Fall 2017

The UMEC Report

The newsletter for the Urban Mobility & Equity Center, a Tier 1 University Transportation Center led by Morgan State University

New research, programs are underway

Welcome to UMEC! The Urban Mobility & Equity Center was created with a $1.4 million grant awarded by the U.S. Department of Transportation's University Transportation Centers Program last fall.

Three schools make up UMEC: Morgan State University, where it's housed; the University of Maryland; and Virginia Tech. All three have a strong history of transportation research and each offers different laboratory capabilities and expertise.

During the next five years, UMEC's research will center on three themes:

- Transit/paratransit and freight planning and operations to improve mobility, access and cost efficiency;
- Buyer acceptance, affordability and government promotion of connected and automated vehicles, including social equity considerations during diffusion of technology; or
- Distribution of transportation costs and benefits, including equity of user fees and taxes that fund infrastructure and services.

To date, UMEC has awarded grants for six core research projects and four competitively awarded projects. (See page 3 for a complete list of the projects.)

Projects are selected through a peer-review process and expected to impact not just the field of transportation but broader segments of society. For example, research into how low-income residents access groceries in 'food deserts' has implications for public health, while optimizing freight vehicle routes reduces congestion and energy use.

Additionally, UMEC has undertaken workforce development in the form of internships and programs that introduce middle school and high school students to the field of transportation.

UMEC also serves as a resource for the community. UMEC researchers helped in the planning of a Baltimore bus line. UMEC Director Dr. Andrew Farkas provided assistance as a technical expert for the Clean Cars Act of 2017 in the Maryland State Legislature to make the bill's financial incentives for electric vehicle purchases more equitable; the bill was enacted. •

Director's Message

Dr. Andrew Farkas

We hope you enjoy the premier edition newsletter of the Urban Mobility & Equity Center (UMEC), a Tier 1 USDOT University Transportation Center. We have used our first few months to get the center up-and-running and meet the reporting deadlines of the UTC Program. This is not our first experience with the UTC program, having had a stand-alone center and having participated in UTC consortia in the past, but UMEC is our first initiative to focus seriously on overcoming obstacles to urban mobility.

Many urban residents in the United States experience spatial mismatch and immobility between affordable housing and jobs; they contend daily with poor and unreliable access to economic opportunity. According to Census data analyzed by the Baltimore Metropolitan Council, 31 percent of Baltimore City households don't own an automobile. Twenty-five years ago Morgan State research revealed that low-income urban neighborhoods had low accessibility to suburban activity centers with expanding employment opportunities. A recent review of access to employment in Baltimore by the Central Maryland Transportation Alliance concluded that not much has changed. Conditions are similar in other large cities.

In the future being able to hail a driverless vehicle and share rides with others could transform public transit services and commuting patterns, but demand-responsive, car-sharing or shared-ride services using autonomous and electric vehicles should be accessible to everyone. Urban goods movement also has issues of immediate and long-term concern.

Our research, education and community outreach/technology transfer programs are addressing these issues and we'll keep you informed of our progress. After looking over this issue, please give us your thoughts about what we have done so far.

The Urban Mobility & Equity Center is a federally funded Tier 1 University Transportation Center led by Morgan State University in partnership with the University of Maryland and Virginia Tech. UMEC focuses on research to improve the mobility of people and goods in an environmentally sustainable and equitable manner.

Director
Dr. Andrew Farkas
Phone: 443-885-3761
Email: andrew.farkas@morgan.edu
Phone: 443-885-3761

Associate Directors
Dr. Lei Zhang
Phone: 301-405-2881
Email: lei@umd.edu

Dr. Hesham Rakha
Phone: 540-231-1505
Email: hrakha@vtti.vt.edu

Morgan State University
CBEIS 327
1700 E. Coldspring Lane
Baltimore, MD 21251
443-885-3666

www.morgan.edu/umec
www.facebook.com/urbanmobilityandequitycenter
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Core research projects

Traffic State Prediction: A Traveler Equity and Multi-model Perspective
Dr. Hesham Rakha, Virginia Tech; Dr. Kyoungho Ahn, Virginia Tech

Development of Multimodal Traffic Signal Control
Dr. Hesham Rakha, Virginia Tech; Dr. Kyoungho Ahn, Virginia Tech

Dynamic Vehicle Routing with Route Guidance for Urban Pickup and Delivery
Dr. Ali Haghani, University of Maryland

Optimizing Small-Sized Automated Transit Operations and Its Applications
Dr. Young-Jae Lee, Morgan State University

Optimized Development of Urban Transportation Developments
Dr. Paul Schonfeld, University of Maryland

Understanding Access to Grocery Stores in Food Deserts in Baltimore City
Dr. Celeste Chavis, Morgan State University; Anita Jones, M.S., Morgan State University

For more information on any of these projects, visit our website at www.morgan.edu/umec

Competitively awarded projects

Developing a Connected Vehicle Transit Signal Priority System
Dr. Kyoungho Ahn, Virginia Tech; Dr. Hesham Rakha, Virginia Tech; Dr. Young-Jae Lee, Morgan State University

Developing and Testing an ECO-Cooperative Adaptive Cruise Control System for Buses
Dr. Hesham Rakha, Virginia Tech; Dr. Hao Chen, Virginia Tech; Dr. Mansoureh Jeihani, Morgan State University

Optimization of Emergency Traffic Patrols (ETP) Operations
Dr. Ali Haghani, University of Maryland; Dr. Mansoureh Jeihani, Morgan State University

Innovative Methods for Delivering Fresh Foods to Underserved Populations
Dr. Hyeon-Shic Shin, Morgan State University; Dr. Paul Schonfeld, University of Maryland

Maryland State Highway Administration 2017 Summer Interns

Destiny Copeland
Venita Russell
Ayomiposi Akinyemi
Amirah Fields
Wayne Johnson
Adrianna Rhoden
Anthony Lovelace

Maryland Department of Transportation/Morgan State University Graduate School Interns

Zohreh Rashidi Moghaddam
Kelechi Uradu
Nnanna Ekedebe
Christopher Tokpah
Steve Charles
Eseose Kadiri
Sha'von Terrell
Chinedu Okeke
Ibrahim Aka
Tu Nguyen
Rawaa Altameemi
Blessing Esimobi

The UMEC Report is published annually.

Smart Road paves way for innovation

The road to sophisticated testing was pretty straightforward.

The Virginia Smart Road, managed by the Virginia Tech Transportation Institute (VTTI) and owned by the Virginia Department of Transportation, officially opened in 2000 and was already in high demand for research purposes.

Since then, more than 26,000 hours of research have been logged on this 2.2-mile test track that features all-weather testing (fog, snow, rain) with 75 weather-making towers, various pavement sections including an open-grade friction course, lighting controls, and seven roadside equipment units that facilitate connected-vehicle communications. The Smart Road has a signalized intersection with complete signal phase and timing using remote controls, and three bridges, one of which is the tallest state-maintained bridge in Virginia.

For nearly two decades, the technologies tested on the Smart Road have ultimately been placed in vehicles, and such research continues today. Connected- and automated-vehicle technology is tested on the Smart Road before deployment in the real world to assess the potential for safety benefits while minimizing driver distraction and information overload.

In the late 1980s, national interest in smart cars and smart technology was growing. A 1990 Richmond Times-Dispatch article quoted U.S. Rep. Rick Boucher as saying Virginia was the first state to apply for federal funds to build a smart highway, which the VTTI (then named the Center for Transportation Research) would design. The highway would be equipped with fiber optic sensors that used navigational computers to warn drivers when they were getting too close to the vehicle in front, when they were veering off the road, when they were approaching a hazard, and when it was okay to pass.

In summer 1991, the Roanoke Times reported, "A U.S. House of Representatives committee has approved Rep. Rick Boucher's request for $10 million for construction of a 'smart road' between Blacksburg and Roanoke." It was November by the time the proposal worked its way through the system and $5.9 million was awarded for a "smart road demonstration project." In December, President George H. W. Bush signed the Intermodal Surface Transportation Efficiency Act of 1991 with approximately $660 million authorized to intelligent vehicle/highway systems during the next six years.

In early 1992, the Montgomery County Board of Supervisors approved the smart road, which was also endorsed by the Town of Blacksburg, the Greater Blacksburg Chamber of Commerce, Roanoke City, Roanoke County, the Roanoke Regional Chamber of Commerce, the New River Alliance, and the Roanoke Times.

Building upon the unique capabilities of the Smart Road, VTTI has worked with various partners during the past few years to create the Virginia Automated and Connected Corridors. These corridors comprise roadways that facilitate testing migration from closed test tracks (i.e., the Smart Road) to public roadways in Northern Virginia (Interstates 66, 95, and 495 and U.S. 29 and 50). Collectively, the corridors allow government agencies, auto manufacturers, and suppliers to safely and efficiently develop, test, certify, and deploy their advanced vehicles. •

Robotics students program drones

A piece of a conference poster board on the bulletin board in the IRAM lab is torn – the result of a bump from a drone flown by a student nicking it. The drone itself is protected from such student mishaps by a curved fender made from pool noodle styrofoam.

The IRAM – Industrial Robotics and Automated Manufacturing – laboratory at Morgan State has not only drones but also mobile robots, an industrial robot, a conveyer and two machining centers.

"I teach students how to use all of them," says Dr. Richard Pitts, Jr., interim chairperson and associate professor of the Industrial and Systems Engineering department. "I try to bring in students to learn about how robots can be designed, instituted and used in society."

In 2013, a team of students designed and built a robot that could travel on the surface of the moon and excavate lunar samples; it was entered in a prestigious international competition 'Lunabotics' at the NASA Kennedy Space Flight Center. One of the IE students (Jason Carter, BS '11, MEng '13) from that team now sets up automated manufacturing plants for Honda.

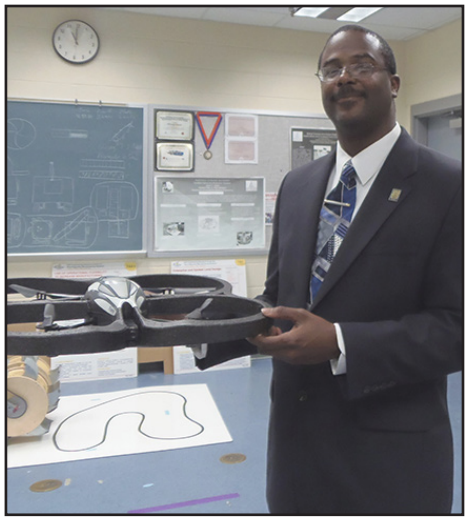
"We were the only HBCU there," Dr. Pitts notes, adding that he hopes his students will compete again in 2018, and the focus now is broadened to include robots that could land on an asteroid or Mars – any rocky surface. That also has implications for mining on Earth.

The IRAM lab also gives students a chance to design a product, test a manufacturing simulation and then actually make it in the lab.

One of the stars of the lab is the Motoman HP3 Performer, a $35,000 robot funded by an NSF grant written and received by Dr. Pitts in 2009, used on automotive assembly lines.

In the world of transportation, drones are, of course, part of the future. Students start by learning the nuances of a small drone and then learn to fly it with an iPad. What's most important and dear to the heart of Dr. Pitts is when students master how to program and write code for drone autonomous maneuverability.

Dr. Pitts is a product of Morgan State. What led him into the field of engineering – rollercoasters! Travelling with his family across the country to test the next thrill ride is



a summer hobby that he enjoys. He graduated with a bachelor's degree in industrial engineering in 1991; but, soon was lured back to Morgan from industry by Dean Eugene DeLoatch, who recruited him to build a robotics lab. Dr. Pitts continued his education by receiving both his master's degree in 1995 and his Ph.D. degree from Penn State in 2006 while teaching here at MSU in between both degree programs.

Both undergraduate and graduate students may work in the lab. One undergraduate student, whose hobby is Tae Kwan Do, is developing a robot that could serve as a sparring partner.

"I open my lab for students to do different robotics projects," Dr. Pitts says. "Students are so creative today; I don't want to limit them." •

Bike Equity Forum well attended

A Bike Equity Forum at Morgan State University in April included two presentations, "Bike Lanes are White Lanes" by Melody Hoffman and "One Barrier Too Many: Understanding What It Means To Bicycle in Black and Latino Communities" by Charles Brown.

2017 Summer Programs

Summer Transportation Institute

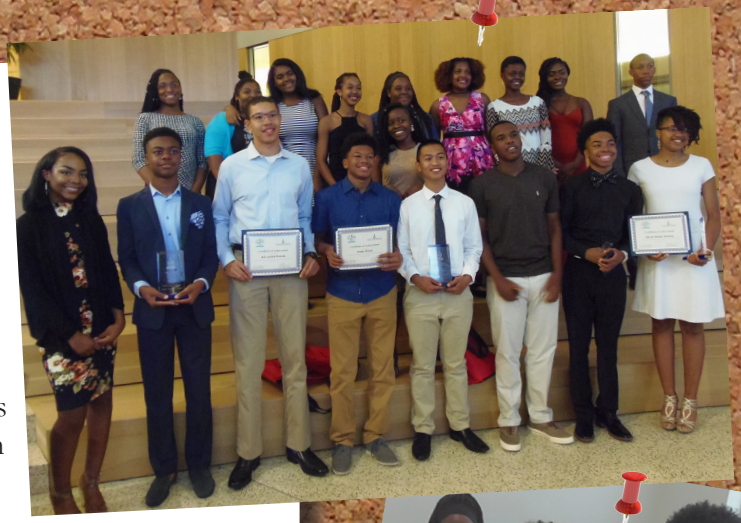
Who: 20 high school students

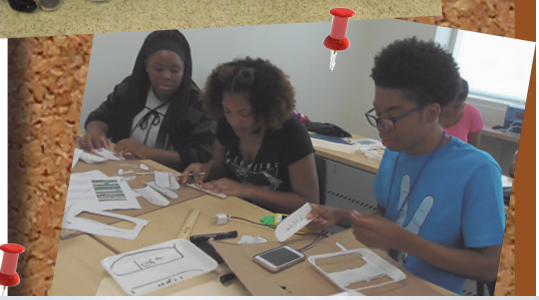
Why: Exposure to transportation field, STEM concepts, SAT prep

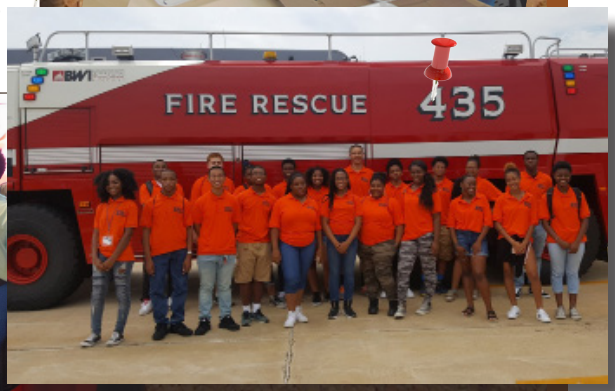
How: Field trips to aviation museums, airports and the Baltimore Harbor; speakers, classroom activities, and recreational activities

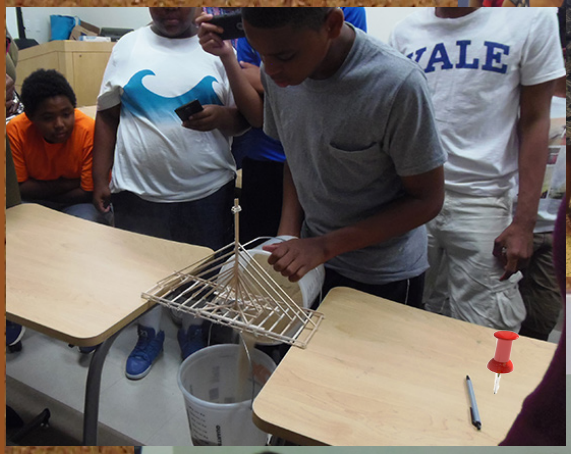
Highlights: Students traveled overnight to the University of Maryland Eastern Shore to visit its flight simulator and the Coast Guard Yard in Ocean City.

Comment: "I wanted to do something in science. After this, I developed a new love for transportation – it seems more interesting than I thought." – Kobe White, a junior at New Town High School









Middle School Summer Transportation Initiatve

Who: 17 middle school students

Why: Exposure to transportation field, STEM concepts

How: Field trips, speakers, classroom activities, recreational activities, visiting area bridges, building models of bridges.

Comment: "I thought building was only for boys, but, boy, was I wrong." – Janiya Johnson, middle-school student