

GROWTH FACTOR

UAH AND CHAMBER OF COMMERCE UNITE IN ECONOMIC DEVELOPMENT

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At UAH, Economic Development Matters

Dr. Ray Vaughn

Velcome to this edition of FOCUS, UAH's research magazine. This issue highlights our efforts to assist in economic development in Alabama and the Huntsville/Madison County community.

Most vice presidents for research at universities have economic development responsibilities included in their title. That makes good sense because the products of research often lead to commercialization opportunities, licenses and patents. The UAH Office of Technology Commercialization plays a very effective role in this regard and is available to assist faculty, staff and students with questions and advice concerning intellectual property and business startups.

A recent publication of the American Academy of Arts and Sciences titled "Public Research Universities: Why They Matter" makes the point that public universities fuel state and national economic development; foster researchand innovation-based relationships with business, industry, the non-profit sector and government; and universities manage their intellectual property for the public good. UAH mirrors this philosophy.

UAH and the Chamber of Commerce of Huntsville/Madison County work handin-hand to attract new businesses to this community and to foster their success. Many times this effort goes unnoticed, but please be confident that UAH stands ready to assist in this community's growth in every way possible. Often, when a prospective new business is looking at the Huntsville community for a possible presence, UAH works very closely with the Chamber and others to present a convincing argument that locating here makes good business sense.

Working in partnership with Madison County, we have initiated an effort to increase international engagement for our community. An example of our outreach bearing fruit is a recent visit from the Mexican Space Alliance (MXSpace) that included tours of UAH, Cummings Research Park and a visit to the Chamber of Commerce of Huntsville/Madison County. We expect to have a similar interaction with the Belgium aerospace alliance at the beginning of 2016. While attending the Paris Airshow this past summer, we met with numerous companies that we could potentially engage as research partners or encourage in establishing a presence in our community. We worked together with the Chamber of Commerce and Madison County in these meetings.

Please take a few moments to look though this issue of FOCUS magazine highlighting UAH research contributions and economic development activities. You are always welcome to contact our office for additional information if needed. My office is available to provide information on the efforts featured in this magazine or any other research project ongoing at UAH.

Go Chargers!

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COVER: Dr. Ray Vaughn, UAH vice president for research and economic development, at left, and Chip Cherry, president and CEO of the Chamber of Commerce of Huntsville/ Madison County, at Chamber headquarters. The University of Alabama in Huntsville has the largest research expenditures among public universities of its size.



ACTIVE PATENT TOTAL - 51

NATIONALLY



Federally financed aeronautical/ astronautical engineering research



NASA R&D expenditures



research

expenditures

Federally financed business and management research

Federally financed

computer sciences

research expenditures



Department of Defense R&D expenditures



Federally financed atmospheric sciences research

SOURCE: UAH Office of the Vice President for Research and Economic Development

WORLD-CALIBER PERFORMANCE



CHAMBER OF COMMERCE, UAH TEAM UP FOR ECONOMIC DEVELOPMENT WHEN A STRONG TEAM HAS A GOOD RECORD AND AN EXCELLENT PLAYING FIELD, WORLD-CALIBER PERFORMANCE CAN TAKE PLACE.

Huntsville's economic development team is led by the Chamber of Commerce of Huntsville/ Madison County and relies on The University of Alabama in Huntsville as a key player. With Cummings Research Park and Huntsville/Madison County as the playing field, people rooting for Huntsville can expect good things.

The nationally recognized research done at The University of Alabama in Huntsville is closely interwoven with industry and government, and that is a powerful economic development tool, says Chip Cherry, Chamber president and CEO.

"We have enjoyed an unprecedented level of private sector success, and that's because companies can see that they can succeed here," Cherry says. "That's because there's a rich heritage here, with UAH being essential to our ability to provide the type of cohesion that is attractive to prospects. That's essential because unity among local officials and institutions is something you can't fake when a company is looking to locate in the area. Now we're in the mode where we have great opportunities."

Dr. Ray Vaughn, UAH vice president for re-

search and economic development, sees supporting the Chamber of Commerce's efforts as fundamental to UAH's mission.

"Most universities assign the mission of economic development to their vice president of research, because of the direct relationship between research and the proliferation of research products into commercial uses and business startups," Dr. Vaughn says. "We partner with the Chamber of Commerce, and we're supporters of their initiatives. We're part of the Huntsville team that recruits to this area. People are amazed at what this community can offer, and they are just as amazed that they didn't know anything about it before."

The local business environment is robust, and Dr. Vaughn says there's another story about the area that includes its beauty, natural resources, recreational opportunities, salaries, world-class medical care, excellent infrastructure and the Port of Huntsville's International Intermodal Center.

"When we try to attract businesses to Huntsville, one of the advantages we offer is a nationally recognized university with research centers and laboratories in place to aid those companies," he says. "But UAH is not responsible for economic development in the area. That job belongs to the Chamber of Commerce and other entities. Our job is to add value to and multiply that effort."

Dr. Vaughn cites the team effort by the Chamber, Madison County and UAH at the Paris Air Show in June.

"We went together over there and talked as a single entity with organizations that might want a presence here locally," Dr. Vaughn says. As an example, the director of the Mexican Space Alliance visited in July and representatives of the Belgium aerospace alliance are expected later this year. Some 40 Belgian companies are involved in aerospace work.

FORWARD THINKING

Nationally, UAH sets itself apart by being particularly forward thinking, Cherry says. When the Chamber contracted with consulting firm Deloitte for a semiconductor manufacturing feasibility study, Deloitte representatives took a tour of UAH's Optics Building.

"At the end of the tour, UAH representatives were asking who they should look to hire in order to best position themselves if something happened. This was only the feasibility study, and UAH was already looking ahead to what would be needed if a company came," he says. "Deloitte told us this type of attitude is quite unusual to find elsewhere in the country. When you start going through the process of looking for somebody to locate here, you realize just how much this is different from other places."

The research being done at UAH is especially attractive to prospective businesses, Cherry says.

"I realize there is theoretical research that's being done at UAH, but a lot of the research done there is more oriented toward a product coming out of that pipeline," he says. "UAH is looking at the whole area of intellectual property and asking the question, 'How do we leverage that to grow the economic vitality in the area?' I think this also has bearing on UAH's efforts to establish an incubator on campus."

He's referring to the Invention to Innovation Center (I2C) project, a business incubator that UAH is planning to build and manage.

"When companies start up, they typically have from one to four employees and not a lot of money," says Dr. Vaughn. "Part of our economic development role is to foster the startups and new companies that are commercializing some of the new technologies that are coming from Redstone Arsenal and NASA."

The center will provide reduced rents



to startups and young companies that will share basic business services and common areas there.

"As the company grows, it hopefully will graduate to spaces that are available in Cummings Research Park," Dr. Vaughn says.

Attracting existing companies to the area is another important facet of economic development. UAH was part of pre-decision visits made by Polaris Industries and Remington Arms Co., both of which ultimately located in Huntsville. The university's product- and produc-

COVER **STORY**



tion-oriented research means that newly locating companies can find ready resources at UAH for R&D efforts, Cherry says.

"We are going to be a center of excellence for Polaris' Ranger," he says, "and that represents a major part of that company's business."

VON BRAUN'S VISION

It was space pioneer Dr. Wernher von Braun's vision that UAH would work closely with local companies. "Von Braun was a very charismatic guy," Cherry says, "and he was able to get to the right people at the right time."

Dr. von Braun's vision included a UAH research institute to serve Redstone Arsenal. That has expanded into many campus research centers that serve those needs today, Dr. Vaughn says.

"My view is that UAH grew up differently than any other university," he says. "This university grew primarily to support NASA and Redstone Arsenal, and we are still executing that mission."

UAH's next-door neighbor, Redstone Arsenal, has grown from a center for rocketry into a base that now supports 72 functions with 125 Senior Executive Service officers on base. "The sphere of influence there is amazing," Cherry says. "UAH's history, as it has evolved to be tied to Redstone Arsenal, NASA and the Chamber, is unique. We are joined at the hip."

The university's geographic proximity to industry, the Arsenal and NASA make for a major regional plus, Dr. Vaughn says.

"There's an advantage to a nationally recognized research university being the anchor tenant in the nation's second-largest research park, and that's UAH," Dr. Vaughn says.

"As an original anchor tenant in Cummings Research Park, UAH has been an excellent resource and partner working with and meeting the needs of the agencies on Redstone Arsenal, NASA and our business community," says Erin Koshut, director of Cummings Research Park. "I am certain that UAH's continued growth and advancements will continue to go above and beyond to meet the needs of our companies and prospective industries that call or are interested in calling Huntsville home."

UAH faculty have contributed to recruitment efforts by producing economic Erin Koshut, director of Cummings Research Park

impact studies and business planning and filling the frontline roles Cherry says are played by UAH's colleges to provide research, student interns and the educated workforce necessary to economic diversification.

The university's strength regionally and nationally lies in the technical and high-level specialty degrees it provides. "Most of our graduates stay close to home, because that's where there's the greatest need for them," says Dr. Vaughn.

"Our community could not have grown and evolved in the way that it has if not for UAH and its capabilities," says Cherry. "Our ability to demonstrate that we can support and provide advanced degrees to folks who then go out and become an engaged and productive workforce is crucial. The integration of academics with the business community here is much different than how it is in other communities. We are bound together by common goals. The key to our success, I think, is our mentality."

Cherry sees increasing future importance for UAH's roles in cybersecurity research and cyber education.

"We have our traditional lines of business, in aerospace and defense, but then also we are on the cutting edge of software development and cybersecurity," Cherry says. "UAH has demonstrated its ability to get in front of that whole emerging field." The Chamber, UAH and local govern-

ments have formed a strong team, Dr. Vaughn says.

"Just like you see a football team grow to be a national championship team, I'd like to see the Huntsville team grow to become a national champion in business location and startups," he says. "The Chamber of Commerce is the quarterback of that team, and we're here to help the quarterback succeed in every way that we can."

CHRISTIAN BERTACCHINI

MADISON COUNTY'S INTERNATIONAL BUSINESS EXPERT IN EUROPE

Doors are opening for Madison County in international trade, says international business development expert Christian Bertacchini, who is the county's representative in the European, Middle Eastern and African (EMEA) region.

"Madison County offers an amazing ecosystem of innovation, research and world-class companies in many different fields," says Bertacchini. "Of course, defense and aerospace dominate the landscape, but there is an increasing diversification into other fields as well, such as energy, cybersecurity and so on. Madison County also offers great infrastructure, with an important cargo airport and a multimodal node.

"UAH, of course, is a highly rated research university offering very specific capabilities in fields such as space and other advanced related technologies," he says. "It can be very appealing for companies to have such an institution in the community, and also for students to come and study."

The Madison County Commission and UAH partnered to retain Bertacchini and send him to open an office in Brussels, Belgium, to represent the area's economic interests.

"This is an international partnership between UAH and Madison County to facilitate international companies doing business in the Huntsville area, or companies located in our area doing business in Europe," says Dr. Ray Vaughn, UAH vice president for research and economic development.

County Commission Chairman Dale Strong concurs.

"International trade, innovation and entrepreneurship are pillars of sustainable economic development," Strong says. "The Madison County Commission and UAH recognize the importance of these pillars and have established a presence in Brussels for the purpose of developing research and business collaborations with potential partners in Europe to strengthen our local economy, here in Madison County."

From his European base, Bertacchini finds new markets, supports company initiatives in the EMEA region and looks for partners or licensees in his quest for international business development initiatives to benefit Madison County-based companies. He is also involved with matters pertaining to Latin America and Asia.

"Another aspect of my work,' he says, "is to identify European companies that are contemplating a move to the United States and to promote Madison County as a destination."

Bertacchini also works to foster international collaborative research and



innovation between UAH and European research centers. "I will also be looking for opportunities for student exchanges and teacher exchanges," he says, "or simply to promote UAH as a great place for EMEA students to come and study."

High-level meetings have been held with representatives of several regions of Europe in advance of the signing of cooperative agreements.

"This opens the doors for getting local

business development entities to assist our companies in finding markets here, or to promote Madison County as a destination," Bertacchini says. "We also have the ear of a number of research centers in Belgium, France, Switzerland, Spain, the Netherlands, Germany and the United Kingdom. They have already expressed an interest in seeking ways to collaborate. We are already working on commercial missions both ways."

After three years at NASA Headquarters in Washington, D.C., as Chief Information Officer, in 2009 Jonathan Pettus (MS '95, Computer Science) returned to Huntsville and Marshall Space Flight Center as the director of Marshall's Office of the Chief Information Officer, a position he first assumed in 2005. "It was a great honor to serve as the senior official responsible for information technology at NASA," he says. "But I enjoy being closer to the action and I love being part of the incredible work being done at MSFC." At Marshall, he leads delivery and operations of information technology solutions to enable its programs and mission, including the center's computing infrastructure, communications networks and software systems. Pettus supervises 140 civil service and more than 1,000 contractor personnel and manages an annual information technology budget of more than \$300 million. While at NASA Headquarters, he managed an integrated portfolio of information technology infrastructure and applications that supported NASA's human spaceflight, scientific and aeronautical programs and he led development of a new information technology strategy. Pettus joined Marshall in

1991 as a computer engineer, designing critical elements of desktop computing environments used center-wide and leading development of Marshall's first Internet website. His career experience includes leading teams that have facilitated online technologies for companies conducting business with NASA, implementing the agency's computerized business management and budgeting systems and integrating all of NASA's program applications. As director of the NASA Integrated Enterprise Management Program Competency Center from 2002 to 2005, he led more than 300 business and information technology professionals tasked with the integration, development and operation of NASA's enterprise-level business applications, providing application support services to more than 15,000 agency users. "UAH and MSFC share a symbiotic history," Pettus says. "When I read about Dr. von Braun's vision for UAH as an institution of higher learning that would help attract and develop the technical workforce that NASA needed in Huntsville, I see myself. My studies at UAH in computer science laid a foundation that helped enable me to be part of the continuing fantastic mission of MSFC."

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ALUMNI // **Focus**

BETTER BOTTLE

Dr. Emil Jovanov, associate professor in the UAH Electrical and Computer Engineering Department, is patenting with UAH a smart water bottle he invented that makes it easy for users and medical personnel to track consumption of fluids. From a user's standpoint, Dr. Jovanov's bottle is fully automatic and sanitary. Fluid consumption sensor electronics in the bottle sense and measure the changing levels of fluid, transmitting the data to a cellphone, the cloud or a wireless network. The electronics can be detached so the dishwasher-safe bottle and lid can be cleansed. Initial development was supported by a \$15,000 grant from the UAH Charger Innovation Fund. His new Huntsville startup, euHydrate LLC, was selected as a finalist of the Alabama Launchpad startup competition. In 2014, Jovanov was named Alabama Inventor of the Year for a smart pill bottle that monitors patient medication compliance, tracking the number of pills taken and when they were consumed. The information is automatically uploaded to the cloud, where medical personnel can track patient compliance. That device was licensed by a New York startup AdhereTech, which is testing, developing and producing the technology.

STUDENT // FOCUS

BOOSTING CYBERSECURITY

A member of UAH's inaugural Cyber Corps scholarship class, master of science in cybersecurity student Stephen Cantley of Huntsville says he has personally benefited from the scholarship. "Through the program and cooperation with UAH's Systems Management and Production Center, I am currently interning with the U.S. Army. I have been shadowing ACA (Agent of the Certification Authority) teams, Blue Assessment Support Teams, as well as computer network defense analysts. The Cyber Corps program has gotten me farther in my field than I could have dreamed to do on my own. The

scholarship and stipend allow me to focus on school, certifications and research. The contacts I have made here at UAH have been invaluable for my professional career. For instance, the Cyber Corps job fair has allowed me to network with other students, as well as just about every federal agency that deals with cyber, such as the NSA, CIA, Secret Service, FBI, etc." Funded by the National Science Foundation's Scholarship for Service program, the scholarships pay student tuition and offer health insurance and book reimbursements, paid professional development travel and a stipend. They are awarded for two academic years for undergraduates and master's degree students and for three years for doctoral

students. Following graduation, a U.S. government service obligation of one year of service in a cybersecurity related position for each year of scholarship received is required. In addition, students are expected to serve in a government cybersecurity related position for a paid internship during the summer semester. Participation in a government job fair in Washington D.C. is required. The Cyber Corps scholarship and the work that UAH Vice President for Research and Economic Development Dr. Ray Vaughn is doing are going a long way in building UAH's cybersecurity program, Cantley says. "At the current pace," he says, "UAH is a major contender in the young field of cybersecurity education."

 Dr. Eric Smith, right, director of the Humanities Center and an associate professor of English, and Deborah Nelson, Humanities Center program assistant.

HUMANITIES CENTER poised to celebrate its 25th anniversary

UAH'S HUMANITIES CENTER WILL CELEBRATE ITS 25TH ANNIVERSARY NEXT YEAR, AND ITS DIRECTOR, DR. ERIC SMITH, IS ENTHUSED ABOUT THE EVOLUTION OF THE CENTER, STARTED WITH A 1991 NATIONAL ENDOWMENT FOR THE HUMANITIES (NEH) GRANT THAT WAS BOLSTERED BY OTHER DONATIONS.

"There are a lot of exciting programs and initiatives emerging in music, theater, art, art history and design, and so on," Dr. Smith says. "Huntsville is a town that has long understood the value of the arts, and it is often through the arts that our university most directly and vitally touches the community."

His door is always open to community members who have ideas or wish to support the center or the arts in general, Dr. Smith says.

In April 2016, the center will celebrate its anniversary with a week dedicated to the humanities and in honor of its founding director, Dr. Johanna N. Shields.

In 1991, the NEH grant was matched by private, public and corporate donations to create endowments to support human-

ities research activities. Income from the grant and matching funds support the Visiting Eminent Scholar Program, Faculty Research Grants, Library Enhancement Grants, Public Program Grants, and Faculty Travel Grants. The center's operation is supported by UAH's Office of the Vice President for Research and Economic Development.

Today, faculty members are researching Byzantine culture and its monetary structure; early maritime lawsuits in New England; and a national revolutionary movement in Bolivia as just some of the projects in which the center is involved.

The center was involved in a spring UAH Sound Studies Symposium with three international eminent scholars on sound, Jonathan Stern from McGill University, Trevor Pinch from Cornell

RESEARCH CENTER // FOCUS



University and Joy Calico from Vanderbilt University. The center also hosted literary and legal scholar and public intellectual Stanley Fish, one of the most significant humanities scholars ever to visit UAH.

Coming in November will be an interdisciplinary symposium honoring the work of renowned French philosopher Alain Badiou.

"It's an enormous coup to host him here at UAH. He's rarely if ever in the Southeast," Dr. Smith says. "It's a rare opportunity to engage a legendary philosopher."

Dr. Smith says the Eminent Scholar Fund is a resource that provides UAH students and faculty with opportunities to interact with some of the most important figures in humanities research today.

"It allows us to bring true international eminence to our community," he says.

While the College of Arts, Humanities, and Social Sciences prides itself on effective teaching, Dr. Smith says that research is as essential to their jobs as to any on campus and the center's track record shows how an investment in the humanities made more than 20 years ago is still bearing fruit.

Recent research grants have allowed UAH faculty to study topics around the world:

 Dr. Andrei Gandila traveled to Romania to conduct research for his book, "Marginal Money: Cultural Encounters on Byzantium's Northern Frontier in the Sixth and Seventh Centuries." The book explores cultural interactions in the frontier regions of the early Byzantine Empire. Byzantine coins represent the most interesting, yet unexplored, media whereby the Empire and the outside world connected at multiple levels.

► Dr. Christine Sears traveled to Boston to visit the National Archives where part of her work included researching maritime cases in the New England District Court Records that covers New Hampshire, Vermont, Maine, Connecticut and Massachusetts from the 1780s through the 20th century. She gave special attention to Massachusetts cases in the 1780s to 1820s, recording instances in which sailors sued for wages and to protest ill treatment.

► Dr. Nicole Pacino received a grant to conduct research in La Paz, Bolivia, to support her book, "Prescription for a Nation: Public Health in Post-Revolutionary Bolivia, 1952-1964." She investigated the role of public health programs in helping the revolutionary government solicit political loyalty from its citizens and support promises to improve people's ways of life and expand political power into the country's rural regions.

In addition to research and travel grants, Dr. Smith says the Humanities Center is responsible for thousands of volumes of humanities-relevant material donated to the library through proposals by the college faculty.

FORMING PARTNERSHIPS IS A GOAL OF THE UAH OFFICE FOR PROPOSAL DEVELOPMENT

Forming partnerships is what Dr. Virginia "Suzy" Young's relatively new Office for Proposal Development (OPD) at UAH is all about.

Dr. Young and her team are responsible for proposals that join together government agencies, colleges, universities, academic disciplines and industries into partnerships to solve problems or answer important questions. The OPD staff consists of grant writers Dr. Katherine Engbert and Susan Phelan, assistant grant researcher Michelle Massey and administrative assistant Janice Temmen.

As director of OPD, Dr. Young says even though proposal writing is not her background, she has an extensive network of contacts in federal agencies

r. Suzy Young, Director of the Office of Proposal Development

RESEARCH // FOCUS



that come in handy when connecting partners for proposals. There's never been a dull moment at OPD.

"It's been in demand since we started," she says. "We've had more than 240 requests for assistance since we started it from scratch almost two years ago."

Of the 240-plus requests for assistance, not all have been from UAH. She says a lot are from government or industry workers who are looking to partner with a specific expert at the university. OPD is the connector.

"We try to pull in industries small or large," she says, adding that networking is important.

"We usually focus on larger dollar values," Dr. Young says. "But we do help individuals when they need help on a lower dollar amount or singular focus proposal."

One of the largest proposals the team is helping put together includes a science mission space payload for UAH. "The UAH portion of the project is to manage the science mission and the science mission payload," Dr. Young says. "We support everything from very technical proposals, like the space mission, to facilities and equipment."

Another proposal the team is working on is for a National Robotics Initiative at UAH to develop and support a Robotics Camp for deaf students at the U.S. Space & Rocket Center.

Still another one involves a proposal



to the National Science Foundation to provide funds for institutional transformation in gender equality for faculty recruitment and retention in the fields of Science, Technology, Engineering and Math (STEM).

"We're still learning what works and what doesn't," Dr. Young says. "Someone will call and say, 'I just finished writing a proposal. Will you take a look at it?' and we will. We look at formatting, grammatical errors, and because of my background, I look at it for technical content. Then we look at alignment of the proposal with the solicitation."

Her background is extensive. Dr. Young worked 30 years as an engineer and researcher with the U.S. Army Aviation and Missile Research, Development and Engineering Center on Redstone Arsenal. She retired in 2011 and went to work for the University of Alabama. She then was vice chancellor for research for the UA System for 2½ years before starting the new proposal office at UAH in 2013.

Proposal development requires daily research on multiple topics and often requires working nights and weekends to meet deadlines. It's not easy, Dr. Young says. An application can be 20 or more pages with multiple attachments. One recent proposal included a 27-page narrative for the application, with 15 attachments.

Since the office was opened the staff has worked on 49 proposals, of which 30 have been submitted for review.

To help others with their proposals, a new web page provides boilerplate information about the university and its Office of Proposal Development staff are, from left, Dr. Kathrynn Seidler Engberg, Susan Phelan, Director Dr. Suzy Young, Janice Temmen and Michelle Massey.

capabilities. "You can also find best practices and good insider grant writing tips for the UAH research community," she says.

Dr. Young also encourages UAH faculty and researchers to utilize the Kwest Funding Opportunity Search Engine. She says it helps locate the most current funding opportunities, which align with a specific area of research and teaching.

The proposal office also posts a weekly funding bulletin each Tuesday around noon. It's available on the website and is distributed to all faculty and researchers.

SHARPENING SOLDIERS



IMPROVING ROBOTIC DEVICE TRAINING IS THRUST OF UAH-ARMY PARTNERSHIP

Barely a year after its creation, the UAH Manned/Unmanned Collaborative Systems Integration Laboratory at Olin B. King Technology Hall supports a growing and critical need for the United States Army.

"The lab has several purposes," says Dr. Sampson Gholston, associate professor of Industrial and Systems Engineering. "But its main purpose is to do human-to-human and human-to-machine research for the Army."

Over the past decade, the Army's increased use of ground robots and unmanned aerial vehicles (UAVs) in Iraq and Afghanistan has shown the need for better training methods for soldiers operating these devices. Dr. Gholston says the lab responds to that need. A grant from Army Research Lab headquarters at Aberdeen Proving Ground, Md., helped get the lab up and running in August 2014.

These modern warfare operations require finely honed hand-to-eye coordination, a trait many

soldiers possess from years of video gaming as children and teens. The lab seeks to capitalize on that.

"These students are the video game generation and are quite familiar with game-type controllers," says Dr. Thomas W. Davis, chief of the weapons branch at the Army Research Lab's Human Research and Engineering Directorate at Redstone Arsenal, who doubles as the lab's co-director.

Modern warfare places increased demands on the mental resources soldiers require to manage their attention, make decisions, and coordinate crew activities and communication on the battlefield, says Dr. Davis. The goal of the research is to identify behavior aspects within soldiers that could either help or hinder them in the performance of their missions, he says.

"The intent is to explore manned and unmanned teaming to accommodate a specific mission or task," says Dr. Davis. "Within that teaming we want to explore decision-making and the trust impact on mission performance."

Researchers can vary scenarios and factors, such as stress levels, distance to target and number of enemy combatants, all in the virtual setting. The goal is to establish statistically valid results that can be translated into better training methods. A typical research project will involve a lead researcher directing a team of undergraduate or graduate student researchers who are typically information technology, engineering or psychology majors.

It's no ordinary computer lab, looking instead more like a gamer's paradise, outfitted with 50-inch monitors and video game controllers. Dr. Davis says the lab is part of the Army's Open Campus initiative, one of several ▲ In the UAH Manned/Unmanned Collaborative Systems Integration Laboratory at Olin B. King Technology Hall are, from left, **Dr. Paul Collopy**, Industrial & Systems Engineering Department chair; lab co-director **Dr. Thomas W. Davis**, chief of the weapons branch at the Army Research Lab's Human Research and Engineering Directorate at Redstone Arsenal; and **Dr. Jeff Hansberger**, a research psychologist at the Weapons Branch.

"field elements" at universities across the U.S.

"We partner with universities across the U.S.," Dr. Davis says. "Each field element supports a local program manager office. Here, our mission is aviation and missiles."

Being located on the UAH campus has certain advantages, one being the ease with which UAH professors and students can assist in the research without having to gain arsenal access.

"If we need faculty for particular expertise, we can locate them on campus," says Dr. Gholston, "making this location very beneficial for the Army Research Lab."

A decade ago, Dr. Davis was the lead human factors engineer in support of the Robotics Systems Joint Project Office (RS JPO), where he was part of an interdisciplinary engineering team tasked to develop virtual trainers to support tactics, techniques and procedures for soldiers and Marines using robotic systems being developed by the RS JPO. The lab grew from those roots.

Dr. Jeff Hansberger, a research psychologist at the Weapons Branch, says a current project involves ways to better visualize information for UAV operators. It involves tailoring the standard computer industry user interface to "an individual's cognitive style and skills," Dr. Hansberger says.

"It's a study focused on the man-to-machine interface. We want to improve how people process, store and retrieve information," he says."We want to tailor how information is being presented to the UAV operator."

Early results seem promising. Dr. Hansberger says the research has already significantly reduced the time required for system information retrieval, allowing quicker interaction between the UAV and an operator who may be sitting thousands of miles away.

SECURING THE FUTURE

Davidson Cybersecurity Laboratory

The neat rows of new computer displays and keyboards behind the door of Room N325 in Olin B. King Technology Hall belie their significance. This isn't simply another well-equipped classroom in the Computer Science Department at the University of Alabama in Huntsville (UAH). It's the Davidson Cybersecurity Laboratory, developing a new generation of high-tech warriors and shields – the people, techniques, software and hardware needed to safeguard vital information and systems from the growing threat of cyber attacks.

In 2014, members of the computer science faculty wrote a proposal to Dr. Ray Vaughn, vice president for research and economic development, requesting the establishment of a laboratory to augment UAH's interdisciplinary cybersecurity program, which involves the Colleges of Science, Engineering and Business Administration. Initial funding was secured and soon a room was being outfitted with special wiring and infrastructure, computers, servers, software and equipment.

Dr. Heggere Ranganath, chairman of the UAH Computer Science Department, says faculty and graduate students are working in the lab, which was fully established about five months ago. Undergraduate students began working and learning there with start of the fall 2015 semester. He expects more than 200 students at all levels will use it each year. During its dedication, Dr. Heggere Ranganath, chair of the UAH Department of Computer Science, explains features of the lab to, from left, Marc Bendickson, president of Dynetics Inc. and UAH Foundation vice chair; Dorothy Davidson, Davidson Cybersecurity Lab donor and member of the UAH Foundation board; Dag Rowe, Huntsville attorney and UAH Foundation chair; Irma Tuder, Analytical Services Inc. CEO and UAH Foundation Development Committee chair; and UAH President Robert Altenkirch.

✓ Josh Jones is the system administrator for the Computer Science Department and the Davidson Cybersecurity Laboratory.

"For students, it gives them an opportunity to experience cybersecurity techniques in a safe, laboratory setting. They will get hands-on experience and that's very important," Dr. Ranganath says. "There is a huge demand for graduates, locally and nationally, and it's only going to continue growing. Everybody is interested in protecting information and protecting themselves from cyber attacks."

The laboratory is already helping faculty members attract funded research projects, he says. Computer science and computer engineering faculty collaborated on work in the laboratory that was used in a proposal that won a National Security Agency grant of nearly \$300,000 earlier this year.

Dorothy Davidson, chair and chief executive officer of Davidson Technologies in Huntsville, recently toured the facility after making a major contribution to aid its future development. It was named the Davidson Cybersecurity Laboratory to recognize her investment in the program.

"Cyber is a mainstay in everything that we all do today in the country. UAH is investing in cyber research and solutions, as is Davidson Technologies," she says, adding that the company even has an intern from the UAH Computer Science Department doing cyber work. "I felt that this donation was an opportunity to support UAH and their work in this growing field."

The new laboratory is an ideal comple-



ment to the five-year, \$4.2 million National Science Foundation-funded full cybersecurity scholarship program, now in its second year at UAH, Dr. Ranganath says. Students in the program matriculate at UAH as part of the NSF's Scholarship for Service Cyber Corps and then work for government agencies as cybersecurity experts to fulfill their scholarship commitment.

In May, Josh Jones became the scholarship program's first doctoral awardee at UAH, where he is also the system administrator for the Computer Science Department and the Davidson Cybersecurity Laboratory. During a tour of the lab, he pointed out the high-speed and high-capacity servers, the rows of PCs and Macs, the tablets and mobile devices – a growing area of cybersecurity concern.

Jones is proud of the research underway in the lab, such as studying the patterns of data traffic to see if they might be used as indicators that a hacker has breached a system, and steganography – hiding secret information inside the other public data or information used by computers. And he's thankful UAH now has the ideal place to develop and explore new ways of protecting systems that we all depend on for everything from commerce to national defense.

"I like knowing our work is safe and secure," Jones says, "and there's room to grow."

RESEARCH // FOCUS

GAMMA GRABBING UAH LEAD INSTITUTION IN 4-YEAR, \$894,000 SATELLITE MISSION PROBING TERRESTRIAL FLASHES

UAH researchers are heading into space in 2018 to measure and better understand terrestrial gamma ray flashes (TGFs) that originate from thunderstorms, a project that will bring hands-on experience to UAH's undergraduates.

In the Terrestrial RaYs Analysis and Detection (TRYAD) mission, two 10 x 10 x 30-centimeter, class 3U cube satellites – or cubesats – will launch as a secondary payload on a large rocket into a 40-degree inclination orbit 400-500 kilometers above Earth, circling in the thin outer atmosphere. The orbital goal is to spend as much time over the tropics and tropical land as possible, since most thunderstorm activity occurs at the equator.

Using orbital drag mechanisms, the satellites will position themselves several hundred kilometers apart. The TGFs will be detected using a lead-doped plastic scintillator. The gamma rays are absorbed in the plastic, causing an emission of blue to ultraviolet light, which is then detected by a silicon photomultiplier tube. Based on the intensity of the light recorded at each satellite and working with a groundbased observation center, the scientists can triangulate on the source of the rapid formation of TGFs. "Terrestrial gamma ray flashes were discovered in Huntsville in the 1990s by the BATSE flight – the Burst and Transient Source Experiment," says Dr. Michael Briggs, the assistant director of UAH's Center for Space Plasma and Aeronomic Research (CSPAR) and principal investigator for the experiment, funded by a \$893,874 collaborative grant from the National Science Foundation. "They have since been observed by several instruments, including the current observation instrument that UAH is involved in, the Gamma-ray Burst Monitor."



▲ Dr. Michael Briggs, left, and Dr. Peter Jenke discuss the TRYAD mission.



The Burst and Transient Source Experiment (BATSE) discovered terrestrial gamma ray flashes in the 1990s.

The TRYAD grant provides for three years of development and a year of flight time. Data will be sent via NASA's Near-Earth Network of dishes through a high-bandwidth PULSAR onboard radio with X-band downlink provided by NASA's Marshall Space Flight Center.

As the lead institution, UAH is responsible for the science instruments, science operations, data distribution, analysis and results publication. UAH's collaborator, Dr. J-M Wersinger, an Auburn professor emeritus in the physics of remote sensing, will develop, integrate and test the two cubesats, interface them with the launch provider and control the two satellites in space.

"Gamma ray flashes are sub-millisecond, extremely intense flashes generated by thunderstorms," Dr. Briggs says. "One thing we'd like to know is, how does a thunderstorm manage to accelerate these particles to extreme energies in order to create the gamma rays?"

Project co-principal investigator Dr. Peter Jenke, an astronomer and UAH research associate, designed and modeled the TGF detector concept used in the grant application. "We proved that we can actually do the science we set out to do in a series of modeling experiments," Dr. Jenke says. UAH will design, test and construct the gamma ray detector that will fly.

The new research offers undergraduate students a hands-on experience, says Dr. Briggs.

"One of the goals of the project is to bring undergraduates face-to-face with real technologies, and not just book learning," says Dr. Briggs, who in 2013 was one of a trio of UAH researchers who observed the largest gamma ray burst ever seen.

Dr. Briggs and Dr. Jenke will teach a spring semester class in space hardware development for undergraduates and graduate students that will focus on the project.

UAH undergraduates will work on the mechanical design of the gamma ray detector, maximizing the efficiency of the detector, the electrical design of the SiMPs and digitizing the signal, and the electronic integration of the cubesats.

Researchers are hopeful they can add clarity to the scientific debate about how TGFs form and gain new insights into how the electrical charges in thunderstorms work.



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