In the wake of the deadly tornadoes during April 2011 in Alabama and other Southeastern states, scientists at The University of Alabama in Huntsville began analyzing data to study the physics of the storms, as well as the psychology and sociology of storm warnings. The photo is a radar image from the UAHuntsville Advanced Radar for Meteorological and Operational Research (ARMOR) showing multiple tornado supercell storms.
Dear Colleagues:

I hope these words find you well.

Research can be an overwhelming environment of numbers, metrics, and milestones. This year, we are fortunate to have had our share of successful ones. A 50th Anniversary celebration for the Research Institute. Entrance into the Carnegie Foundation’s “Research Intensive, Very High Activity” research university classification. Seventeen peer-reviewed student papers at the 2011 International Astronautical Congress in Cape Town. The largest NSF research grant ever achieved by a faculty member in the College of Liberal Arts. $85 million in research expenditures. And more.

Numbers matter. But if we stop only at the numbers, we miss the greater reality of the value of research to faculty, staff, and students, as well as to the community we are called to serve.

Research is a creative and purposeful activity of exploration - in body, mind, and in spirit - that makes whole a meaningful education and a fulfilling professional life within the context of a University. As within any community of learners, we share knowledge we have, but is new to others. Reciprocally, we acquire knowledge that is new to us, but already known to others. Research is different. Research is the discovery of knowledge that is new to everyone.

Research - the ability to generate new knowledge - brings power. When applied constructively, it can transform the world around us, and ourselves, both immeasurably for the better. Applied in other ways, it can be among the most destructive tools at the disposal of humanity. Therefore, research brings not only the power to generate and apply new knowledge, but also a great responsibility in how to apply what is learned.

It is important to think upon this responsibility as we move into 2012, the 100th anniversary of the birth of Wernher von Braun - another metric and milestone. Within the same research activity, he and his team developed the foundations of our ability to deliver nuclear weapons of mass destruction, and the ability to transport humanity off of our planet for the purpose of better knowing our universe - and ourselves - in transformational ways.

Research is indeed more than just numbers. It is about the experience of generating new knowledge. It is about the people who pursue new knowledge. It is about the application of that knowledge, and our responsibility for the outcomes generated.

It is a global pursuit, crossing cultural, language, and social boundaries, that can help all of us make the world a better place. And it is an activity in which UAHuntsville thrives.

In this 2011 Research Review, I hope you have a chance to immerse yourself beyond the numbers, and into the people, processes, and outcomes of our vibrant research enterprise. We are proud of what we do, and proud of the positive social, economic, educational, and quality-of-life outcomes for stakeholders we build through research.

Thank you for allowing us to share some of our work with you.

Kind regards,
Severe weather

When the Southeastern United States was hit with the spinning and horrific tornadoes of April, 2011, the experts of UAHuntvilles’s Severe Weather Research Team were ready to scan the skies for answers. UAHuntville’s scientists began organizing a research program to better understand the deadly outbreak of tornadoes that killed more than 240 people in Alabama and other Southeastern states on April 27. Supported by a one-year, $150,000 grant from the National Science Foundation (NSF), the UAHuntville team began analyzing radar information from that day, then merged that information with detailed storm surveys and other data. They are determined to learn more about how the storms formed, what made that day’s storms so unusually powerful, and what might be done to make tornado warnings more effective.

In their analysis of the storm data, Knupp and his team will use data from the NWS NEXRAD between Huntsville and Chattanooga, a dual-polarimetric Doppler radar at the Huntsville International Airport, and UAHuntville’s own mobile dual-polarimetric Doppler, which on April 27 was stationed between the two stationary radars.

“We have three radars, we can reconstruct the wind field in detail for each of the cells, and track the line that moved through that day,” Knupp said. “We had a full spectrum of storms that day and it seemed that almost every storm was forming a tornado.”

The data will be compared to detailed aerological reconnaissances of the tornado tracks.

“We looked at Google Earth to see what was in those areas before the storms hit. Was it metal buildings, a residential area, forest or fields?” he asked. “We can use that information to relate what we saw in the radar with what was being churned up by the tornado.”

The detailed radar and surface data will also help the scientists determine whether other factors, such as surface roughness, topography or gravity waves, played a role in forming or strengthening tornadoes.

Knupp’s team went out into the field to assess the storm damage before it was all cleared away. They spoke with witnesses while the memories were still vivid, and have spent the months since then studying what they’ve observed from the fallen trees and wreckage— as well as the radar records, satellite images, survivor interviews and social media posts by people who witnessed the tornadoes and filmed their aftermath.

They have been gathering this visual documentation of the tornadoes and associated cloud formations to provide important links between the tornado intensity, surrounding cloud formations and corresponding radar signatures.

In addition to studying the physics of the storms, the team also began looking at the psychology and sociology of storm warnings. UAHuntville faculty, student volunteers, and a graduate student from the University of Oklahoma, began interviewing survivors to learn more about how and when people reacted to the storms, the team also began looking at the psychology and sociology of storm warnings.

“The damage path is really the fingerprint of the tornado,” Knupp said. “That is why it was so urgent to do the reconnaissance quickly, before the cleanup or re-growth could erase the clear tracks.”

NSF is funding this project through a Rapid Research Response (RAPID) grant, which enables support for fast-response research tied to events such as tornadoes.

Data compiled by UAHuntville post-doctoral student Tim Coleman showed that there had been about a ten-fold increase in warnings between Memphis, Atlanta and Tallahassee since the Weather Service installed the NEXRAD Doppler radar system, and that about 80 percent of all warnings are “false.”

“One thing we were after was whether people were desensitized because the false alarm rate is so high.”

– Dr. Kevin Knupp
UAHuntville Professor

The increase in warnings is due in large part to the NEXRAD radar’s ability to spot “rotation” inside a storm system. Installed between 1993 and 1997, the five NEXRAD radar units in Alabama are also better at detecting small tornadoes than the previous system. In the years since NEXRAD was installed, the number of small tornadoes (EF0 and EF1) documented by the National Weather Service in Alabama has increased almost threefold, while the number of larger tornadoes has stayed roughly the same.

“Before NEXRAD we didn’t know these rotational elements, along squall lines were so prevalent,” Knupp said. “If a small tornado didn’t cause property damage or wasn’t reported, we might never know about it. Now we can see the rotation, pinpoint the location, then go out afterward and look for damage to confirm that there was or was not a tornado on the ground.”

The UAHuntville survey team is trying to determine how the public judges the threat of dangerous weather.
MORE THAN MEETS THE EYE
UAHuntsville researchers have developed a unique set of waterproof coatings for retinal implants

Millions of people around the world suffering from ocular disease would regain some of their vision through the development of successful retinal implants. In 2011, UAHuntsville researchers designed, synthesized, and analyzed polymers to move this idea one step closer to reality. Retinal implants under development stimulate ganglion cells in the retina electrically, following signals received from a camera.

The electrode array that stimulates the cells is the “heart of the device” and it is the only part of the device that is implanted inside the eye. The implant needs to be hermetically sealed to keep water away from the embedded sensitive circuitry. At the same time, it needs to be fully compatible with the surrounding eye tissue.

Dr. Carmen Scholz, Professor of Chemistry at UAHuntsville, and her colleagues, have been testing a wide variety of materials to come up with a set of waterproof coatings that would protect these electronic implants, and also the sensitive surrounding eye tissue.

Dr. Scholz presented her work and the importance of keeping the impermeable material dry and biocompatible during a session on Polymer Chemistry at the American Chemical Society national meeting in March of 2011. “We don’t want any scar formation,” Scholz explained. “Even a thin layer of damaged tissue could block the implant’s font electrical signals.”

Initially, her team tested two polymers and two other substances by implanting them into pig eyes. Polyethylene glycol, and diamond-like carbon, performed better than amorphous aluminum oxide or polyvinyl pyrrolidone, which caused an irritation. Since then, Scholz’ group has focused on creating block copolymers made of polyethylene glycol and amino acid-based polymers. The researchers have also experimented with polyoxazoline as an alternative to polyethylene glycol.

The group has developed novel synthetic techniques that allow them to have absolute control over the size of the developing polymers. Their research also led to a better understanding of the reaction mechanisms.

Working with former graduate student Dr. Tracy Armstrong, who defended his Ph.D. on this work in January 2012, these polymers were designed, synthesized, and analyzed to serve as biomimetic surface coatings. But these polymers also hold the potential for many more applications, including block copolymers self-assembled into three dimensional structures that can be exploited for biomedical applications as well as micro reactors.

For more information, contact Dr. Carmen Scholz at cscholz@chemistry.uah.edu

Pictured above is a second-generation retinal prosthesis. The implanted part of the device is inserted from the back side of the eye through the sclera into the sub-retinal space.

OSP Mission Statement:
The Office of Sponsored Programs’ mission is to support three distinct groups. 1) UAHuntsville faculty, students, and research staff; 2) the UAHuntsville Administration; and 3) Funding Sponsors. OSP strives to maintain balance among these groups by reviewing proposals to external funding agencies, proper fiscal management of funds received, and oversight of compliance matters related to external agencies and the federal government.

OSP’s role is to support the faculty, staff, and administration of UAHuntsville in effectively seeking, obtaining, and managing their research and scholarly activities to enhance their educational role.

Within any organization, sports team, or university, there is a need for constant self-improvement. There is a desire to get better, and a need to always learn more. At UAHuntsville, the Office of Sponsored Programs (OSP) provides training and programs to help faculty and research staff achieve new goals, and to grow a better university.

Two major themes shaped OSP’s training effort for 2011: increasing competency and bolstering compliance. The emphasis on competency focused on increasing the ability of UAHuntsville faculty and researchers to acquire the strategies, tools, and techniques needed to write competitive grants. Grant writing workshops were offered for both beginning and experienced grant writers.

Webinars throughout the year provided individuals with analysis of specific solicitations, agency insights into successful proposal development, and the role and responsibility of the university community in the Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs.

Ten junior faculty and new prospective grant writers participated in “Breaking Through the Barriers to Writing Proposals,” presented by Dr. Robert A. Lucas. He discussed the transition from academic writing to successful grant writing, and tackled common barriers that challenge beginning grant writers.

For experienced grant writers, two “Write Winning Grants” seminars were presented by Dr. Stephen W. Russell and Dr. M.S. ‘Peg’ AtKisson. Addressing both practical and conceptual aspects important to the proposal-writing process for NSF and NIH, topics explored included idea development, writing a linear progression of logic for reviewers, and tips and strategies for presenting an applicant’s case to reviewers.

Each participant selected a comprehensive grant writing workbook which details strategy and format, and provides examples for every proposal component.

The second training thrust, compliance, further implemented the university’s Responsible Conduct of Research (RCR) training plan. RCR is generally defined as the practice of scientific investigation with integrity. The Federal Office of Research Integrity identifies shared values that define RCR as “HONESTY, ACCURACY, EFFICIENCY, and OBJECTIVITY.”

More than 550 individuals on campus received nearly 2,500 hours of RCR face-to-face instruction in the areas of Research Misconduct, Authorship, Conflict of Interest and Collaborative Science.

For more information on the programs and seminars available through OSP, please contact Susan Phelan at susan.phelan@uah.edu

Training through UAHuntsville’s Office of Sponsored Programs Focuses on Increasing Competency and Bolstering Compliance

“People who write about spring training not being necessary have never tried to throw a baseball.”

- Sandy Koufax
UAHuntsville’s Propulsion Research Center and College of Engineering Lead NIRPS Academic Advisory Team

For more information, contact Dr. Robert Frederick at robert.frederick@uah.edu or Dr. Shankar Mahalingam at shankar.mahalingam@uah.edu

UAHuntsville’s Propulsion Research Center named PopSci’s #3 Most Awesome College Lab for 2011

In a NASA-sponsored student rocket-launching competition, the UA Huntsville propulsion community into the national spotlight. Students from UAHuntsville successfully launched and recovered its Aethon rocket at the NASA Wallops Test Flight Center in Virginia as part of the NASA University Student Launch Initiative (USLI) - Level 2 Program. UAHuntsville was one of three universities in the nation tapped to participate in this pilot program at the NASA Wallops facility. The overall objective of the program was to build a sounding rocket that would achieve a maximum altitude of 10,000 feet, demonstrate a scientific payload, and be successfully recovered at sea. This program is a follow-on to the Level 1 activity where students build a rocket to fly to an altitude of one mile, roughly half as high as this program.

The UA Huntsville rocket left the launch rail at 10:31 EST under the power of a 800-pound thrust solid rocket motor, and 28 seconds later reached a maximum altitude of 12,321 feet. The recovery system deployed and the vehicle landed 1.4 miles downrange in the Atlantic Ocean.

This is a fantastic program, giving students a hands-on opportunity to do things, rather than just reading them from the book,” said NASA Wallops Flight Project Manager Jack Viera. “It’s a priceless opportunity. I congratulate the whole team for doing such a fine job. The UA Huntsville vehicle was quite unique. It had a lot of self-fabrication and you could see the pride in the workmanship.”

On this flight, UA Huntsville’s team successfully demonstrated a new non-pyrotechnic ejection system. “This system successfully deployed the parachute using pressurized CO2 in a one-of-a-kind triggering system designed and tested by the students,” said Dr. Robert Frederick, engineering professor and faculty advisor to the team. Students from UAHuntsville successfully launched and recovered its Aethon rocket at the NASA Wallops Test Flight Center in Virginia as part of the NASA University Student Launch Initiative (USLI) - Level 2 Program. UAHuntsville was one of three universities in the nation tapped to participate in this pilot program at the NASA Wallops facility. The overall objective of the program was to build a sounding rocket that would achieve a maximum altitude of 10,000 feet, demonstrate a scientific payload, and be successfully recovered at sea. This program is a follow-on to the Level 1 activity where students build a rocket to fly to an altitude of one mile, roughly half as high as this program.

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A team of 14 undergraduate and graduate students in Mechanical and Aerospace Engineering participated in the program, overseeing all aspects of the design, manufacturing, and testing of the launch vehicle in preparation for the Wallops launch.

“This is a major success for UAHuntsville and how we instill the heritage of the Huntsville propulsion community into the future workforce,” said Dr. Frederick. “In less that 10 months, students went from having never launched a vehicle, to the successful design, fabrication, testing, safe launch, and recovery of a high-powered sounding rocket.”

The project pursued a two-semester design sequence in the Department of Mechanical and Aerospace Engineering. Sponsors include the NASA Alabama Space Grant Consortium and UAHuntsville’s Office of the Vice President for Research.

“USLI allowed me to explore and develop project management skills, in addition to specific technical expertise, that caught the interest of my NASA supervisors,” said Daniel Cavender, UAHuntsville student, and project lead. “This, and other student-led projects, are paramount to the training of America’s future workforce.”
Research Institute marks 50 years of growth and success

In November of 2011, the Research Institute (RI) at UAHuntsville celebrated its 50th anniversary, and used the momentous occasion not only to commemorate the many accomplishments that have come from RI over the decades, but also to open publicly its newest laboratory.

University President, Dr. Robert Altenkirch, and Vice President for Research, Dr. John Horack, welcomed a crowded room that included special guests Congressman Mo Brooks (R-AL), Congressman Robert Aderholt (R-AL), and Mr. Eric Edwards, Executive Director of the U.S. Army’s Aviation and Missile Research, Development and Engineering Center (AMRDEC), among others.

The Research Institute, created in 1961 by a $3 million investment from the State of Alabama legislature, was a result of Dr. Wernher von Braun’s pleas to fund a research institute on the UAHuntsville campus.

“It was the strong encouragement from our federal partners that motivated the Alabama Legislature to provide seed money to create the UAH RI,” said Dr. Richard Rhodees, current director of the Research Institute. “We have chosen to celebrate that creation in the building built with those state funds, while also officially opening the institute’s newest laboratory.”

What began primarily as a way to provide advanced courses to Redstone Arsenal employees, has transformed over five decades into an integral part of the campus, providing cutting-edge research, in addition to contributing to the academic mission of the university, particularly at the graduate level.

The Research Institute executes applied research and engineering programs, principally to meet the needs of Department of Defense customers, as well as NASA and private industry. It now consists of three main parts: the Aerophysics Research Facility, located on Redstone Arsenal; the Office for Enterprise Innovation and Sustainability; and the new Reliability and Failure Analysis Lab (RFAL), both located on campus.

Opening the Reliability and Failure Analysis Lab (RFAL)

The primary focus of the RFAL is reliability—the probability that a system or component will perform its required functions under stated conditions for its mission duration.

The Lab investigates possible failure mechanisms of parts and materials through mathematical modeling and physical testing. By looking at the “Physics of Failure”, the Lab is able to develop Failure Mode and Effects Analysis (FMEA), Failure Mode, Effects, and Criticality Analysis (FMECA), and Failure Reporting, Analysis, and Corrective Action System (FRACAS) to aid in the risk assessment of the material or component.

While reliability engineering may be relatively new in comparison to the other engineering disciplines, over the past several decades there has been a major push to utilize the capabilities of the discipline to become a major discriminator in the design of new products. This move is clearly evident in the Department of Defense, automotive and aerospace industries, and in biomedical devices. Each of these sectors shares the need to deliver complex products and systems to their customers that maintain high standards of reliability.

The RFAL also focuses on maintainability. Designing for reliability and maintainability enables preventive maintenance actions such as Condition Based Maintenance or Time-Directed Maintenance, to be easily implemented, and to ensure that design requirements will be met.

The lab has the capability to model and test the reliability and availability of a wide range of complex systems, products, and components.

“The things that RFAL does in the testing of parts and components and materials is truly remarkable. It’s cutting-edge. It’s that cutting edge that again plays its role in the synergy that helps make the Tennessee Valley so impressive from a high-tech and intellectual standpoint that attracts more people to our community.”

- Rep. Mo Brooks
U.S. Congressman

In a laboratory known for burning, freezing, eroding, and stressing materials – cutting a normal ribbon would just not suffice.

The student workers in RFAL showcased their knowledge by doing more. With the use of the Axial/Tension/Compression Fatigue Testing System, student lab workers attached a polycarbonate strip to the grips of the fatigue testing system, and amidst smoke and music, they used the equipment to precisely pull on each end of the material – until it fractured.

“It’s just a normal tensile test that we do,” said Nathan Rigoni, a senior majoring in aerospace engineering at UAHuntsville, who also works at the RFAL. “We take a coupon and we load it into the testing system, and pull directly on it. From that, we can get some of the main factors of the strength and capability of the material.”

Celebrating Success... and Unveiling the Future

UAHuntsville graduate students didn’t just cut the ribbon at the opening of the new Reliability and Failure Analysis Lab - they fractured it!

UAHuntsville student lab workers operating the Fatigue Testing System during the ribbon fracture for the Reliability and Failure Analysis Lab.

Dr. Richard Rhodees, RI Director 1997 - Present

Chris Sautter (left), RFAL Director, demonstrates laboratory equipment to U.S. Congressman Robert Aderholt (R-AL).

RFAL Lab Manager, Mark Gauldin (left), shows U.S. Congressman Mo Brooks (R-Al) a helicopter rotor which was used in lab tests.
Celebrating Success cont.

“If somebody comes up with a new material - and we’ve had a couple of them come in over the last couple of months - we can determine the strength capabilities of that material, and they can then better associate it with the market,” said Rigoni.

During lab tours on the day of the event, the student workers also displayed coupons from the blades of a U.S. Army helicopter that had been tested after a possible defect had been identified.

“Basically, we were asked to study a potential defect in the manufacturing process,” Rigoni said. “The stakeholder expected all the fibers to come out linear. During the manufacturing process, some of the fibers get waves. We wanted to discover and understand what the effect of the waviness was in the fibers.”

Leading the RFAL opening was Chris Sautter, RFAL Director and a Principal Research engineer at the RI.

“This lab is needed because we see the world wanting to drive things farther, fly them longer, and still do it while keeping everyone safe,” said Sautter. “Our research provides the answers on how to accomplish those goals.”

In addition to original seed funding to the RFAL made possible through Senator Richard Shelby (R-AL) and the U.S. Congress, the lab has also received significant research funding over the past three years from the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC).

The 50th Anniversary celebration also included a public colloquium on the history of the RI and the establishment of a research university in Huntsville, Alabama. The colloquium was led by Dr. Charles Lundquist, first director of the RI and former team member of Dr. von Braun, and featured speakers Dr. Carroll Johnson, Dr. Richard Rhoade, and Dr. William Vaughan.

Dr. Horack, in hosting the celebration, summarized the event and new lab opening well with his thoughts on research.

“I view research to be the very first link in the value chain of prosperity,” Horack said. “If you see a prosperous community like ours, I think you can trace that back to the fact that sometime in the past, research was done, new ideas were generated, people were innovative, people were creative.”


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UAHuntsville named one of only 73 'VERY HIGH' research institutions

Latest ranking is an external validation that UAHuntsville is moving forward

In our quest to become one of the nation’s leading research universities, UAHuntsville had much to celebrate this year when The Carnegie Foundation for Advancement of Teaching named the University’s status to the “very high” research category.

UAHuntsville now joins a select group of national research universities with its new classification, an elite assembly of only 73 public universities in the United States. This new ranking was based on data from 2008, according to the Carnegie Foundation, and puts the University in the highest category attainable in those rankings.

“The Carnegie ranking is extremely significant, and we are very proud to have achieved this level of research, especially when one compares the size of UAHuntsville to the other universities in our group,” said Dr. John Horack, UAHuntsville’s Vice President for Research. “And while it is an important milestone, it is not the objective. The goal is to bring UAHuntsville to the status of an exceptional research university. This ranking is an important external validation that our faculty and research staff are doing the right things, moving UAHuntsville forward, and serving our students, our city, our region, and the people of Alabama.”

UAHuntsville had been classified as a “high” research activity institution for numerous years, but this new ranking puts the University at the highest category attainable in the Carnegie Foundation rankings. The classification is based on various criteria: R&D expenditures in science and engineering as well as non-S&T fields, science and engineering research staff, research staff, and doctoral conferred across a wide range of areas.

“A very high” research activity classification places UAHuntsville in the top 3 percent of the almost 2,000 four-year accredited degree-granting colleges and universities in the United States. Only two Alabama universities are in this classification — the University of Alabama in Birmingham and UAHuntsville.

“The ranking is noteworthy in that it recognizes the high level of cutting-edge research being conducted by our faculty and researchers as well as the quality of our doctoral students, and will bring additional accolades to the campus and could provide momentum in recruiting higher quality students and faculty,” said Provost Vistasp Karbahi.

“We are extremely proud of the world-class research, around a wide range of disciplines, that defines our campus,” said Dr. Horack. “Achieving classification in this premier category recognizes the accomplishments achieved by our faculty, researchers, students and staff, and reflects the growth in the University’s impressive research portfolio.”

The Carnegie Classification was created to assist those conducting research on higher education, and provide a way for colleges and universities to be compared to institutions of similar qualities. The full database of universities and their Carnegie Classification can be found at http://classifications.carnegiefoundation.org.
**Decision Support Improves Patient Safety**

UAHuntsville’s interdisciplinary team uses business analytics to aid nurse staffing decisions

If you or a loved one have ever had to seek medical care at a hospital, you know the value of having a nurse nearby. The nurse and hospital administrators know that, too. Research and experience tell us that having the right levels of nurse staffing can have a big impact on improving patient safety and quality of care. Now, thanks to an interdisciplinary team of researchers at UAHuntsville, health care decision makers will be getting better guidance about staffing and other hospital needs.

As a result of winning the 2011 Alabama Launchpad Business Plan Competition, the UAHuntsville team, which includes Drs. Faye Anderson, Karen Frith, Fan Tseng, Mikel Petty, and Mr. Gregory Reed, launched Decision Innovations, a health information and decision technology company. The company received $100,000 in seed money from the Launchpad competition, which it is using to refine and market its first product, the Nursing Dashboard. The product includes a software package that integrates real-time organizational data with ongoing research to help health care administrators make more informed decisions about their unit, including nurse staffing levels.

“Experienced nurses have an innate sense of the best decisions, but they do not always have the data readily available to support the decision,” Anderson says. “Our software provides the nurse leader with the data they need to minimize situations where safety could be compromised, thus promoting quality care and reducing risk.”

The effort to help nurses make better decisions began in 2008 with research projects led by Dr. Frith and funded by UAHuntsville’s University Research Infrastructure Investment grant. In partnership with the Catholic Health Initiative (CHI) hospital system, the research was grounded in the real problems that nurses and hospital staff face, leading to a direct application in the market, and the opportunity to start a company.

“We began with a pilot research study to investigate the relationships among nurse staffing and patient outcomes,” says Dr. Anderson. Dr. Fan Tseng of UAHuntsville’s College of Business joined the team to perform statistical analysis that led to the identification of the mathematical relationships between the level of nurse staffing and patient outcomes. The team found that registered nurse staffing had an impact on patient outcomes such as length of stay, the number of adverse events in the hospital, and medication errors. Those results led the research team at UAHuntsville to think about how to make the project more meaningful beyond basic research.

Dr. Tseng, along with Dr. Frith and Dr. Anderson, then took the resulting concept to Dr. Mikel Petty and Mr. Gregory Reed of the Center for Modeling, Simulation, and Analysis who collectively developed the software in which the mathematical models reside. Dr. Petty is also a professor in the Computer Science Department, and Mr. Reed is a Ph.D. student in UAHuntsville’s new Modeling and Simulation graduate program, one of only three in the United States.

“We wanted to know what might occur in the future using different staffing levels,” Petty says. “An important aspect of the software product is that nursing managers can experiment with different staffing levels to see what might be the result in terms of patient outcomes.”

Today the team continues to bring their diverse expertise to revising and upgrading the software package based on the feedback from beta testing being conducted in nursing units at an Arkansas hospital.

“UAHuntsville provides an environment where Ph.D.s in fields as diverse as nursing, computer science, and management science/operations research can come together to work on a project like this,” Reed says. All of us provide expertise from a variety of angles, which allowed us to implement the project from start to finish and provide real value to nurses and the patients they serve.”

For more information, email info@decisioninnov.com or contact members of the UAHuntsville Decision Innovation Team directly at:

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- Mikel.Petty@uah.edu
- Fan.Tseng@uah.edu

*“Our software provides the nurse leader with the data that can be used to minimize situations where safety could be compromised, thus promoting quality care and reducing risk.”*

*Dr. Faye Anderson*

UAHuntsville College of Nursing and Decision Innovations Team
Taking The IAC By Storm!

UAHuntsville is a dominant force at the 2011 International Astronautical Congress (IAC).

In October of 2011, the world’s foremost space professionals gathered in Cape Town, South Africa. On hand to represent UAHuntsville were students, faculty, and research staff that demonstrated the strength and breadth of the university through the contribution of over twenty papers to the annual International Astronautical Congress (IAC).

The IAC is the world’s largest annual gathering of space professionals from nearly all areas of expertise, including the heads of the world’s space agencies, senior policy and decision-makers, as well as leading scientists, engineers, program managers, and explorers from around the world.

The UAHuntsville group consisted of sixteen undergraduate and graduate students, along with ten faculty members and research staff. The students participating had each submitted an original research abstract, and were selected through peer review to complete the research, author their paper, and present the work in person to a large audience of experienced managers, astronauts, leading engineers, historians, and policy-makers from around the world.

The sessions, which took place at the week-long conference in Cape Town, South Africa, covered a broad spectrum of space related topics including propulsion engineering, earth science and remote sensing, high-energy particle measurements in the atmosphere, environmental control and life support for human spaceflight, space policy, and space history.

While attending the conference, UAHuntsville students were also honored to take part in private breakfasts with: NASA Administrator Charlie Bolden, Thomas Reiter, former European Astronaut aboard Soyuz and Space Shuttle, and current Head of Human Spaceflight and Exploration at the European Space Agency; Mr. Jean-Jacques Dordain, Director General of the European Space Agency; Professor Johann-Dietrich Woerner, Executive Director of the DLR; and Dr. David Kendall, Director of Science and Technology for the Canadian Space Agency.

These meetings, arranged through the UAHuntsville Office of the Vice President for Research, added additional value to the students’ experience, giving them first-hand access to many of the world’s most prominent space leaders.

“I would be a university student, and be afforded the opportunity to have in-depth conversations with the head of NASA, the European Space Agency, and other incredible leaders, was simply amazing,” said mechanical engineering major Brandon Setayesh, who says he has found a renewed energy for pursuing his career after attending the conference. “I will never forget the opportunity that UAHuntsville has provided me, and know that the connections I made in Cape Town will have an impact on my future.”

Student participation was facilitated through a grant from the Office of the Vice President for Research (OVPR), and organized by the Coordinator for Student Research Programs, Mr. David Cook.

Dr. Christina Carmen, from the Department of Mechanical and Aerospace Engineering, served as advisor to several of the involved students on their research projects, and her paper, titled “Integration of a NASA ESMD Faculty Fellowship Project Within an Undergraduate Engineering Capstone Design Class” was also selected for the conference. Additional UAHuntsville papers were contributed at the IAC in heavily attended sessions involving Dr. Elizabeth Newton, Dr. Richard Fork, Mr. Richard Tyson, and Dr. Michael Griffin.

“The IAC is the world’s biggest annual space conference. As we continue to raise the profile and contributions of our University to the world community, the IAC is a place where we simply must be very visible, as a leading research University based in a deeply rich spaceflight community. It is very encouraging, and incredibly satisfying, to see our students interacting in one-on-one situations with some of the world’s pre-eminent leaders from all facets of space,” said Dr. John Horack, Vice President for Research at UAHuntsville. “Our students derive a greater sense of confidence in their abilities, expand their professional network, and raise the level of their professional capabilities, while building a much better idea about what their future may have in store.”

International Astronautical Congress continues impacting lives of UAHuntsville students

Douglas Casey
Attended the IAC in 2010 and 2011; Invited to and participated in the Research Fellowship Summer Program for the Center for Space Nuclear Propulsion at Idaho National Labs (Summer 2012).

Eric Becnel
Mark Becnel
Participated in STEM outreach at the Youth Museum of the South African Air Force.

Emily Mattax
Attended the IAC in 2010 and 2011; Paper recommended by session chairs for publication in the Acta Astronautica, the archival journal of the International Academy of Astronauts (IAA).

Cristina Poleacovici
Awarded the P.E.O. International Peace Scholarship Fund for outstanding international women studying at UAHuntsville; Selected in 2012 for a prestigious International Astronautical Federation (IAF) Internship in Paris, France.

Lisa Tunstall
Mark Becnel
Nominated for the IAF 2012 Young Space Leaders Recognition Program.

Mark Becnel
John Alcorn & Other Members of the UAHuntsville Space Hardware Club:
- Selected to build the “ChargerSat 1” Cubesat for launch by NASA.
- Attended the IAC in 2010 and 2011; 1st place winner, in the 4th Wernher von Braun Memorial Symposium, Student Poster Competition.

Eric Becnel
Mark Becnel
Attended the IAC in 2010 and 2011; Met members of the Icarus Project and was invited to join as a research collaborator.

Setayesh, who says he has found a renewed opportunity to

Lisa Tunstall
Mark Becnel
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“Gliding” Through the Data

ITSC researchers integrate programs to improve satellite data analysis

Nearly two centuries ago, artist Caspar David Friedrich depicted forest, mountains, clouds, and sky blurred into an incomprehensible mass in the painting *Wanderer above the Sea of Fog*. Earth scientists can often have a similar feeling of an incomprehensible mass as well, as they sift through satellite data depicting our world. If only they could just glide through the mist and connect the bits the right way...

Doing this is a key achievement of a UAHuntsville project called GLIDER.

GLIDER is the Globally Leveraged Integrated Data Explorer for Research, developed by a UAHuntsville team led by Computer Science Professor Dr. Sara Graves and the Information Technology and Systems Center (ITSC). ITSC research staff, including Dr. Rahul Ramachandran, Todd Berendes, and computer science graduate students, integrated two existing programs that visualize and overlay satellite data with a third that sifts through the data to get answers. Doing so saved the equivalents of four full-time programmers two years to develop a new product. GLIDER is a free computer tool and operates on virtually any computer platform. The team was awarded the 2010 Recognition Software Reuse Award from the NASA Earth Data Systems Software Working Group.

Satellite data present many views across electromagnetic spectrum, including visible light, and microwaves. Each frequency window tells a small slice of the story of Earth below; adding, subtracting, and comparing data sets make our understanding of the richer and more complete. It has to explore questions like: How can I predict where the next hurricane will dump its water? Will a change in snow cover help insurgents in a mountainous area?

GLIDER lets the user apply analytical tools to find patterns that yield the answers, and then poke into the data to confirm it wasn’t a coincidence. GLIDER interprets data from multiple sets onto a unified map so each datum is connected to the right point in space and time, and allows multiple views of scenes and events for novice and skilled users alike. Then it helps users develop workflows so the analytical tools can be repeated or modified as needed.

GLIDER is freeware (though users must register) and includes several tutorials so Earth scientists will be able to wander through their data sets without getting lost. It can be found at http://miningsolutions.itsc.uah.edu/glider/

For more information, contact Dr. Sara Graves at sgraves@itsc.uah.edu
When a crate shows up on campus, standing 14 feet high, stretching 10 feet wide, and weighing about 25,000 pounds, people take notice. And that was just the first box. Dr. Pat Reardon, Director of the Center for Applied Optics (CAO), and his staff were ready and anxiously awaiting the arrival of UAHuntsville’s newest piece of optical fabrication equipment, a Zeeko IRP-600X Free-form polishing machine. The machine was the result of a successful MIR grant from the National Science Foundation.

One of the world’s best (and rarest) devices for polishing optical surfaces, the British-made Zeeko is capable of shaping free-form optical surfaces in virtually any material: glass, metals, or composites. “Basically, if you can find the right abrasive, it can be applied by the Zeeko,” said Dr. Reardon.

And while a gathered crowd was impressed watching the unloading of these giant crates, the real amazement came when this machine went into action. The Zeeko IRP-600X is an “Intelligent Robotic Polisher”, capable of creating optical quality surfaces of virtually any shape in almost any material, on parts up to 600mm in diameter and 450mm in height. The pass-off tests proved that the machine can figure an optical surface to better than 16nm RMS figure error, which is nearly three times better than the standard definition of “perfect” for most visible optical lens surfaces.

Obtaining the polisher was the idea of Dr. Reardon and his UAHuntsville colleagues, Drs. Bob Lindquist (Principal Investigator on the Zeeko Proposals), Joe Geary, Brian Robinson, and Richard Fork, after trying out the smaller version, a Zeeko IRP-200. This smaller machine was leased for research on a NASA-Goddard Space Flight Center (GSFC) program investigating the feasibility of polishing silicon carbide, an extremely hard material being investigated for use as an optical mirror substrate. The smaller Zeeko proved so impressive that it provoked interest in the bigger model. “It allowed us to take machine-rough silicon carbide and produce a 5nm RMS rough surface relatively quickly,” said Reardon of the IRP-200. “And we could have gone further, but the customer, GSFC, was already satisfied with the results.”

From there, the group submitted a grant proposal to the National Science Foundation (NSF) to fund acquisition of the IRP-600. After two proposal attempts, and some tweaks based on reviewers feedback, the third time was the charm. The Zeeko will allow UAHuntsville to create optical devices of greater size, quality, and complexity than could ever be made before. This has already bolstered collaboration, including work with NASA’s Marshall Space Flight Center. The CAO intends to use the polisher to support local, regional, and national teams in the fabrication of complex optical systems, as well as extending its research efforts in optical fabrication process development, optical testing, and optical design.

Totally computer-controlled, the Zeeko can be programmed to select the exact type of polishing motion, pressure, speed, slurry, and direction of attack. The operator of the machine has control over a minimum of seven polishing variables, which can prove both useful and daunting.

“The power of the Zeeko system is that you have so many variables available to optimize the polishing process. But the challenge is also that you have so many variables available to select the polishing process,” said Dr. Reardon.

There are presently only a dozen Zeekos in the entire United States – and UAHuntsville has the only “600 series” in America, and the second largest of all.

“This is very exciting for us. We are now operating such a unique and powerful instrument, and have the ability to design and fabricate optics of extraordinary quality. These optics can have shapes and purposes never before conceived,” said Dr. Reardon. Additionally, processing for this kind of optical fabrication is still a new and expanding research area, all of which integrates well with the CAO’s expertise, and the desires of local, regional, and national teams for interaction.

The Center for Applied Optics at UAHuntsville adds the Zeeko to its list of recent acquisitions as it grows a comprehensive portfolio of optics fabrication, design, and metrology assets. In 2010, the CAO acquired a Nanotech UPL250 precision diamond turning lathe with a NASA grant. This machine is capable of producing free-form optical surfaces up to 350mm in diameter. The lathe has already been used to produce and deliver optics for terahertz, visible, x-ray, and gamma-ray wavebands, achieving surface-smoothness (RMS) values of less than 2-5nm.

This new piece of equipment shows that good things also come in large packages.

For more information on the Center for Applied Optics and its capabilities, contact Dr. Pat Reardon at patrick.reardon@uah.edu
Dr. Angela Balla, Assistant Professor of English, presented “George and Edward Herbert’s Intertwinned Paths Toward Toleration, Locating George Herbert: Family, Place, Traditions” at the George Herbert Society Conference, at the University of Wales, in October 2011.

Dr. Christina Carmen, Lecturer in Mechanical and Aerospace Engineering, was awarded the SAE International Ralph R. Teetor Award, which recognizes and honors young educators who are successful preparing engineers to meet the challenges that face society.

Dr. Diana Dowdy, DSP, RN, CNM, RDMS, published “Poly Cystic Ovary Syndrome: A Guidebook for Teens,” to be used in medical facilities as take home material for patients.

Dr. Alanna Frost, Assistant Professor and Director of First Year Composition presented at the Feminisms and Rhetorics Conference at Minnesota State University on “Literacy Practices in a First Nations’ Community: Women Writing Culture.” She also published “Literacy Stewardship: Dakelh Women Composing Culture” (College Composition and Communication. 63.1 September 2011).

Dr. Karen H. Frith, PhD, RN, NEA-BC, Associate Professor in the College of Nursing, and Dr. Faye Raines, DNS, RN, NEA-BC Dean of the Nursing College, presented their research and developments in a presentation titled “Using Technology to Support Nurse Staffing Decision Making” at the international meeting of the Medical Automation Organization in November, 2011.

Ms. Peggy Hays, DNS, RN, Associate Professor of Nursing, presented “Developing a Practice Environment Using Nurse Handoff Communication: A Pilot Study” at the 2011 KING International Nursing Conference at Montana State University.

Dr. Clark Roundtree, Chair and Professor of Communication Arts, recently published “The Chameleon President: The Curious Case of George W. Bush” (Santa Barbara, CA: Praeger, December 2011).

Dr. Peter J. Slater, Professor in the Computer Science Department and Mathematical Sciences Department gave the opening and closing invited keynote addresses at the Bordeaux Workshop on Identifying Codes in Graphs in Bordeaux, France in November, 2011.

Dr. Chad Thomas, Assistant Professor of English, directed a stage production of Shakespeare’s The Comedy of Errors, that was performed in November, 2011, in the Chan Theatre.


Ms. Louise O’Keefe, NP, Clinical Assistant Professor in the College of Nursing and Director of the UAHuntsville Faculty and Staff Clinic, received the 2011-2012 Outstanding Regional Nurse Practitioner Award for North Alabama.

Dr. Jason M. Smith, Sociology Professor, and Dr. Philip E. Kovacs, Education Professor, published “The Impact of Standards-based Reform on Teachers: The Case of ‘No Child Left Behind’,” Teachers and Teaching: Theory and Practice.”

Dr. John Christy, Professor of Atmospheric Science and Director of the Earth System Science Center, won the 2011 Quest for Excellence Award given each year to publicly recognize outstanding contributions of individuals in the greater Huntsville community in the fields of Science, Technology, Engineering, and Mathematics (STEM).

Dr. Q.H. Ken Zuo, Associate Professor of Mechanical and Aerospace Engineering co-authored a paper in the Journal of Applied Physics intended to assist in the design of bird strike-resistant aircraft windshields.

Dr. Gary P. Zank, Professor and Chair of the Physics Department, was elected as a Fellow of the American Geophysical Union (AGU). The award is honored by AGU to only one in a thousand members each year.

Dr. Philip Kovacs speaking at the computer donation ceremony at Hazel Green High School.

Dr. Alana Frost, working with a Hazel Green High School student.

Dr. Kovacs working with Hazel Green High School students Keyontay Johnson and Kishlon Lee.

Higher Education Working with K-12

UAHuntsville professors create program to boost students’ scores in reading comprehension

In 2009, two UAHuntsville professors created a digital literacy program for a nearby high school’s ninth grade. They wanted to research the benefits of Science, Technology, Engineering and Mathematical (STEM) related programs, and how interactive learning and using computers can improve reading comprehension.

Dr. Philip Kovacs, an assistant professor of education, and Dr. Alana Frost, an assistant professor of English, worked with English teacher Jennifer Taylor and fifteen high school freshmen who spent the semester researching and writing about a topic of their choice. They also made class presentations and created powerpoint shows, videos, text and links to online sources. This planning and testing phase continued throughout the 2010-2011 school year.

Following the semester, Kovacs and Frost spent time analyzing the data they collected from reading tests they did at the beginning and end of the year with a control group, and the group of students engaged in the Emerging Scholars Program. They wrote papers on their observations and continued to study their work.

The pilot program resulted in a 60 percent aggregate gain on state-mandated tests, with some students jumping as much as six grade levels in reading comprehension, according to the same metric.

“We didn’t teach a single reading strategy or a single writing strategy,” Kovacs said. “We just let them read and write.”

The program was so successful, that Kovacs and Frost wanted to take it to the next level, and integrate the entire ninth grade. Unfortunately, Hazel Green High School did not have the necessary computers to make the program available to all students.

“We were prevented from doing this on a large scale because the school only had one computer lab for approximately 400 students in their ninth grade academy,” Kovacs said.

However, Dr. Kovacs and Dr. Frost continued to push for their program. While giving a presentation to the Huntsville-Madison County Chamber of Commerce Workforce Coalition about the work he and Dr. Frost had been doing at Hazel Green High School, Dr. Kovacs came across some help. Intrigued by the program, a Lockheed Martin representative suggested the Lockheed Martin-managed Outsourcing Desktop Initiative for NASA (ODIN) program at NASA’s Marshall Space Flight Center (MSFC) in Huntsville.

In a partnership with NASA, and following the guidelines of the Stevenson-Wyler Technology Innovation Act (200), Lockheed Martin donated 100 used computers to Hazel Green High School in March of 2011. The computers, which were originally used by NASA employees, would go to Hazel Green’s ninth grade. The school’s English teachers would be able to use the laptops for the Emerging Scholars Program and keep them after the program ended.

“We are welcoming this idea because the push in education is toward technology,” said Elisabeth Smith, an assistant principal at Hazel Green. “Not only are our students interested in it, but it’s something they need to be prepared for in the future.”

Thanks to the generous donation, the formal program was launched for the 2010-2011 school year to nearly 200 ninth grade students. It follows in the same pattern, with students choosing their own topics and spending time in school doing their research and posting on a social network accessible by Kovacs and Frost, their teacher, and their classmates.
UAHuntsville’s Office of Technology Commercialization helps facilitate new ideas and generates economic growth.

Somewhere, a great idea for a commercial product is being born. A faculty member on campus is figuring out a way to develop her concept. A researcher has come up with something that just might be marketable. A student has imagined a new product. A business has an idea, but needs the research expertise. Where can they go to turn their notions into potential?

UAHuntsville’s Office of Technology Commercialization (OTC), under the direction of Mr. Kannan Grant, is helping these ideas become commercial products, starting companies, and in turn, generating economic growth within the Huntsville community.

“OTC facilitates new ideas into the marketplace and connects UAHuntsville faculty and students to the industry, to work together on the problems they face,” said Grant.

This year, the OTC has taken a forward-thinking approach to working with industry and has developed a Master Cooperative Research Agreement (MCRA) that can be used as a vehicle by companies that want to partner with UAHuntsville. The MCRA greatly simplifies the process of partnering, allowing companies to have one agreement that governs all projects that they have with UAHuntsville.

“The end goal is to spur economic growth by creating something that will be made available for public consumption,” said Grant. “Many of the University’s spin-off companies remain in the community, where they become employment opportunities for the residents of the area.”

In addition to managing intellectual property, OTC also aids the movement of new technologies into the market by partnering with existing companies or creating new ones. Over the past few years, Grant’s office has been heavily involved with the UAHuntsville spinoff companies that compete in the Alabama Launchpad Competition. The highly competitive statewide business plan competition has seen UAHuntsville win the top prize consecutively over the past two years (see the Decision Innovations story on page 14).

“It is great for the University, and for the community, when an idea can go from a mere thought, to a product on the table,” said Dr. John Horack, Vice President for Research. “UAHuntsville has the talent, and intellectual property to create amazing products and help move the community in a positive economic direction.”

For more information, contact Kannan Grant at kannan.grant@uah.edu

Partners in Progress

Working Together for Technology Research

Partnership takes aim at new missile defense technology

In August of 2013, UAHuntsville, joined by Auburn University and Tuskegee University announced a partnership with Lockheed Martin to help build federal technology. Known as the Lockheed Martin Innovation Marketplace, the group intends to support private sector and academic sector technologists in participating in the U.S. Department of Defense’s Small Business Innovation Research, Technology Transfer and Mentor Protege programs.

With this initiative, the four parties hope to provide national-level benefits by supporting emerging technology for missile defense applications, and help bring more cutting-edge technologies in the systems our war fighters rely upon to defend the country.

As part of the program, Lockheed Martin will provide a center on its Huntsville campus that will provide researchers with meeting and work space, as well as high-speed network connections to similar Lockheed Martin centers elsewhere in the United States.

The company plans to expand the facility in 2012 to include a technology test bed where researchers will be able to plug their new products into a simulation environment to assess interoperability with existing Lockheed Martin and government systems.

The collaboration will support Department of Defense small business innovation research. “We’ll identify a particular initiative that the government needs to have solved and then we will assemble the best team available across all of our partners,” said John Holly of Lockheed Martin.

Dr. John Horack of UAHuntsville adds, “We’re only going to solve those problems by bringing new, creative ways of thinking through people educated in both the technical and cultural arts, to understand how we can solve these challenges that we face.”

Tennessee Valley Corridor Fall Partnership Event Focuses on Economic Development

Public and private sector leaders from throughout the region joined with the Tennessee Valley Corridor congressional delegation to discuss and collaborate on ideas centered around the theme, “Turning Regional Resiliency Into Economic Development.”

The two-day event in November, 2011 involved major sessions that discussed the lessons learned and the opportunities created from the tornadoes that struck the region this spring.

Though states and cities often compete for economic development, the discussion was mainly about coming together as a region and putting aside city, county and state differences.

“We’ve got to work with our synergy and work off each others’ strengths,” said Huntsville Mayor Tommy Battle. “This is all about jobs. Economic development happens by talking and communicating.”

Dr. John Horack, Vice President for Research at The University of Alabama in Huntsville and a corridor board member, served as the event’s moderator. He emphasized the importance of science and technology, research in growing a prosperous community, and the importance of competing with the likes of the Silicon Valley.

For more information visit www.tennvalleycorridor.org
Studying a Snowstorm... In Alabama?

When most people think of a snowstorm, they picture soft, white snowflakes falling quietly to the ground. However, in January, 2011, Huntsville, Alabama experienced something much more violent. A powerful snowstorm, with a 50-mile long lightning bolt, loud thunder, and almost a dozen gravity waves. This rare phenomenon is known as “thundersnow”. And while Alabama may seem like the most unlikely place to study a snowstorm, it worked out extremely well for UA/Huntsville and NASA researchers.

“Thundersnow” is a term used to describe a snowstorm that produces significant amounts of lightning and thunder. This type of storm is rare and difficult to study, but in January 2011, Huntsville, Alabama experienced one.

The research team usedUA/Huntsville and NASA instruments at Cramer Research Hall, two lightning detector networks, and advanced dual polarization Doppler radar at Huntsville International Airport, and the National Weather Service Doppler radar at Hytop, Alabama in Jackson County. Knupp also sent the university’s mobile dual polarization Doppler radar unit to set up outside of New Market, Alabama, in Northeastern Madison County.

“We are studying the storm’s ‘comma’, the area of small scale waves or instabilities near the end of a storm system,” said Ryan Wade, a student in UA/Huntsville’s atmospheric science Ph.D. program. “These instabilities can dump large amounts of snow over small areas. That’s why you might have a storm that drops four inches of snow across a hundred miles, but eight inches in one place and a dusting in another. What causes these waves isn’t well studied or understood. This is a unique opportunity to study the ‘comma’ part of this storm.”

The initial plan of the evening was to research what happened in the ‘comma’ of a snowstorm, but then the lightning flash occurred, and the team’s focus was set on learning more about the thundersnow.

Lightning detection networks set up by NASA and UA/Huntsville scientists detected seven lightning flashes during the snowstorm. Lightning only occurs in snowstorms under special conditions, which include the presence of updrafts. Ice particles carried aloft on these updrafts bump against each other, swapping electrons and building an electric charge.

However, sustained updrafts are uncommon in snowstorms. That’s where the gravity waves come in. A gravity wave is simply a wave in the atmosphere similar to waves in the water. Air is pushed up the front of the wave and falls down the back. These waves can start in a number of ways, such as a violent updraft in a thunderstorm or a sudden change in the jet stream. According to Knupp, the eleven gravity waves that rippled across Huntsville and western Madison County that night were caused by wind blowing out of the east bumping into and being pushed over Monte Sano, a small mountain a few miles east of UA/Huntsville.

“When there was a nearly constant, uniform progression of gravity waves,” said Knupp. “An easterly flow of air on the other side of the mountain ridge bumped into and over Monte Sano, forming eleven separate waves, about one per hour!”

Knupp believes it was the clockwork up and down motion of the waves that created variations in the updrafts responsible for the heavy snow, leading to the charge separation that generated lightning. He, along with graduate student Chris Schultz and the rest of the team, will continue examining the details of the lightning in this snowstorm.

There is plenty of data to be analyzed from that evening, and that’s a good thing. It may be quite a while before another storm of this magnitude happens at UA/Huntsville again. However, when it does, Knupp and his team will be ready.

Above: This image shows a horizontal map of snowfall echo, as observed by the ARMOR radar over Huntsville, Ala., on Jan. 10, 2011, at 10:28 p.m. CST -- just prior to the first lightning flash detected. The warmer the color, the heavier the snowfall. The white dashed rings are spaced every 9.4 miles from the radar. The blue triangles represent the location of the NASA/University of Alabama in Huntsville science center, where many of the snowfall particle size measurements were collected.

For more information, contact Dr. Kevin Knupp at kevin@nsstc.uah.edu
UAHuntsville helps complete cryogenic mirror testing for NASA’s James Webb Space Telescope

When you are creating the world’s next-generation space observatory there are many pieces of the puzzle that need to come together before building the large, deployable telescope. For the James Webb Space Telescope (JWST), the completion and final testing of the 21 mirrors was a major piece of the puzzle that fell into place in 2011. And UAHuntsville researchers played a significant role in the process.

The Webb telescope, once completed, will be the most powerful space telescope ever built. It will provide images of the first galaxies ever formed, and explore planets around distant stars. But in order to work, the primary mirror, which is comprised of 18 hexagonal segments, working together to total 6.5 meters in diameter, must remain smooth and focused in the cold temperatures of space. Therefore, before the mirrors could be attached to the JWST and the satellite launched to its observing position one million miles from the Earth, they would have to undergo extensive evaluation.

Dr. James Hadaway, Principal Research Scientist from UAHuntsville’s Center for Applied Optics, and his team, were subcontracted through Ball Aerospace to test the 18 gold-plated mirrors at the X-ray and Cryogenic Facility (XRCF) at NASA’s Marshall Space Flight Center in Huntsville, Alabama.

Hadaway, who has been part of the Webb telescope program since its inception, when he led the optical design team that came up with the initial layout for the telescope, tested each of the mirrors to be sure they could operate at a very cold 40 Kelvin (-387 Fahrenheit or -233 Celsius).

“We need to confirm that the mirrors can withstand the extreme temperature that will be experienced in space,” said Hadaway, “and they must remain cold so that their own heat does not drown out the faint infrared images.”

During two test cycles, telescope engineers took detailed measurements of how each individual mirror’s shape changed as it cooled. Testing verified each mirror changed shape with temperature as expected, and each one will be the correct shape upon reaching the extremely cold operating temperature after reaching deep space.

Following the cooling process, the mirrors had to be warmed up slowly over a period of several days, to avoid damage, distortion or condensation, which could leave behind deposits on the polished gold surface.

“This testing ensures the mirrors will focus exactly as intended when in space,” remarked Hadaway, “When they do, they will enable us to see farther into the universe than ever before.”

The JWST is a joint project of NASA, the European Space Agency and the Canadian Space Agency. Northrop Grumman is the prime contractor under NASA’s Goddard Space Flight Center, and Ball Aerospace & Technology Corporation is responsible for mirror development.

The expected launch date for JWST is 2018. With the cryogenic testing of the mirrors now complete, the next piece of the puzzle can start taking shape.

For more information, contact Dr. James Hadaway at hadaway@uah.edu
Imagine yourself behind the wheel of your dream car. Can you see yourself tearing up the road in a fabulous red Porsche? Perhaps you prefer the elegant sophistication of a Jaguar. Or maybe you imagine the speed of a sleek Corvette. Well, for a group of students at UAHuntsville, it isn’t any of those. For them, the ultimate ride is a moonbuggy. And they set out to prove the merits of their dream vehicle at NASA’s 2011 Great Moonbuggy Race.

Sponsored by NASA’s Marshall Space Flight Center, the Great Moonbuggy Race is an event that challenges high school and college students to design, build, and race light-weight, human-powered rovers, or “moonbuggies”, that address many of the same challenges faced by Apollo-era engineers. Specifically, teams must deliver a two-driver buggy (usually in a three- or four-wheeled configuration) capable of posting the fastest vehicle assembly and race times, while incurring the fewest penalties on a course that simulates the rocky surface of the Moon. In 2011, the UAHuntsville team competed against 41 other colleges and universities and had an impressive 2nd place overall finish. They also won the System Safety Challenge, receiving a $300 award for their efforts.

“Our team exhibited a level of professionalism throughout the whole process that was simply amazing,” said Dr. Christina Carmen, the team’s faculty advisor. “They transformed a non-functioning vehicle to fully functional and durable within six weeks, which gave them a month to train and test the vehicle before the race. Their discipline and determination had a major impact on our strong showing this year.”

In addition to the race, UAHuntsville moonbuggy team members supported a range of educational outreach activities and events, all designed to encourage elementary and high school students to pursue science, technology, engineering, and mathematics (STEM) academic paths and careers. Whether taking 4th graders for a ride on the moonbuggy, or conducting demonstrations for prospective students at a UAHuntsville open house, all the team members agreed that their most rewarding experiences were with the students.

“Building the vehicle and competing in the race were incredibly exciting,” said Michael Patterson, team lead, “but there’s nothing more rewarding than watching a kid’s face light up when he gets to manipulate or ride in the moonbuggy. They really love it and ask all kinds of questions just so they can learn more.”

Dream Buggy

UAHuntsville moonbuggy team places 2nd

Gravity Probe-B Confirms Two Einstein Space-Time Theories

NASA’s longest running project is deeply rooted within UAHuntsville and the Huntsville community

Upon hearing NASA’s 2011 announcement that NASA’s Gravity Probe B (GP-B) mission had confirmed two key predictions derived from Albert Einstein’s general theory of relativity, UAHuntsville and the Huntsville community couldn’t help but reminisce.

The spacecraft, which is one of NASA’s longest running projects, was managed by Marshall Space Flight Center (MSFC), and by Dr. Francis Everitt, from Stanford University, who has been the Principal Investigator since 1963. However, it wasn’t until 2004 that the spacecraft was finally launched.

The experiment used four ultra-precise gyroscopes to measure two effects: the hypothesized geodetic effect, the warping of space and time around a gravitational body, and frame-dragging, the amount a spinning object pulls space and time with it as it rotates. GP-B determined both effects with unprecedented precision by pointing at a single star, IM Pegasi, while in polar orbit around Earth. If gravity did not affect space and time, GP-B’s gyroscopes would point in the same direction forever while in orbit. But in confirmation of Einstein’s theories, the gyroscopes experienced measurable, minute changes in the direction of their spin, a direct result of general relativity.

“Imagine the Earth as if it were immersed in honey. As the planet rotates, the honey around it would swirl, and it’s the same with space and time,” said Dr. Everitt. “GP-B confirmed two of the most profound predictions of Einstein’s universe, having far-reaching implications across astrophysics research. Likewise, the decades of technological innovation behind the mission will have a lasting legacy on Earth and beyond.”

Innovations enabled by GP-B have been used in GPS technologies advancing precision agriculture and automated aircraft landings. Additional GP-B technologies were applied to NASA’s Cosmic Background Explorer mission, which accurately determined the universe’s background radiation. That measurement is an underpinning of the big bang theory, and led to the Nobel Prize for NASA physicist John Mather.

The drag-free satellite concept pioneered by GP-B made a number of Earth-observing satellites possible, including NASA’s Gravity Recovery and Climate Experiment and the European Space Agency’s Gravity field and steady-state Ocean Circulation Explorer. These satellites provide the most precise measurements of the shape of the Earth, critical for precise navigation on land and sea, and understanding the relationship between ocean circulation and climate patterns.

Over the past 45 years, GP-B has affected the lives of many scientists and has generated almost 100 Ph.D.’s. While the majority came from Stanford (85), UAHuntsville had the second highest amount of any university. UAHuntsville played an important role during the development, operation, and scientific analysis of the mission. Among the notable UAHuntsville contributors are Dr. Peter Ely (Data Analysis, Gyroscope Torque Analyses), Anne Coleman and Dr. Charles Lundquist (Program Archives), Dr. Gerald Karr (Cryogenic Fluid Mechanics), and Dr. R. U. Huang (Tidal Behaviors and Liquid Containment in Zero-G).

The Huntsville community, and the State of Alabama played major roles in the manufacturing process as well. The precise, niobium-coated spheres which served as the gyroscopes to measure the effects of G-R were machined in Cullman, Alabama, at Arsys Technologies. Lockheed Martin Corporation of Huntsville designed, integrated and tested the space vehicle and some of its major payload components.

The story of the GP-B mission, the complexities of the engineering, and the technical breakthroughs required to build this satellite, fly it in space, and test General Relativity directly is quite impressive. UAHuntsville, the Huntsville community and the State of Alabama, with their strong history and contributions, can be proud to play a role in these important scientific discoveries.
OVPR Grant Programs

Junior Faculty Distinguished Research Program

The Junior Faculty Distinguished Research (JFDR) Program is designed to encourage the growth and development of UAHuntsville faculty scholarship in all academic areas. The program is intended to enhance individual faculty member’s talents, scholarship, and their ability to pursue externally-sponsored research activities in her/his respective field of study.

The program requires the submission of competitive proposals in basic and applied research, motivated to discover new ideas, information, or applications. The development of proposals to this program will further strengthen those faculty members’ skills that enable the development of sponsored research from other sources.

2011 JFDR Grant Recipients:

- Dr. Sayed Sadeghi – Physics
  Light-activated Nanoparticle Molecules
- Dr. Babak Shotorban – Mechanical and Aerospace Engineering
  Uncertainty Quantification of Turbulence Models with High-Performance
- Dr. Lingxi Duan – Physics
  Rapid Scanning Optical Coherence Tomography based on a Single Femtosecond Laser
- Dr. Kelly Gamble – Accounting and Finance
  Does Intuition Influence Investor Judgment?
- Dr. Derrick W. Smith – Education
  The Characteristics and Role of Tactile Graphics in Secondary Mathematics and Science Textbooks in Braille
- Dr. Wafa Hakim Orman – Economics and Information Systems
  Corporate Philanthropy as a Compensating Differential
- Dr. Jodi Price – Psychology
  Chinese Character Learning: Do Point Values and Presentation Format Matter?
- Dr. Marita O’Brien – Psychology
  Refining a Process for Describing Human Technology Interactions
- Dr. Christine Sears – History
  Privateers in the Early American Republic: Sailors, National Identity and Maritime Labor
- Dr. Brenda Talley – Nursing
  Smokeless Tobacco Use Among Rural Women

UAHuntsville Research Infrastructure Investment

The UAHuntsville Research Infrastructure Investment (UIRII) Grant program is intended to support basic and applied research activities, which are motivated by an effort to probe toward the discovery and development of new ideas, information, or applications. Collaboration across colleges, academic departments, and research centers allows for fresh multidisciplinary approaches to problem solving and is strongly encouraged; it is therefore weighed positively in the proposal evaluation process.

2011 URIII Grant Recipients:

- Mr. Darrel Engelhardt – Center for Space Plasma and Aeronautical Research
  Design, Fabrication, and Demonstration of Lightweight Freeform Mirrors
  Co-Investigator: Dr. Landrum – MAE
- Dr. Michael Briggs – Center for Space Plasma and Aeronautical Research
  Matching a Photodiode to a Gamma-Ray Scintillator for a TGF Instrument
  Co-Investigator: Dr. Connaughton – CSPAR and Dr. Reardon – CAD
- Dr. Emil Jovanov – Electrical and Computer Engineering
  Real-Time Monitoring of Occupational Stress
  Co-Investigators: Dr. Frith, Dr. Anderson, Ms. Elezzer – CON
- Dr. Qiang Hu – Center for Space Plasma and Aeronautical Research
  Global Extrapolation of Solar Coronal Magnetic Field from Solar Dynamics Observatory Measurements
  Co-Investigator: Dr. Wu, Dr. Li, Dr. Wang, Dr. Ao – CSPAR and Dr. Ravindran – MAE
- Dr. Nathan Siegers – Mechanical and Aerospace Engineering
  Intuitive Remote Control of Robots Using Gestures
  Co-Investigator: Dr. Jovanov – ECE
- Dr. Haley Hoy – College of Nursing
  Development of Web-Based Mobile Technology Application for Healthcare Providers in Transplant Care
  Co-Investigator: Dr. Alexander – CON and Dr. Maskey, Ms. Connor – ITSC
- Dr. Kevin Knupp – Atmospheric Science
  Lidar Centimeter Upgrade to UAH Mobile Profiling System
  Co-Investigators: Dr. Newchurch, Dr. Christopher – ATS

Investing in OUR People and their BEST Ideas
Research Funding

Sponsored research expenditures by source for FY 2011

Total: $84,982,318

- 48% - Department of Defense
- 1% - Department of Education
- 1% - Department of Commerce
- 1% - Other Federal
- 2% - Private/Non-Profit
- 3% - Academic
- 3% - National Science Foundation
- 20% - NASA
- 12% - State of Alabama
- 9% - Commercial

UAHuntsville Sponsored Research Expenditures 2001-2011
Research expenditures in millions ($USD)

Colleges & Research Centers

College of Business Administration
Caron H. St. John, Ph.D., Dean
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256. 824.6736

College of Engineering
Shankar Mahalingam, Ph.D., Dean
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256. 824.6474

College of Liberal Arts
Glenn T. Dasher, Dean
dasherg@uah.edu
256. 824.6200

College of Nursing
C. Fay Raines, Ph.D., Dean
rainesc@uah.edu
256. 824.6345

College of Science
Jabo D. Fy, Ph.D., Dean
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256. 824.6606

School of Graduate Studies
Rhonda K. Gaede, Ph.D., Dean
256. 824.6002

Continuing Education
256. 824.6030

Cooperative Education
256. 824.6741

Louis Salmon Library
256. 824.6530

Office of Compliance
256. 824.6845

Office of Sponsored Programs
256. 824.6000

Research Security Administration
256. 824.6035

Center for Applied Optics
Patrick Reardon, Ph.D., Interim Director
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Center for System Studies
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256. 824.6331

Center for Management & Economic Research
Jeff Thompson, Interim Director
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Center for Modeling, Simulation & Analysis
Mikel D. Petty, Ph.D., Director
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Center for Space Plasma & Aeronautical Research
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256.961.7401

Earth System Science Center
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256.961.7752

Humanities Center
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Information Technology & Systems Center
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Laboratory for Structural Biology
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256. 824.6533

Center for the Management of Science & Technology
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Propulsion Research Center
Robert A. Frederick, Ph.D., Interim Director
robert.frederick@uah.edu
256. 824.7200

Research Institute/Aerophysics Research Center
Richard S. Risso, Ph.D., Director
risso@uah.edu
256. 824.6343

Rotorcraft Systems Engineering & Simulation Center
Sue O’Brien, Acting Director
obrians@uah.edu
256. 824.6139

Systems Management & Production Center
Gary A. Maddox, Ph.D., Director
gary.maddox@us.army.mil
256.313.1299

Office of Technology Commercialization
Kannan S. Grant, Director
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256. 824.4623

Research Funding

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3% - National Science Foundation
2% - Private/Non-Profit
1% - Department of Commerce
1% - Department of Education
48% - Department of Defense
1% - Other Federal
9% - Commercial
12% - State of Alabama
20% - NASA
Research Funding

$0 $20 $40 $60 $80 $100
College of Science
School of Graduate Studies
Continuing Education
Cooperative Education
Louis Salmon Library
Office of Compliance
Office of Sponsored Programs
Research Security Administration
Center for Applied Optics
Center for System Studies
Center for Management & Economic Research
Center for Modeling, Simulation & Analysis
Center for Space Plasma & Aeronautical Research
Earth System Science Center
Humanities Center
Information Technology & Systems Center
Laboratory for Structural Biology
Center for the Management of Science & Technology
Propulsion Research Center
Research Institute/Aerophysics Research Center
Rotorcraft Systems Engineering & Simulation Center
Systems Management & Production Center
Office of Technology Commercialization
UAHuntsville Sponsored Research Expenditures 2001-2011
Research expenditures in millions ($USD)

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The University of Alabama System consists of three doctoral research universities: The University of Alabama, The University of Alabama at Birmingham, and The University of Alabama in Huntsville. The System is governed by The Board of Trustees of The University of Alabama as stipulated by the Alabama Constitution. The purpose of the Board of Trustees is to ensure the effective leadership, management, and control of the institutions of the System in order to provide for a definitive, orderly form of governance, and to secure and maintain responsive, progressive, and superior institutions of higher education. The Board of Trustees created the present multi-campus structure in 1969, and each of the component institutions has a unique mission that is consistent with the broader mission of the System.

The Board of Trustees executes its governance responsibilities through a chancellor, who serves as the chief executive officer of the System. A president heads each campus with responsibility for campus administration and reports directly to the Chancellor, and through the Chancellor to the Board of Trustees. The Board of Trustees and the Chancellor delegate certain administrative functions and maintain such offices as deemed appropriate to meet the administrative needs of the System. The Chancellor also provides linkage between the System and various components of state and federal governments, as well as other educational groups and organizations.

Institutions of The University of Alabama System exist to serve all people of Alabama through teaching, research, and service programs. As resources permit, the institutions extend these functions to the nation and beyond through a wide variety of educational programs and services. The institutions of the System assist students in developing the knowledge, skills, attitudes, and behaviors necessary to function as responsible and productive citizens in a democracy. They endeavor to improve the quality of life through programs for high-quality research, public service, outreach, cultural enrichment, health care, and economic advancement.
Dr. John M. Horack, Ph.D.
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