility sponsor the STI in partnership with N.C. A&T’s Transportation Institute in an effort to recruit talented young people to the transportation industry and increase minority representation in the workforce.

Street Safe Driving Experience

On Saturday, Sept. 21, 2019, five CATM scholars attended a “Street Safe” driving experience at East Forsyth High School in Kernersville, North Carolina. The event included classroom instruction as well as behind-the-wheel practice and a “seat-belt convincer” crash simulator.



Kiana Williams navigates the cones while wearing the “drunk goggles” which simulate visual impairment.



From left: Quadir Donaldson, Marvin Edge Jr., Tyreak Carr, Gregory Syewart and Kiana Williams.



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