# Engineers' Forum

Volume 25 No. 3 September 2006


# Simple,

# or not?

THE ART OF SIMPLICITY

A BRIEF LOOK INTO MOBILE PHONE TECHNOLOGY

DR. KRAFT TO PRESENT MOON ROCK TO VIRGINIA TECH

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# From The Editor

Dear Reader,

Welcome to yet another issue of the Forum! As the new academic year commences, I would like to welcome all incoming students into the VT community. The next four years are going to be the best of your life, but do remember to keep the balance between work and fun; the rest will just piece together on its own.

For decades now, the Forum has been the voice of VT engineers, always bringing you VT engineering news and other stories. As a part of our quest for change, we would like to introduce some new features into the magazine. Don't be alarmed, however, because everthing else is the same as before. In the next few issues, you will notice some changes and additions. Starting from this issue, we have modified our cover page a little bit, to make it more consistent and organized. We would be delighted to hear what you think about these changes, so feel free to drop us a line. I hope you enjoy this issue.

Respectfully,

Divakar Mehta
Editor-in-Chief
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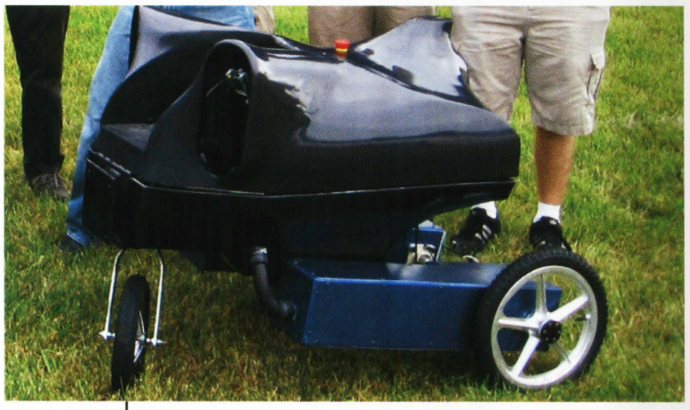
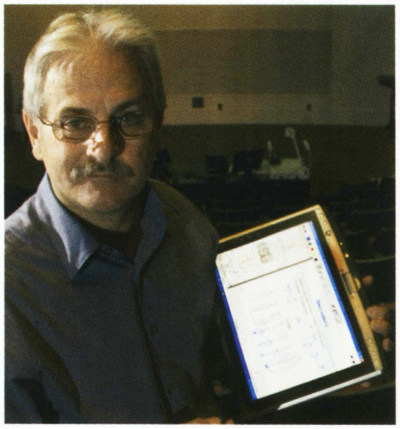





# Inside

# Virginia Tech Engineering Students Win Autonomous Vehicle Competition For Third Year

By Liz Crumbley

For the third year in a row, the Virginia Tech Autonomous Vehicle Team swept the international Intelligent Ground Vehicle Competition (IGVC), winning best and second-best overall and placing first in the three top event categories. The team of mechanical engineering (ME) students also was awarded $15,000 in prize money.


**IGVC Team along with their vehicles**

The Virginia Tech team entered three of the 40 autonomous vehicles that competed in this year's IGVC, which took place in June at the Selfridge Air National Guard Base in Harrison Township, Mich. Thirty-three universities in the U.S. and other countries were represented at the event.

The Virginia Tech students were guided by ME faculty advisers Charles Reinholtz, Alumni Distinguished Professor, and professor Alfred Wicks. Much of the design and construction of the vehicles was directed by graduate students Andrew Bacha of Reston, Va.; Ruel Faruque of Charlottesville, Va.; and Brett Gombar of Montclair, Va.

Three team members graduated from Virginia Tech in May with bachelor's degrees in ME: Ben Amar of Pembroke, N.H.; Randy Depoo of Herndon, Va.; and Ryan Tenga of Fairfax, Va. Graduate student Jon Weekly of Cincinnati, Ohio, and senior Peter King of Alexandria, Va., also participated in the competition.

During the IGVC, autonomous vehicles use on-board computer and navigational technologies to navigate obstacle courses and point-to-point destination courses without human intervention. The entries also are judged on design innovations.

The Virginia Tech team equipped their vehicles — "Chimera," "Gemini" and "Johnny-5" — with computers and navigational sensors, including digital cameras, digital compasses, GPS and scanning laser range finders. The vehicles differ in body construction, power sources, and operational variations that the team implemented in the on-board computer software.

Gemini placed best overall in the 2006 IGVC — repeating its first-place performance from the 2005 competition — and also won the Autonomous Challenge. Johnny-5, which best placed overall in 2004, came in second place overall for 2006 and won the Navigation Challenge. Chimera, a new vehicle built during the past academic year, placed first in the Design Competition.

The Virginia Tech team also won prizes for implementing a new software standard for unmanned systems and for implementing the ability to point to a target at the end of a navigation run.

The IGVC is supported by a number of sponsors, including the Association for Unmanned Vehicle Systems International, U.S. Department of Defense, Society of Automotive Engineers, and General Motors.

# College of Engineering Announces Alliance With Fujitsu and Microsoft

By Lynn Nystrom

A few months back, the College of Engineering announced an industry alliance with Fujitsu Computer Systems Corporation and Microsoft Corp. to support its new Tablet PC computing initiative for incoming freshmen.

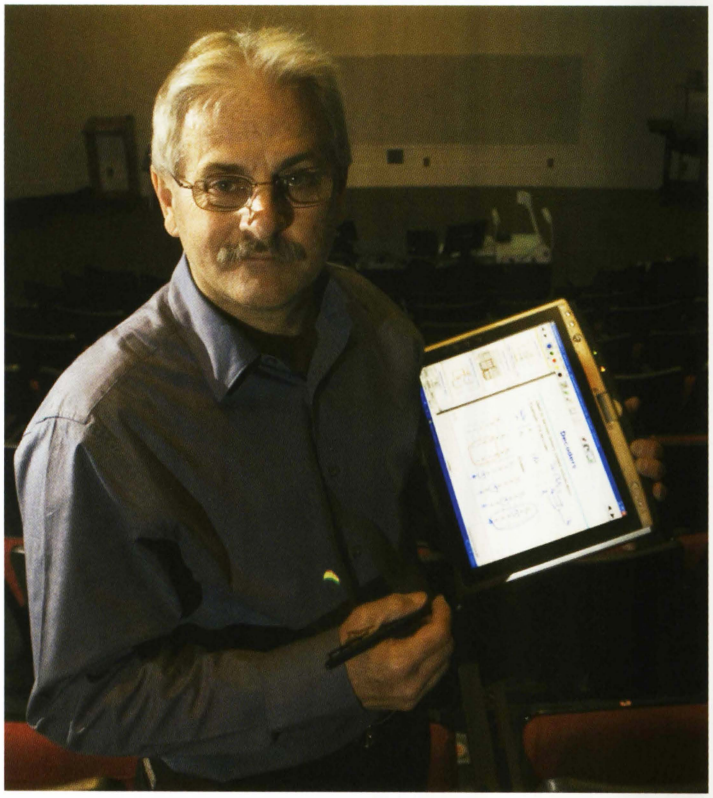
The alliance between Fujitsu, Microsoft, and Virginia Tech will offer engineering students high levels of hardware and software purchasing power and support, and will also provide students, faculty, and staff with training and assistance throughout the development and implementation of new models of teaching and learning.

The Fujitsu LifeBook® T4000 Series convertible Tablet PC combines the convenience and familiarity of a notebook with the powerful and versatile functionality of a slate Tablet PC. In conventional notebook mode, the Tablet PC offers a keyboard for typing. By rotating and folding the screen it transforms into a tablet configuration. Using a stylus, students can make handwritten notes and drawings in a manner comparable to the way in which pen and paper are used. The LifeBook T4000 Series convertible Tablet PC offers a bright 12.1" display with greater than 160° viewing angles. It is the only convertible Tablet PC on the market with a built-in modular bay that supports an optical drive or second battery for those extra long school days.

"We selected the Fujitsu LifeBook T4000 Series convertible Tablet PC based on its reliability and flexibility, as well as the company's ability to support learning experiences in or outside of the classroom," said Glenda Scales, associate dean for computing and distance learning, College of Engineering at Virginia Tech. "In our deliberations, we also balanced price, weight, service, screen size and years of corporate experience with Tablet PCs. While several vendors met our minimum computer requirements and were strong in a particular area, by selecting Fujitsu hardware we were able to meet the majority of our educational requirements for a Tablet PC."

"In the first year engineering courses, students will use their Tablet PC

to literally sketch their designs on their computers instead of using a mouse that links to drop down menus. Additionally, students will create an electronic lab book where they will have the flexibility to include handwritten notes as well as collaborate with each other electronically," said Tom Walker, professor of engineering education (EngE).



**Professor Joe Tront from the department of Electrical & Computer Engineering with a Tablet PC**

Faculty will use applications such as Microsoft Office OneNote, Classroom Presenter, and SketchUp in support of the first year curriculum changes.

Beyond the freshman year, students will use Tablet PCs to actively participate in classroom presentations and exercises by drawing responses to queries and sending them to the instructor for public display and further discussion. "The ability to receive a copy of the instructor's notes, including in-class electronic ink annotations, and to add personal notes gives the student a very powerful tool for both classroom participation and after class study," said Joe Tront, professor of electrical and computer engineering (ECE). For the past two years, Tront has been working with groups of 15 to 20 students who use Tablet PCs in his ECE classes.

This summer, Virginia Tech piloted faculty and student

use of Tablet PCs in coordination with the College of Engineering's student transition program. This National Science Foundation sponsored program provides students an opportunity to become familiar with the Virginia Tech university community prior to the start of their academic career.

"Our goal with this pilot is to help our students see the full capabilities of the machines, and we hope that the Tablet PCs will facilitate the collaborative efforts required of these students through their academic years and beyond," said Jean Kampe, also a member of Virginia Tech's Department of Engineering Education faculty.

Virginia Tech's alliance with Fujitsu and Microsoft enabled Virginia Tech to provide specific training for faculty on the use of the Tablet PC technology in the classroom during the summer months. With Fujitsu and Microsoft's assistance, Virginia Tech's Faculty Development Institute (FDI) worked on developing models by which to train professors and graduate students on the technology and pedagogical techniques of using these new tools specifically in an engineering learning environment. These models can be disseminated to other schools as they implement Tablet PC technology locally.

"We will work with education researchers at Virginia Tech on the use of the Tablet PC in order to investigate the longer term pedagogical implications of using this technology," Scales added. "We have a three-year implementation plan for this initiative. Since the Summer of 2006, we have been working to engage with Engineering Education faculty to develop exciting pedagogical models for their classrooms. We expect to offer this opportunity to additional faculty each summer as they begin to think about new ways Tablet PCs can help them facilitate learning."

With this decision, Virginia Tech becomes the largest and first public college of engineering to require the Tablet PCs for the engineering freshmen. This announcement follows a number of firsts by Virginia Tech's College of Engineering in the area of personal computing.

In 1984, the college was the first public institution in the U.S. to require its entering engineering freshmen to own a personal computer. In 2002, the college moved to a laptop requirement and many of its academic buildings were outfitted to offer wireless communication capabilities.

"With our decision to move to Tablet PCs, our College of Engineering continues to be a leader in technology for engineering education," said Richard Benson, dean of the College of Engineering. "The overall engineering community will benefit from the scientific studies of the effectiveness of this program."

In the most recent (2004) survey of the Engineering Workforce Commission of the American Association of Engineering Societies, Inc., the Virginia Tech College of Engineering ranks eighth nationally for the number of undergraduate degrees awarded. "America's Best Colleges 2006" survey, released by U.S. News & World Report in August 2005, ranks Virginia Tech's College of Engineering's undergraduate program 14th in the nation among all accredited engineering schools that offer doctorates, and eighth at public universities.



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# The art of simplicity

By Divakar Mehta

What exactly is the meaning of this word simple? Oxford University Press defines it as "easily understood or done, plain and uncomplicated in form, nature, or design" along with other definitions pertaining to other scenarios. In recent years, many of us have forgotten about simplicity. Popular culture and media have made it hip and cool to lead complicated lives. This complication has penetrated into every facet of our life ranging from the way we speak to the things we use.

Turn on any radio or television and you will immediately notice the newscasters picking the most pretentious word they can find, so that they can come off as erudite. Similarly, visit any Best Buy or Circuit City around the country and many of the gadgets being sold are as far from "easily understood, plain and uncomplicated" as possible. Let's pick an example: a modern cordless phone vs. an old rotary phone. Many of us have probably never owned a rotary phone, but the phone was composed of a dial and just a few other things that were essential to making (or receiving) phone calls, that's it.

A modern cordless phone on the other hand is covered with buttons from one end to another. When was the last time you used the button labeled "flash" on your phone. I am an engineering student who loves gadgets, yet I do not have a clue as to why that button exists. I am still able to make and get calls, which was the ultimate reason behind buying the phone. So why does all of this matter? Today's designers are more concerned with putting all the latest features into their products, than making sure that their product meets its main purpose.

**A Deeper Look**

Over complication of products can also end up costing designers negatively. The majority of the people around the world already have too many problems to deal with, so a

complicated product is not what they want to add to their daily to-do list. There are numerous examples of extremely simple products becoming great successes. For example, many experts feel that one of the biggest reasons behind the iPod success is its simplicity. The iPod, when compared to other MP3 players manufactured by companies such as Creative or Toshiba falls

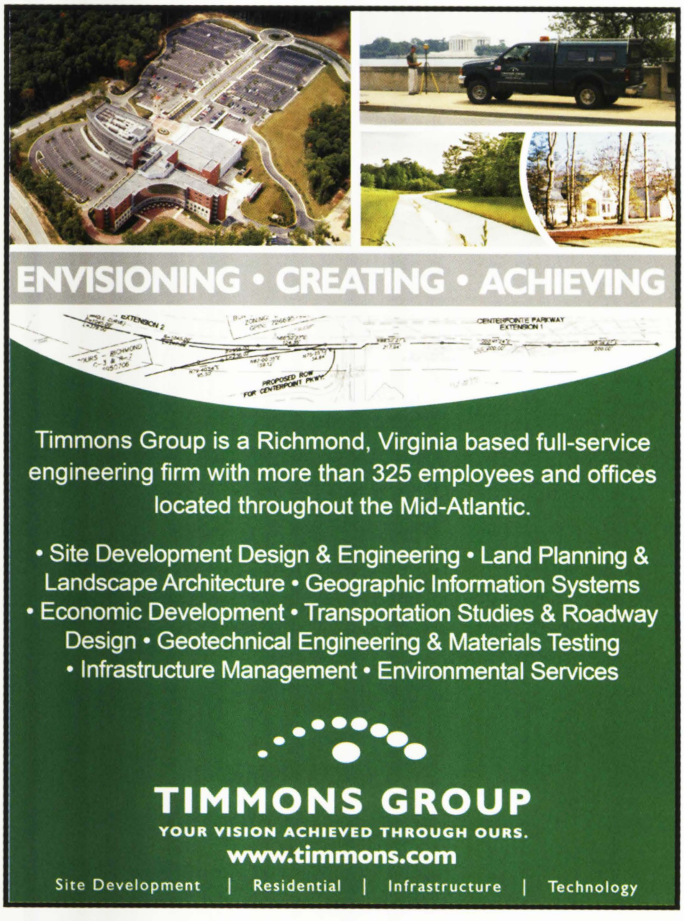

**The Apple iPod™ mp3 player**

short in many features, however, it is still able to outsell the other players, simply because people find the wheel intuitive and can pick the player up and start jamming in a few seconds. Additionally, Apple made it possible for customers to download music with iTunes, a player that is equally simple and easy to use.

Another not so visible example of complication is the change in society. Like it or not, the world has changed. It is not the same as it used to be. Gone are the days when people used to simply sit and talk at the neighboring grocery store. Today, the daily life has become so complicated that most of us cannot fathom standing around and talking for a few minutes.

Grocery stores have become a racetrack with people trying to get in and out as soon as possible. Grocers also feed this fire for speed by coming up with solutions such as self-checkout, which by the way is another gadget thrown in to the mix. As a society, we spend so much time with gadgets that it has started taking over our lives. Stress has become an integral part of every-





body's life. As a society, there is so much stress that problems like insomnia are becoming a disease.

A book published by the United Nations University titled "Women Encounter Technology: Changing Patterns of Employment in the Third World" found that "inputting or manipulating text or data using a visual display unit (VDU) or visual display terminal (VDT)" leads to many problems including insomnia. A VDU or VDT is nothing but a computer with a monitor and keyboard. All the blame can obviously not be placed on complicated devices, but it is a big contributing factor.

The average Joe is so concerned with trivial issues that could be reduced greatly by simplifying lifestyles. The answer designers came up for this problem is multi-tasking. All of a sudden, multi-tasking became trendy and product manufacturers churned out products that could supposedly do everything. A few years ago, printer manufacturers came up with the idea that one machine should fax, copy, scan, and print. The result: a product that was either plagued with constant technical issues or unhappy customers that found the product hard to use. The lesson here again was creation of more problems than results.

Another big issue arising from complicated products is that they can end up costing the planet more than simple products. The amount of wiring and circuitry inside the rotary phone, mentioned earlier, is negligible, when compared to a cordless phone. The chemicals, metals, and plastics used to manufacture such products are not nature friendly. After disposal, many of these products cannot be composted and are therefore land filled and the rate at which the world population is growing, this will become a big problem very soon.

**The Path Towards a Solution**

There are companies around the world that do believe in simplicity of design. Bose is a company that has been long known for manufacturing well-researched sound solutions. At the same time, the company is known for its simplicity in design and packaging. Rather than packing their products in the most appealing boxes with product manuals that look more like a marketing campaign, they usually come in simple boxes with austere product manuals.

Headphones that cost a few hundred dollars come packed in a box that is as simple as a box could be. Does this mean that they lose business?

No! They are promising only one thing when you buy their products: better sound. The problem therefore is that many designers are unable to answer the reason behind their design. The frills needed to sell the product outweigh the performance of the product.

Virginia Tech (VT), a renowned engineering school is known to have produced many respectable engineers, however, I believe that the subject of simplicity could use more focus at VT and all other schools around the world. Before beginning the design of any product, the first question the designer should ask himself/herself is: What will this product do? Once this question has been answered, the next step should be to solely design the product to achieve that function.

After thorough testing and confirmation that the product achieves its goal, the designers can start including other features that will add to the functionality and make the product better. Hopefully we will not end up as a society that has lost its human touch due to over complication.

Anything in excess is not beneficial. Many problems facing modern society can be dealt with effectively by simplifying. There is no reason to be accessible all the time. Try leaving your cell phones at home, the next time you arrive at a dinner table to dine with your family or friends and see how fulfilling the conversation will be without a phone ringing every few minutes.

# Virginia Tech Engineering Students Catch Top Prizes at ASME Competition

By Liz Crumbley

The Virginia Tech chapter of the American Society of Mechanical Engineers (ASME) carried away several top awards--including one for the design of a fishing apparatus for a quadriplegic--during the recent District F student conference hosted by the University of Tennessee.

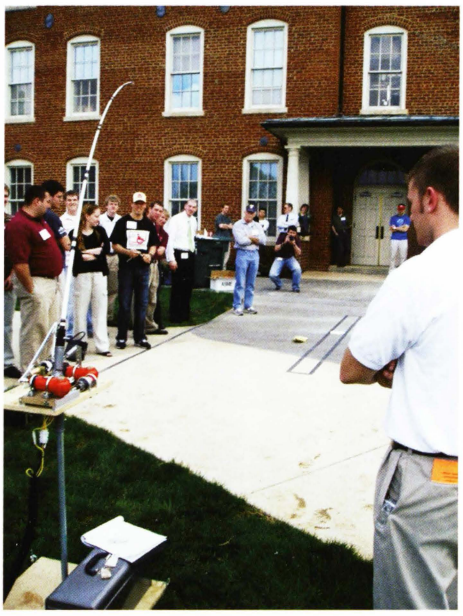
The Virginia Tech undergraduate mechanical engineering (ME) students, under the guidance of their long-time faculty adviser Charles Reinholtz, an Alumni Distinguished Professor of ME, won first place in seven out of the eight competitions held during the conference.

The Virginia Tech chapter placed first in the Student Design Competition with "Hokie Hooker," their version of a cost-effective, reliable apparatus that would enable a quadriplegic to cast a fishing lure accurately, retrieve it, make additional casts, and reel in a weight simulating a fish on at least one cast.

For winning the design competition, the Virginia Tech chapter received $200 and another $1,000 in travel funds for the national ASME competition in Chicago in November.

Several individual Virginia Tech ME students also won awards during the District F Conference. Tiffany Murray, a senior from Norfolk, Va., won first place in the Technical Web Page Competition.

In a series of "Old Guard" competitions, which are sponsored by retired ASME members who continue to support student activities, Ramtin Taheri, a senior from Virginia Beach, Va., placed first in the Technical Content Competition; Amanda Thomas, the chapter's chair for the year and a senior from Vienna, Va., placed first in the Technical Poster Competition; and Taheri placed second and Greg Vonder Reith, a senior from Fredericksburg, Va., placed fourth, in the Oral Presentation Competition.



**The fishing pole from the ASME competition in action**

The Virginia Tech chapter also placed first in the Ingersoll-Rand Contest, which recognizes the most active student chapter in the district for the academic year. "In the five years that this award has been presented, our chapter has finished first three times and second twice," Reinholtz said. "This should again put us in good position to compete for the title of the most active student ASME section in the world."

In addition, the Virginia Tech chapter won the Student Kilometer Award, for bringing the most participants the longest distance, and the Students in Attendance Award for having the largest number of students at the conference.

"I want to convey a special thanks to our chair, Amanda Thomas, for leading the student section to another banner year," Reinholtz said.

ASME District F includes engineering schools from Alabama, Delaware, District of Columbia, Florida, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee and Virginia.

# Engineering Students Win Challenge X Competition with Ethanol-Powered SUV

By Liz Crumbley

With a Chevrolet Equinox SUV they re-engineered into an ethanol-powered hybrid, the Virginia Tech Hybrid Electric Vehicle Team (HEVT) took top honors during the second-year competition of Challenge X: Crossover to Sustainable Mobility, held at the General Motors (GM) Mesa Desert Proving Grounds in Arizona.

The HEVT is among 17 university teams selected by the U.S. Department of Energy (DOE) and GM to compete in the three-year Challenge X, a national competition that encourages engineering students to help develop advanced propulsion technology for the next generation of energy-efficient, low-emissions vehicles.

In addition to placing best overall, the Virginia Tech team won in three categories, reported mechanical engineering graduate student Steven Boyd, HEVT's leader. "We took first place in best written technical report, lowest emissions, and lowest petroleum consumption," Boyd said. "We achieved a 75 percent petroleum reduction from the standard Equinox consumption."

The HEVT engineering students, most of them undergraduates, modified the Equinox using a Saab 2-liter E85 engine that runs on 85 percent ethanol and 15 percent gasoline. The team integrated the Saab engine into the Equinox with a split parallel hybrid electric drive.

"With the E85 engine and two battery-powered electric motors, we can use either to turn the wheels — or we can use them together," said Doug Nelson, HEVT faculty adviser and professor of mechanical engineering at Virginia Tech. "The motors also can be used as a generator to absorb energy from the engine and recharge the batteries."

Ethanol is a renewable fuel typically distilled from corn. In addition to achieving the goal of reducing petroleum consumption, the E85 fuel mixture produces fewer overall greenhouse gas emissions.

"It helps to have the 15 percent gasoline in the fuel for cold starts," Nelson added. "From the beginning of the competition, our goal has been to reduce the petroleum

consumption of the Equinox by as much as 80 percent."

"Developing the advanced technologies that reduce U.S. dependence on imported oil is critical to the future prosperity of our country," said Ed Wall, program manager for the FreedomCAR and Vehicle Technologies Office of DOE's Office of Energy Efficiency and Renewable Energy.

To succeed in Challenge X, the Virginia Tech team had to produce a fuel-efficient, low-emissions Equinox that also retains all of its original performance and utility factors, such as fully operating air conditioning, cargo space and acceleration performance.

"Designs like our Equinox hybrid demonstrate that alternative fuels and advanced propulsion technologies can increase fuel economy and reduce emissions without sacrificing vehicle performance or utility," Boyd said.

During this second year of the competition, the vehicles re-engineered by the HEVT and other teams were judged on design, fuel economy, performance and a number of other factors. After this event, the teams will have another year to refine their entries for the final competition event and judging in June 2007.


**The HEVT Team in Mesa Arizona**

The HEVT members are students from the departments of mechanical engineering, electrical and computer engineering, and computer science in the College of Engineering.

"These students are working on the same challenges that our GM engineers continually work on every day — high-efficiency, high performance vehicles that consume less fuel and produce fewer emissions from the well to the wheel," said Dan Hancock, vice president of GM Powertrain Engineering. "This hands-on learning is providing them the necessary skills to embark on a career in engineering with a competitive advantage."

DOE and GM gave each team chosen to participate in Challenge X an Equinox and $10,000 seed money, as well as up to $25,000 in automotive parts.

The other teams competing in Challenge X are from Michigan Technological University, Mississippi State University, Pennsylvania State University, Rose-Hulman Institute of Technology, San Diego State University, Texas Tech University, Ohio State University, University of Akron, University of California-Davis, University of Michigan, University of Tennessee, University of Texas at Austin, University of Tulsa, University of Waterloo, University of Wisconsin-Madison, and West Virginia University.

# A Brief Look into Mobile Phone Technology

By Kari Adkins

Have you ever wondered how that little cellular phone in your pocket or purse actually works? How does that phone place a call without any wiring to someone across the country or on the other side of the world without a moment's hesitation? Most of us take our cell phones for granted, never questioning how the device works or the years of research and development that went into one of the fastest growing technologies in the world.

A cellular phone by definition is "a mobile radiotelephone…that uses a network of short-range transmitters located in overlapping cells throughout a region, with a central station making connections to regular telephone lines." What makes a cell phone work is its ability to use radio frequencies to transmit sound across great distances to cellular base stations and then on to the receiving end of the call.

The technology that is used in the modern cell phone can be traced back to the 1950s with the development of two way radios for emergency services. A two way radio essentially works like this: one person pushes the transmit button on his or her device and talks to the person on the other end, ending his statement with the phrase "over" to signify that he is done speaking. Then the person on the other end of the two way radio can talk back to the other person.

Essentially a two way radio allows for one person to transmit sound data while the other person waits for the channel to open up once the first person finishes speaking. This is called a half-duplex radio.

In contrast, a cell phone is a full-duplex device, meaning that both parties on the call can speak at the same time. This is due to the fact that the two phones are operating on different channels instead of the same channel as seen in two way radios that have been used for over forty years in the United States.

What we today would call a modern cell phone was first developed for commercial use in the 1980s. Across Europe and the United States in this time period many dif-

ferent cell phone technologies were developed to meet the ever-growing desire of the public to have mobile phones. In Europe the Global System for Mobile Communications (GSM) network was developed by the European Union to be a unified system enabling users to go from country to country without having to purchase another mobile phone while in that country.

This is made possible through a series of towers that all operate on the same band of frequencies, thus eliminating one of the common problems that would be faced if each country developed a different network. Today there are four different bands that cell phones operate on: in Europe the phones either operate on the 900 or 1800 band; in the United States, Canada, and South America the phones operate on either the 850 or 1900 band. Many of today's phones are quad-band phones, making them able to connect to calls all over the world, whether their phone was purchased in the United States or Europe.

Another attribute of the GSM network that makes cell phones what we know them to be today is the Subscriber Identity Module (SIM) card. A SIM card stores information about the user of a cell phone and their personal data such as phone numbers and the country of origin for the phone. The development of these two technologies paved the way for a common cell phone system across Europe.

In the United States we also use the GSM network. There is also another network that is used as well: the Code Division Multiple Access (CDMA) network. CDMA is a network that has been developed primarily in the United States. The only downside to this network is that the phones do not utilize SIM cards, as mentioned above. This complicates the process of purchasing a new phone or visiting a foreign country and having to buy a new phone while visiting that country because the country uses a different band as compared to the United States.

**The devices that make it possible**

Now that the method of transmission has been established, one can look at the evolution of the cell phone into the modern small phones that we are all familiar with today.

The first mobile handheld phone was the Motorola DynaTAC 8000X, which was rather large and cumbersome, but truly revolutionary for the time. At this time all phones were installed in cars and ran on an analog signal.

As car phones became more popular developers were trying to figure out ways to "cut the cord" and make the phone truly wireless and capable of being carried anywhere with relative ease. Cell phones began to diminish in size with the development of power amplifiers and transceivers that could provide the amount of power needed to make a cell phone function in an even smaller package. Without these power amplifiers a cell phone like we use today would not work because the small battery would not provide enough power. The development of these chips paved the way for the cell phone as we know it today.

The size of the cell phone decreased exponentially after the development and marketing of power amplifiers to industry leaders, including


**The Motorola ROKR™**

Nokia and Motorola, today's number one and two, respectively, in the cell phone industry. Phones today are lightweight and hold a decent charge. Most phones provide hours of talk time and can last for a few days on standby, before needing a re-charge. These phones have color screens, cameras, GPS tracking systems, internet and instant messaging access, and even the ability to download songs and data without being connected to a computer or on a wireless LAN.

The newest phones can also play MP3's and industry leaders are working on combining devices such as the popular Apple Ipod with a phone, as seen with the Motorola Rokr phone which was released this year. Many phones are Bluetooth technology ready, enabling consumers to connect their phones with their computers and synchronize their calendars and pictures with their phones with a simple click of a button.

The future will only tell what new technologies will be incorporated

into cell phones as consumers desire phones to be combinations of many different devices. How cool would it be able to have everything in one device: a PDA, iPod, cell phone, and internet access in one device? It is a little over the top admittedly but it is a dream that is becoming a reality with every passing day.

Cell phone technology changes on a daily basis, caused by the influx of so many different designs of phones by the many different manufacturers in the industry. Who knows what the future will bring as it relates to cell phones and our interactions with these devices. One thing is certain: as long as there is a market, the phones will get smaller and combine multiple technologies so that consumers can "get the most bang for their buck" with their new piece of technology.

So, the next time that you pull out your cell phone to make a call, just remember that the call you are making is the result of many years of research and development around the world that has changed the way the world and its citizens interact with a simple click of the talk button.

# Chris Kraft to Present Moon Rock to Virginia Tech's Engineering College

Staff Writer

The man who led the U.S. mission to the Moon in the 1960s will be honored at Virginia Tech Sept. 30 by the National Aeronautics and Space Administration (NASA) for his direction of America's space program. Dr. Christopher C. Kraft, Jr., a 1944 aerospace engineering graduate of Virginia Tech, will receive NASA's Ambassador of Exploration Award.

Michael L. Coats, director of NASA's Johnson Space Center, will present the award to Kraft in front of more than 100 of his prominent fellow alumni of Virginia Tech's College of Engineering. In turn, Kraft will present the award — a small sample of lunar material encased in Lucite and mounted for public display — to Richard Benson, dean of engineering, for permanent display in the college.

The moon rock to be awarded to Kraft is part of the 842 pounds of samples brought back to Earth during the six Apollo lunar expeditions from 1969 to 1972.

The ceremony will begin at 10:30 a.m. at The Inn at Virginia Tech. Because of limited seating, admission will be by invitation only.

"We are deeply honored by Dr. Kraft's decision to present his award to Virginia Tech's College of Engineering for permanent display," said Benson. "There is a generation of engineers, of which I am a part, which came of age during the Mercury, Gemini and Apollo space missions. Dr. Kraft was the face of those missions – engineering at its daring best. Dr. Kraft's extraordinary contributions to NASA are just the measurable part of his legacy. How many of those inspired teenagers in the 1960's went on to successful careers in aeronautics, microelectronics, medical devices, computer science, engineering education, and more? We'll never know the whole of his legacy, but we can safely say that few Americans have ever done so much to advance the engineering and scientific prowess of this great nation."

NASA also is presenting the Ambassador of Exploration Award, in ceremonies elsewhere, to the 38 astronauts and other key individuals who

participated in the Mercury, Gemini and Apollo space programs, for realizing America's vision of space exploration from 1961 to 1972.

Kraft's career is indeed phenomenal. As NASA's director of flight operations in the 1960s, he was instrumental in the decision to land an astronaut on the moon. It was 1961 and the Russians had just sent Yuri Gagarin into space. Several weeks later U.S. astronaut Alan Shepard completed a successful mission, spending 15 minutes in a suborbital flight directed by Kraft. Following that flight, President Kennedy challenged the country to land a man on the moon within the decade and return him safely to earth.

Kraft recalled this challenge, saying "With all due respect to the memory of John F. Kennedy, I must tell you that I thought the man had taken leave of his senses. We had never even placed a man in orbit. And yet, here in front of television cameras beaming his message all over the world was the President of the United States committing us to a lunar landing."

Despite his reservations at the time, Kraft says NASA succeeded with the moon landing because of the "national commitment to the cause. We had financial problems. We had people problems, and we had horrible experiences to deal with…But the great majority of the public, the Congress, and the presidential administration we had during that time period were very supportive of the goals we had set."

After Neil Armstrong set foot on the moon, Kraft went on to lead the planning and operational control of the two sub-orbital Mercury missions through Gemini, Apollo, Skylab, and the Apollo Soyuz/test project.

He was deeply involved in the development of the Space Shuttle. During its definition and design studies, he played a vital role in the decision-making process that created the Space Shuttle program, and he determined the initial configuration of the Space Shuttle system, a new concept in space transportation. Kraft was the director of NASA's Lyndon B. Johnson Space Center in Houston, Texas from January 1972 to August 1982.

**Dr. Christopher C. Kraft**

A native Virginian, he was born in Phoebus in 1924, two years prior to the launching of the first liquid-fueled rocket by the American physicist Robert Goddard. The influence of high school teachers led him to his choice of engineering as a profession, and he selected Virginia Tech. Graduating in 1944 with a bachelor's degree in aeronautical engineering, he immediately joined the Langley Aeronautical Laboratory of the National Advisory Committee for Aeronautics (NACA), the precursor of NASA.

In October 1958, Dr. Kraft was selected as one of the original members of the Space Task Group, the organization established to manage the Project Mercury. The group developed the basic concepts of the Mercury Project that launched the human space flight program for the United States. He personally served as the flight director for all of the Mercury missions and many of the Gemini missions.

Dr. Kraft retired from NASA in1982. In a tribute to his career at the time, the Roanoke Times editorialized that Dr. Kraft "… probably instilled more confidence in our space program than any slick campaign could have done, because of his knowledge and ability to impart it. He knew more about all of the systems aboard our spacecraft than anyone else, and was in the unenviable position of making quick, life and death decision about the flights. He was the ultimate technical generalist. Even his name seemed perfect for the job."

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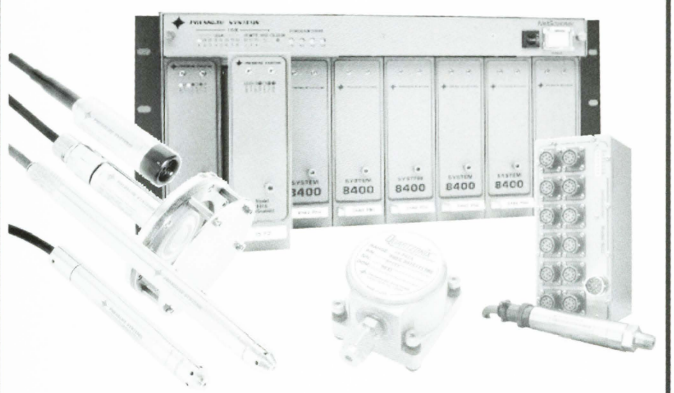

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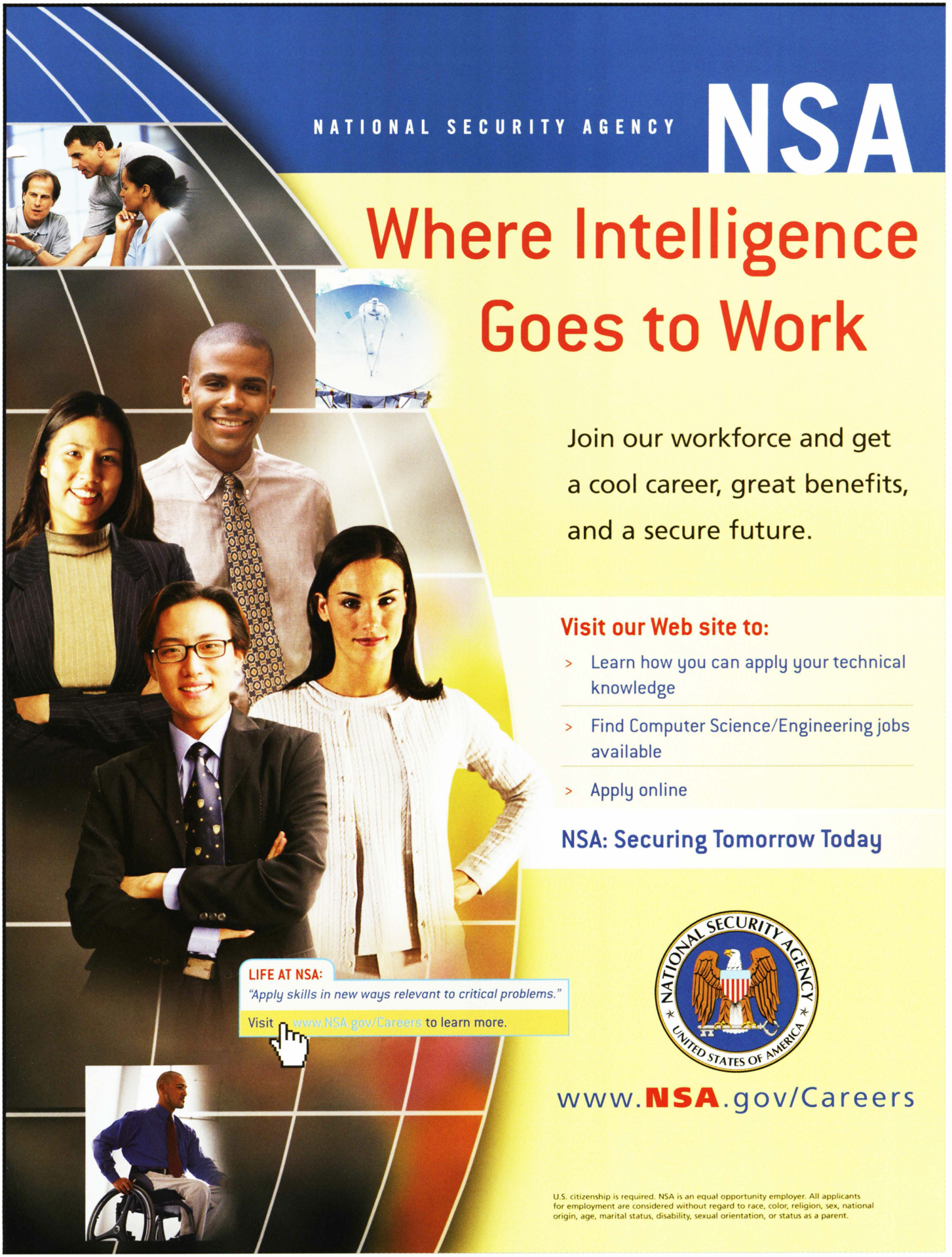
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