



ICTAS Connection

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Issue No. 3 | November 2007

Proud Contributors Share in Celebration of ICTAS A Grand Opening

On September 21, 2007, more than 200 guests participated in a ceremony celebrating the official opening of the first ICTAS building. ICTAS A houses the Nanoscale Characterization and Fabrication Laboratory (NCFL), a state-of-the-art facility on par with the best nanotechnology labs in the world.

Richard Benson, Chair of the ICTAS Stakeholders committee and Dean of the College of Engineering, offers a toast: "To invention! To the future! To ICTAS! To Virginia Tech!" as ICTAS Director Roop Mahajan and Virginia Tech President Charles Steger join in.



It was a beautiful fall afternoon and a joyous occasion for the attendees, many of whom who have invested time and effort in ICTAS, from concept to operations, and now prosperity. The formal ceremony was followed immediately by a reception and tours of the lab facilities.

The celebration began with opening remarks from the ICTAS Director, **Dr. Roop Mahajan**. "Many individuals have made a difference in the development of this institute through original ideas and countless hours of effort," Mahajan acknowledged. "I am deeply invested personally in building on the existing foundation and taking it to new heights."

University President **Dr. Charles Steger** expressed thanks "to alumni, faculty, industry representatives, and state officials who recognize the long-term value of research and who have worked together to make this facility a reality," noting that ICTAS is the result of more than a decade of visionary effort.

Dr. Steger also acknowledged that more than half of the equipment currently in the NCFL was made possible through funding provided by the Commonwealth Research Initiative.

Speakers at the celebration included **Ray Martin**, former co-chair of the 30-member ICTAS Task Force and a Virginia Tech alumnus; **Joe May**, Head of Virginia's Joint Commission on Science and Technology (JCOTS); **Steven Danziger**, Program Manager of Technology Diversification Space Systems and Electronics for BAE Systems in Manassas, Virginia; and Virginia delegates **Dave Nutter** and **James Shuler**.

Dr. Richard Benson, chair of the ICTAS Stakeholders Committee and Dean of the College of Engineering, recognized contributions of former Deans of Engineering Malcolm McPherson and F. William Stephenson; former ICTAS Directors Tom Dingus, Hassan Aref, and Rodd Hall; Materials Science and Engineering Department leaders David Clark and William Reynolds; alumni Ray Martin, Cliff Lilly, and Joe Vipperman; university President Charles Steger; and the many ICTAS-funded researchers contributing to the development and success of ICTAS and the NCFL.

"We have successfully crossed the first milestone of the ICTAS journey upon which we embarked several years ago, and exciting times are ahead," Mahajan said.

The *Roanoke Times* ran an article covering the building opening in the September 22, 2007 edition. A link to the article is available on the ICTAS website.



Guests at the celebration included (from left to right) former Board of Visitors rector Pete White, Adele McComas White (former "first lady" of Virginia Tech), shown chatting with Malcolm McPherson (originator of the ICTAS concept) and his wife Shirley.

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DEAN'S CORNER

A Tale of Two Cultures

Most of us are familiar with the well-known thesis posited by British scientist and novelist C.P. Snow in his 1959 lecture entitled "The Two Cultures." Snow's thesis described the divide between the sciences and humanities and how this divide posed a serious challenge to the explication and resolution of many of the world's problems.

While I think that divide is in some respects still there, the major challenge at present is created by similar divides that separate different science disciplines. The divide most commonly recognized is the one that distinguishes between what is referred to as basic and applied research.

Cultural clashes abound, but it is the duty of the educated to understand the underpinnings of these clashes, to appreciate that these underpinnings evolve in time, and to use these evolutions to ameliorate the differences and work them to our advantage.

The clash between basic and applied research is undergoing an evolution driven in large part by the successes and advances in both fields. Progress in applied research has produced technology that enables us to probe deeper into materials, to explore farther out into the universe, and thence, to study phenomena in realms considered impossible even as recently as a decade ago.

In the meantime, progress in basic research has come up with paradigms having broader scopes of applicability than ever before. The successful sequencing of the human genome is a good example. Without advances in computation, this exercise would be extremely difficult. However, with them, we have complete genomic



*Lay Nam Chang
Dean, College of
Science*

sequences of various species, including our own. Now we can ask the critical question: How can the tremendous variety of information that defines life be stored so efficiently in the sequence? Without the technology, we are unable to ask the right question; without the right question, we won't come up with the breakthrough leading to the next level of sophistication in technology.

ICTAS is Virginia Tech's enabling organization to facilitate this dialog between the two research cultures. Its aim is to provide the means for investigating the complex problems we face today by marshalling expertise across the full spectrum of the human enterprise. Its activities aim to touch upon all of the major challenges we face at the present, to then manifest the most proficient strategy, and finally to map out the terrain where future challenges might lie.

To the extent that it covers learning through inquiry, discovery through cutting-edge technology, and engagement through dissemination to cognizant constituencies, ICTAS is the engine that drives the ideals of the land-grant objective. Its realization represents the culmination of the aspirations of the pioneers who initiated the effort a decade or so ago, particularly those of Malcolm McPherson, whose foresight and acumen continually informed and guided the planning process.

We owe a debt of gratitude to these pioneers, as well as to Virginia Tech's administration for their support and to the many faculty members who contributed to the implementation of the idea.

We are poised for exciting adventures ahead!

DIRECTOR'S CORNER



*Roop Mahajan
Director, ICTAS*

Nurturing Convergent Cultures

I resonate with the observation made by Dean Lay Nam (on the opposite page) that for too long “the two cultures” – the sciences and humanities – have developed in isolation.

To a lesser extent, the same divide has existed between the basic sciences and engineering. It is noted that traditional disciplines have defined the core of university life for centuries and have provided the scholarship and expertise necessary to advance knowledge. However, many of the problems facing society today cover a spectrum of complex issues requiring a comprehensive range of scholarship across science, engineering, humanities, and social sciences.

Meeting this challenge is one of the main objectives of ICTAS, which aims to provide an intellectual

ICTAS received 70 proposals in response to a recent call for proposals. 15 will be awarded for the 2007-08 budget period in areas ranging from Water to Nano-Bio to Sustainable Energy and beyond.

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space in which interdisciplinary research will be fostered and encouraged.

ICTAS seeks to strike a balance between the scholarship needed in a traditional discipline and the entrepreneurial spirit that is often required in interdisciplinary research. I am pleased to note that a good fraction of Virginia Tech's faculty and students are in tune with this philosophy and are ready to engage in cross-boundary research and education.

ICTAS has embarked on an exciting journey in interdisciplinary research to build a global leadership position for Virginia Tech in transformative technologies for societal good. Our recently-inaugurated Nanoscale Characterization and Fabrication Laboratory represents a first major step in meeting our goal.

Equipped with state-of-the-art electronic and optical microscopy instruments, this facility provides a much-needed capability to observe and characterize matter and life at the nanoscale, and places Virginia Tech in a strong position to conduct frontier research in several emerging technologies. It will serve as a resource for researchers from across the nation and in particular from the Commonwealth of Virginia and the surrounding regions. It will also help Virginia Tech attract talented faculty from across the nation to conduct research with a potential for real-world impact.

Finally, I would like to take this opportunity to thank all the individuals and organizations for making NCFL a reality on the ground. I offer my special gratitude to faculty, staff, and students whose diligence helped make the inauguration a grand success.

As always, we value your partnership and welcome any feedback or suggestions that you might have to make ICTAS an institute we can all be proud of.

TECHNOLOGY FOCUS

Environmental Nanoscience and Technology at Virginia Tech

It is well known that there has been an enormous effort worldwide in the development of nanoscience and technology, and it is estimated that the worth of nano-based products, industries, and business will generate trillions of dollars in revenue worldwide within the next decade. Eventually, this area of technology will rival the importance of the molecular biology revolution of the last 20 years.

However, one sector of the nano-revolution that has been completely overshadowed is in the area of environmental nanoscience and technology.

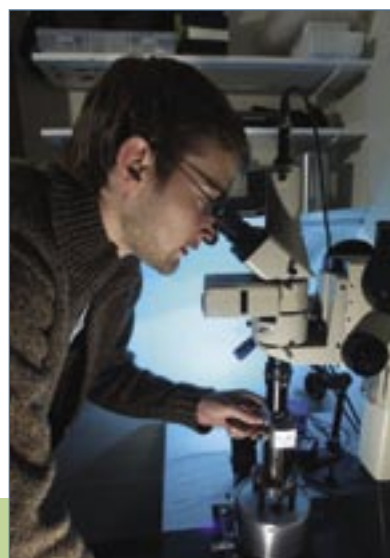
Just a few months ago, an independent report from the National Research Council stated that the nation is not paying enough attention to the environmental, health, and safety risks posed by nanoscale products. Unless these gaps are filled, the report warns, "the field's great promise could evaporate in a cloud of public mistrust." Similar points are being made in the popular press from the Washington Post to Time Magazine.

The good news for Virginia Tech is that it already has

established environmental nanoscience and technology programs that are internationally recognized. The lead group in this effort is headed by University Distinguished Professor **Michael Hochella** in the Department of Geosciences.

Hochella began to pioneer this field 15 years ago, and has raised many millions of dollars to date to pursue research in this area. In the last year, Hochella has been summoned to Capitol Hill, to speak before the U.S. Senate Committee on Public Works and the Environment, as well as to the science and policy staff of the General Accountability Office (formerly the General Accounting Office) in Washington, D.C. He has explained to lawmakers and federal officials what is currently known about nanomaterials in the environment. In early December, he will give a keynote address at the annual National Science Foundation meeting on nanoscience and technology, again on environmental aspects of nanoscience and technology.

Another example of Virginia Tech researchers in this field includes Professors **Linsey Marr** and **Peter Vikesland** in the Department of Civil and Environmental Engineering,



and **Harry Dorn** in the Department of Chemistry. They have recently been awarded a large grant by the National Science Foundation and the Environmental Protection Agency for a project entitled "Cross-Media Environmental Fate and Impacts of Manufactured Carbonaceous Nanomaterials."

Perhaps the single most important tool in finding, observing, and characterizing environmental nanoparticles is high-resolution transmission electron microscopy (HRTEM). Dr. **Joerg Jinschek** of ICTAS and the Department of Materials Science and Engineering is a renowned expert in this area. Jinschek operates one of the finest HRTEM's in the world today, the FEI Titan, for ICTAS.

Jinschek's HRTEM research with the groups mentioned above has already provided breakthroughs in the understanding of environmental nanoparticles. It is easy to forget that, from the human frame of reference, observing and studying a single nanoparticle with a transmission electron microscope is the same, in terms of magnification, as probing the entire Earth down to the level of a single light bulb. As remarkable as that seems, the FEI Titan HRTEM can extract a surprising amount of information from a single nanoparticle.

"It is easy to forget that, from the human frame of reference, observing and studying a single nanoparticle with a transmission electron microscope is the same, in terms of magnification, as probing the entire Earth down to the level of a single light bulb."

In another exciting and timely move, ICTAS has brought together the environmental nanoscience and technology team of Hochella, Dorn, Marr, Vikesland, and Jinschek, along with Professor **Patricia Dove** of the Department of Geosciences, to form the new Environmental Nanoscience Supergroup. This Supergroup will be housed in ICTAS I, the newest ICTAS building, in a large, well-equipped, state-of-the-art laboratory.

The Environmental Nanoscience Supergroup will provide new approaches for the characterization and understanding of manufactured and incidental nanomaterials and their natural counterparts. This effort will result in the development of methods for fast, real-time detection of both man-made and natural nanomaterials, and will determine how manufactured nanoparticles move and transform in the environment. This, in turn, will help us understand their environmental fate and their ecosystem and human health impacts, and lead to safer protocols for manufacturing processes and utilization. Without extensive efforts in this area, the research, development, and business of nanoscience and technology will never reach its potential. Environmental nanoscience and technology is literally that important, and Virginia Tech is, and will continue to be, among the world leaders in these vital endeavors.



At far left: Mike Hochella in his nanogeoscience and technology laboratory in the Department of Geosciences, Derring Hall, Virginia Tech.

Second from left: Nick Wigginton, Ph.D. candidate, operates an atomic force microscope.

At left: Juan Liu, Ph.D. candidate, synthesizes lead sulfide nanoparticles.

Right: Mike Hochella collects water samples from the Clark Fork River in Montana in a search for nanoparticles that carry toxic heavy metals downstream.



FACILITIES NEWS

ICTAS A – THE NANOSCALE CHARACTERIZATION AND FABRICATION LABORATORY (NCFL)

Nanoscale Characterization and Fabrication Laboratory (NCFL) activity is currently focused in two areas: (1) advanced applications training for the NCFL instrument specialists on the new tools in the facility, and (2) guided tours to better acquaint the community, state, and nation with the facility and its research-related capabilities.

Each of the instruments in the laboratory requires specific specialized training, some held on-site and some held at off-site schools, depending on the particular piece of equipment. Also underway is International Trade in Arms Regulations and Export Acquisition Regulations (ITAR/EAR) training for all technicians. A technology control plan is already in place for the facility.

Recently hosted tours include representatives from Precision Parts, Inc.; Corning Incorporated (Corning, NY, and Blacksburg, VA); DuPont (from facilities in Wilmington, DE, and Richmond, VA); the University of Connecticut; ETH Zurich, Switzerland; and the Virginia Department of Planning and Budget. The NCFL has also had organized visits of Virginia Tech students and faculty from the Geosciences department, the Materials Science and Engineering department, and the Macromolecules and Interfaces Institute.

About a dozen companies are currently using the facility and sponsored research programs are underway or in planning stages in response to requests from the National Institute of Standards and Technology (NIST) and ADA Technologies Inc.

ICTAS I

Plans are in final phase for lab upfits that will be incorporated into the original project completion plan. The building is tentatively scheduled for completion in July 2008.

ICTAS II

This building is in schematic design phase. Construction is scheduled to begin during the summer 2008.

STUDENT SPOTLIGHT

GETTING TO KNOW Jeremy Archuleta

Currently a Ph.D. student in the Department of Computer Science at Virginia Tech and a member of the inaugural class of elite ICTAS Doctoral Scholars Program, Jeremy is co-advised by Dr. Wuchun Feng and Dr. Eli Tilevich of the Computer Science Department.



Jeremy came to Virginia Tech from the University of Utah where he received a M.S. in Computer Science under the tutelage of Dr. Steven Parker. He is also an alumnus of the University of California Berkeley where he earned a B.S. in Electrical Engineering and Computer Science.

Jeremy is an avid outdoor sports enthusiast. He especially enjoys snowboarding and has traveled to Mt. Hutt in New Zealand, Lake Tahoe, the French Alps, the Swiss Alps, British Columbia, the Southern Rockies, the Northern Rockies and the Wasatch Range in pursuit of this passion. He also enjoys mountain biking and hiking, Ultimate Frisbee, amateur photography, hanging out at the beach, traveling, and vintage automobiles.

His research interests to date include system administration for high-performance computing clusters, efficient parallel algorithms for scientific computation, high-performance networking, parallel genomic sequence-searching, and efficient parallel systems for scientific computing. Currently, Jeremy's research is in efficient parallel systems for high-performance computing as part of the Systems, Networking, and Renaissance Grogking (SyNeRGy) team in the Computer Science Department.

Jeremy's interest in and support of humankind and societal needs is currently centered on Boarding for Breast Cancer, Keep Tahoe Blue, Surfrider Foundation, Lance Armstrong Foundation — Livestrong, and the Susan G. Komen Breast Cancer Foundation.

STUDENT NEWS

Introducing the 2007 ICTAS Doctoral Scholars

On September 5, 2007 ICTAS held a reception honoring the first cohort of ICTAS Doctoral Scholars. The event celebrated the official opening of the program and honored the eleven scholars who are part of the inaugural class.

The scholars, individual advisors, department heads, deans, associate deans, and select ICTAS staff enjoyed a brief welcome and presentation by Dr. Roop Mahajan, ICTAS Director, followed by a formal introduction of each of the ICTAS Doctoral Scholars. Each scholar spoke briefly about his or her background, including academic and research interests.

This new program, established in 2007, honors exceptional Ph.D. applicants through award of full financial support for the Ph.D. qualifying period.

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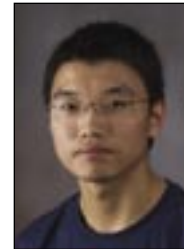
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ICTAS Connection is published by the **Institute for Critical Technology and Applied Science** at Virginia Tech

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Hochella appointed University Distinguished Professor

By Catherine Doss

BLACKSBURG, VA., June 27, 2007 — **Michael F. Hochella** of Blacksburg, professor of geosciences in the College of Science at Virginia Tech, has been named a University Distinguished Professor, a rank that honors select members of the faculty for widely renowned scholarly achievements.

The rank of University Distinguished Professor is bestowed by the Virginia Tech Board of Visitors to no more than one percent of members of the faculty whose scholarly attainments have attracted national and/or international recognition.

Hochella is a pioneer in the emerging field of nano- bio- geochemistry, a field of study believed to be a critical part of studies of the global environment. He was the first in his field to use atomic-force and scanning-tunneling microscopes as well as high-resolution transmission electron microscopes to study surface properties at the atomic level. He has applied this research to many areas of earth science and mineralogy, particularly environmental contamination issues.

To date, his sponsored research programs total \$12 million. He has written more than 120 scientific papers in professional journals and books, and his published work has had more than 3,000 citations. He is also one of the three founding editors of *Elements*, a major international magazine in the field of mineralogy, petrology, and geochemistry.

In addition to his research, Hochella is also a highly respected teacher. He consistently receives high student teaching evaluations.

Hochella has been a leader in introducing nanoscience and nanotechnology into the curricula of Virginia high schools. He is a highly sought-after international speaker, and he has given nanoscience and technology briefings to the United States Senate Committee on the Environment and Public Works, the General Accountability Office in Washington, and the Virginia General Assembly.

He has been honored with the Geochemical Society's Distinguished Service Medal, induction as a Fellow in the American Geophysical Union, Virginia Scientist of the Year (2005) Award, the Virginia Tech Alumni Award for Research Excellence, and the Alexander von Humboldt Research Award.

Hochella received his bachelor's degree and master's degree from Virginia Tech and a Ph.D. from Stanford University.



Hochella

Sincerest congratulations to Mike Hochella, who leads the Environmental Nanoscience Supergroup, a theme area under the umbrella of the ICTAS Nanoscale Science and Engineering focus group.



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