

# Engineers' Forum



April/ May 2013 | Volume 34 | Number 3

## Letter from the Editor

Hokies!

Thank you for your continued support. Engineers' Forum has been a big success this past year, chiefly because of increased readership, more website hits and more likes on our Facebook page. Basically, because of readers like you.

In this April issue, our final issue for the academic year 2012-13, we have continued with our previous ideas of a point of view article, two retrospective articles, and three photo essays. Andrew Mussey, a graduating senior has written an article that talks in retrospect about the technologies displayed at the CES. He has also authored a photo essay about the CES 2013. Have a look!

Robel has written a point of view article asking the readers whether online voting is a good idea or not. It is an interesting read and I am sure you will enjoy it. There are two additional photo essays that have been authored by Eileen and Sofia. They both talk about design and manufacturing laboratories in the college of engineering. I am sure you will gain some valuable insight!

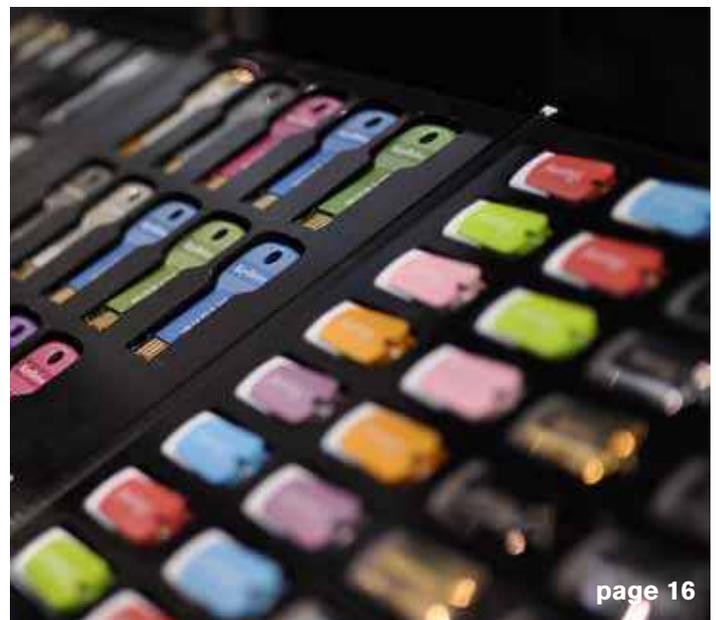
SEC has continued to develop exciting plans for the engineering students. Interested in reading what they are? Turn to Ryan's article.

For the engineering students who always wanted to know the history behind the electrical engineering revolution, Kanika has written a pretty awesome piece about how we evolved from vacuum tubes to microchips. Lastly, read about a lesser-known (but very cool) project, a human-powered submarine, authored by Dennis.

Our membership is growing but we are always looking for new writers and photographers. Please visit our website and also visit our Facebook and Twitter pages.



Sumedha



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# Point of View: Should We Use Online Voting?

Written by Robel Fasil, a sophomore in Industrial and Systems Engineering

Did you vote this past election? You might have had to travel out to the airport or a nearby elementary school, or even miss class. Wouldn't it be much easier if we could just vote from our computers? No waiting in line, and the whole process wouldn't take more than a few seconds. In the recent 2012 election, electronic voting was used for soldiers overseas and in certain states. However, the biggest reason online voting is used all over the country is the lack of security. While there are obvious benefits of voting online in the United States, there are some strong arguments against voting online. Online voting is a new service, so all the bugs haven't been worked out yet. The program that conducts the voting could be vulnerable to hacks. In 2010, Washington, D.C. released an internet voting pilot project to be used for overseas voting, starting with an open invitation for the public to test the prototype's security. Within 36 hours of the release, one professor and a few students of the University of Michigan were able to hack the system. They gained the ability to view people's votes, change their votes and even have their school's fight song play on the confirmation page of the online voting program. In addition to security concerns, voters may not take online voting as serious as they would if they took the time out to go out and vote in person.

While it would be much easier to vote online, I feel that online voting should not have been used in the fall 2012 election and shouldn't be used in the near future. I feel that online voting right now has a much greater risk than traditional voting methods. It is important to keep votes as accurate as possible and even the slightest vulnerability in the code of the online voting program could make a huge negative impact on the United States. I do realize there will be risks in either method of voting but I feel like the traditional voting system is far safer. Perhaps in the future as computer security and technology advances, online voting might be the better decision, but at this moment in time, I feel we should refrain from online voting.



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# Point Of View : Early Release Dates Only Hurt The Consumer

Written by Jordan Sablan, a sophomore in Computer Science

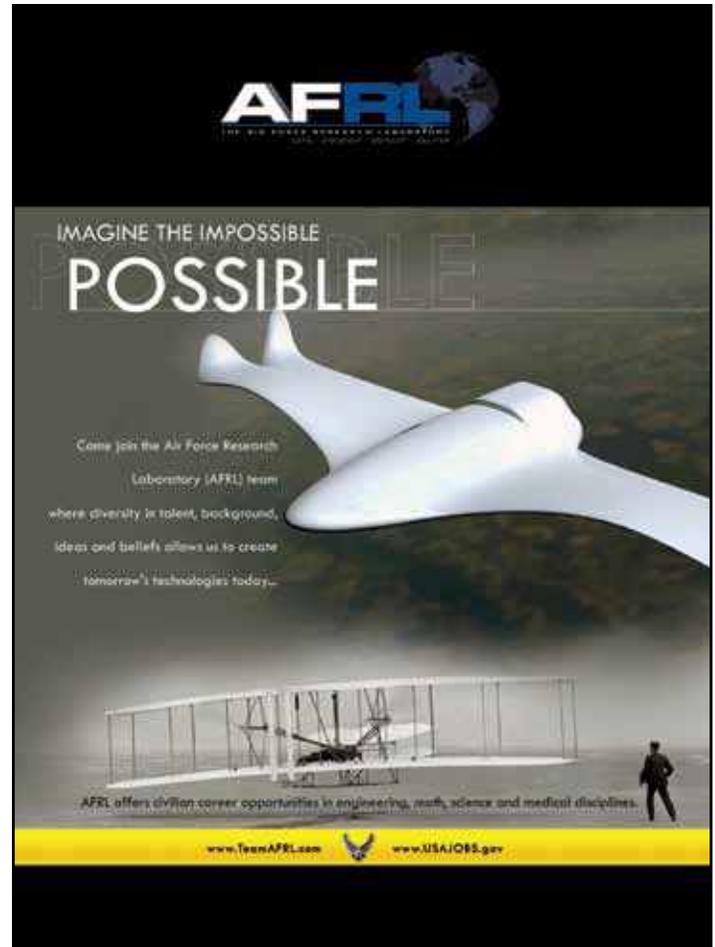
In November, 2001, Microsoft made its initial foray into the console world with the original Xbox. Shortly after the release, they decided to get a jump on the competition and release their next-generation console as early as possible. After a short four years, the Xbox 360 made its debut in North America. While the Xbox 360 certainly had its flaws, this tactic seemed to work, and Microsoft sold 11,600,000 units by the end of June 20.[1] Even though the PS3 had comparable first year sales, Microsoft had an extra year in the market, giving it time to attract developers and build hype for its system, despite its hardware failures. Currently, the Xbox 360 still has a 2.7 million unit edge over the Playstation 3.[2] It comes as no surprise that Sony seeks to turn the tables in the next generation, and their new system (code named "Orbis") ought to be released before Microsoft's new system.[3]

How will this affect the consumer? In my opinion, it means we can expect to pay more for less. The rushed production of the 360 resulted in a product with an almost 60% failure rate.[4] The consoles are waging a war for popularity, rather than quality. While the Wii may be the dominant console with 95.4 million units, the 360 and PS3 are fighting hard to win the number two spot. Early release dates mean an easy advantage for companies, but distress for consumers. The pressure to push out content as fast as possible will only result in a lower quality product. It's tough to justify spending up to \$500 for a console and \$60 per game for a system that is likely to crash. This problem does not only apply to hardware, either. Video game developers think in the same way. The rush of a game release means a poorer quality game for the consumer. The Call of Duty franchise is a perfect example of quantity over quality in the video game industry, systematically releasing a game every year for the past six years.[5] The games have begun to focus more on the multiplayer experience than the single player, resulting in single player campaigns that last as little as five hours for some players.[5] The parent company recently unveiled Call of Duty Elite, a subscription service that offers downloadable content, strategy guides, year-round competition, "and much more"[6] all for a nominal yearly charge of \$49.99.

I have always been of the opinion that almost all downloadable content should be included in the original game. This new service perfectly illustrates the worst concepts of early releases. Games are pushed out into the world in a semi-finished state with the idea that all they need is a patch or two to bring it to completion. Not only that, but that users are expected to pay extra for content that should be included from the start. As gamers, we have a responsibility to ourselves to voice our opinions (or maybe they're just my opinions). "As

gamers, what makes our medium great is interactivity. Video-game developers should be as open to input as the games they develop. It's important to voice our opinion, and respond accordingly to drastic changes by developers."

If you folks are just as tired of this treatment as I am, there can be only one course of action. Stop buying the content they push out. Wait for the games that earn your dollar. Buy a console that lasts; do not invest a cheaply-made hurriedly-released console. As for downloadable content, make it worth the time. I will never understand why I should pay ten to fifteen dollars for three extra maps to play. Three maps are hardly worth 1/4 of the entire game I just bought, and if they're so critical, why were they not included to begin with? It all boils down to quality over quantity. What would you rather see released in the next year, a fresh new game on par with The Elder Scrolls V: Skyrim, or another seventy Cooking Mamas?



# Club Spotlight: Student Engineer's Council

Written by Ryan Martin, a freshman in Life Sciences



Virginia Tech is well known for its 600+ student clubs and organizations that enable every student to become involved and make a difference on campus. One of these organizations is the Student Engineers' Council, better known as the SEC. John Lohr, president of the SEC, says that the group is completely student run and based around the goal of bridging the gap between the college of engineering and the students that it embodies. The SEC accomplishes this goal through acting as a communicator; when the students need something, the SEC relays that information to the college and vice versa. One of the biggest events that SEC organizes and administers is the annual Engineering Expo, held in early fall. The expo brings in around 250 employers seeking both graduates and current students of Virginia Tech's college of engineering.

Using the money generated by the registration fees of the expo, the SEC sponsors over 20 design teams in the

engineering department. At a recent meeting, the SEC gave out several thousand dollars to those who sought monetary support for various competitions, one of which involved human-powered flight. The group also sponsors two scholarships for members as well as putting on E-Week (March 25-29), a week-long celebration of engineering as a whole, which hosts various speakers and activities where students can learn about the design teams and get inspired to join in. For students who wish to become involved, Lohr says they should "do it early" and come to the bi-weekly meetings in order to talk with the design teams who are constantly seeking members. The SEC's philanthropy supports all students in the college of engineering and is not exclusive to its members, as seen in its sponsorship of the Signature Engineering building whose completion is expected in the fall of 2013.

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Paul Flatley  
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The advertisement features a large background image of a steel truss bridge under construction. In the top left corner, the website URL 'www.americaninfrastructure.com' is displayed in yellow. On the right side, there is a small inset photo of Paul Flatley, a man wearing a white hard hat, sunglasses, and a high-visibility orange safety vest. Below the photo is a quote in white text: "Nothing feels better than knowing you've built something of significance, something people will need and use every day." Underneath the quote is the name 'Paul Flatley' and 'Virginia Tech, Class of 2002'. At the bottom left, there is a list of services: 'Site Development', 'Heavy/Highway', 'Water/Wastewater', and 'Construction Materials'. At the bottom center, the 'American Infrastructure' logo is shown, consisting of a stylized 'A' icon and the company name. At the bottom right, the locations 'PHILADELPHIA • BALTIMORE • WASHINGTON, D.C. • RICHMOND' are listed.

# Creativity And Promiscuity

Written by Jordan Sablan, a sophomore in Computer Science

The advent of the information age has brought humongous changes to societal, legal, and ethical issues. The internet is responsible for new communication standards, mediums, and ideas. The information age is a monolith chugging on, rapidly acquiring every last bit of knowledge in the world. In many ways, this is a good thing. Facts, instructions, and educational material all can be found with just a click. However, all this good has to come with some bad, particularly in regard to the creative liberty of artists.

This past week I watched a TED series lecture on copyright. While I had seen much of the content before, there were incredible bits of information provided that were new to me. The lecture focused on how using other protected works to create a new idea is not criminal, but a natural act, one that has already occurred in history many times over. A thought occurs to me, "how much of the internet is true creativity?"

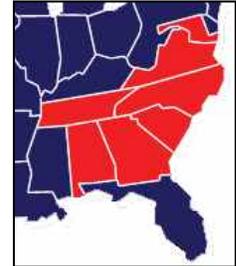
On the other side of that, how much of the internet is promiscuity? According to the authors of *A Billion Wicked Thoughts* the most visited site on the internet is LiveJasmin.com, with about 2.5% of all internet users.[2] It is no surprise then, that many find the internet dangerous given the access to pornography, predators, even an illegal drug market.[1] Despite this, the majority of users spend their time on the internet sending or reading email, and searching for information.[3]

The internet diverges into two fundamental spaces. One space focuses on factual, traditionally educational purposes and stores scholarly information. The other is a menagerie of business, self-interest and the random mumblings of whatever comes to mind. Coming back to copyright, with the knowledge available and the ability to access, can copyright survive or even better function in the future? The internet is a machine capable of great accomplishments, but an institution like copyright will fight that at all turns (at least in its current form). Certainly a hot new single from Lady Gaga may not be traditionally educational, but as the crime aspect of the internet grows, and the copyright legislature grows with it, how long before the knowledge becomes blocked or is forced underground? Government bills like SOPA and PIPA set the framework for this. SOPA (had it passed) would have granted the government the ability to block user access to sites that encourage or help copyright infringement. This tactic might sound familiar; China employs a firewall to block users from accessing "questionable" websites. Of course SOPA focuses on copyright violators, but the law has a generality that allows it to apply to variety of situations. Knowing all this, can creativity flourish? I believe so. Despite the many dangers and illegitimate uses of the internet, it still at its core remains a massive knowledge space. I am confident that the future will bring more positive improvements.



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# From Vacuum Tube to the Microchip: a Brief History of Electronics Evolution!

*Written by Kanika Saini, a graduate in Electrical Engineering*

Imagine a life without the mobile phone, computer, or television. How handicapped would you feel without those devices? Let's go back to a time hundred years ago. It was a time when the modes of travel were not too frequent and electricity was only in the major cities. Thanks to the advancement in technology since then, that the world has become a smaller place. You can text or call or video conference anywhere in the world in matter of seconds. Have you ever wondered from where all this began? The journey from a hundred years ago to today was anything but smooth. This article will take you through the amazing world of discovery and provide insight to the various milestones on the road of progress.

Microelectronic chips have grown in capacity from a single transistor per chip to hundreds of millions of transistors per chip on present day microprocessors and memory devices. A transistor is a three terminal solid-state device that controls electric current or voltage between two terminals by supplying voltage at the third terminal. A transistor is essentially made of a semiconductor material. Most materials fall into two categories i.e. conductors (which conduct electricity) and insulators (which do not conduct electricity). But there is a third type of material also known as semiconductor (whose conductivity can be modified easily i.e. by shining light or injecting charges). These are generally non-conducting, but can conduct electricity as required. Examples include germanium, arsenic, silicon, indium, and others.

While semiconductor technology came into popularity in the 1980s, the idea was discovered in the 1920s, but lacked the facilities necessary to develop it. Before the semiconductors era, vacuum tubes governed the electronic devices.

Created in 1904 by the British scientist John Ambrose Fleming, vacuum tubes were similar to light bulbs in appearance, and they ruled the electronics industry from 1930s to 1950s. Essentially, it consists of a glass tube that surrounds a vacuum (an area from which all gas has been removed). When the electrical contacts were put at the ends, current flowed in the vacuum. Vacuum tubes were bulky and also consumed a lot of power, and they had a tendency to burn out and generate a lot of heat.

The world's first computer was ENIAC (Electronic Numerical Integrator and Computer). It came in the year 1946 and contained 17,468 vacuum tubes. It weighed more than 30 tons. It was roughly by 8 by 3 by 100 feet and consumed 150 KW of power. It cost almost \$500,000, and required six full-time technicians to keep it running. You may be surprised if you compare it with your desktop, which occupies the area of your desk and your laptop, which fits in your lap both of which are

far more efficient than the ENIAC and consume about .01% of the power the ENIAC required.

After ENIAC, the first point contact transistor was invented by the pioneers William Shockley, Walter Brattian and John Bardeen at Bell Labs in December, 1947. The transistor originally used germanium as a semiconductor, which was later replaced with silicon. This invention revolutionized the whole electronic industry, as it could do what vacuum tubes could do, but faster, while also being lighter and portable. Then in 1958, Jack Kilby and Robert Noyce developed the Integrated Circuit (IC). In an IC, all the components that make up an electronic circuit are fabricated on a single piece of silicon semiconductor material. An IC processes all the information on the computer. A decade later in 1968, Noyce founded the semiconductor production company with Gordon Moore. These days, IC can be found in devices such as cars, cell phones, washing machines, automobiles, television, and more. Before the advent of IC, the electrical engineers had to construct circuits by hand, soldering each component in place and connecting them with metal wires. This was tedious and inconvenient, since the number of components used in electric circuits was enormous.

In the year 1970, Intel released its first microprocessor, the Intel 4004, which contained 2200 transistors on a chip. This was capable of performing arithmetic calculations and was used primarily in calculators. The integrated circuit has come a long way since first microprocessor. In 1965, a few years before the founding of Intel, Moore made an observation that the number of transistors on a chip doubles every 18 months. This observation, commonly referred to as "Moore's Law" has continued for the past four decades. Chip technology has advanced from the first processor with 2,200 transistors to 134,000 transistors in 1982, to 5.5 million transistors in the Intel Pentium 1995 and 5.1 billion transistors in 2012 in the Intel I-core. Now, if you hold a modern-day chip in your hand, you will not be able to see the components individually, as the size of these transistors is around 22 nm, that is 0.000022 millimeters. After 1978, an era of VLSI (Very Large Scale Integration) started. VLSI refers to integrating or putting together thousands of components on a chip and is continuing to make our lives easy.

Each year computer chips become more powerful yet cheaper than the year before. Gordon Moore once said, "If the auto industry advanced as rapidly as the semiconductor industry, a Rolls Royce would get a half a million miles per gallon, and it would be cheaper to throw it away than to park it."

intel.

# Moore's Law Timeline

(mórz lð) (n.) The observation made in 1985 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future.

1,000,000,000 transistors

100,000,000 transistors

10,000,000 transistors

1,000,000 transistors

100,000 transistors

10,000 transistors

1,000 transistors

30 transistors

1958: Jack Kilby and Intel co-founder, Robert Noyce, Co-invent the integrated circuit

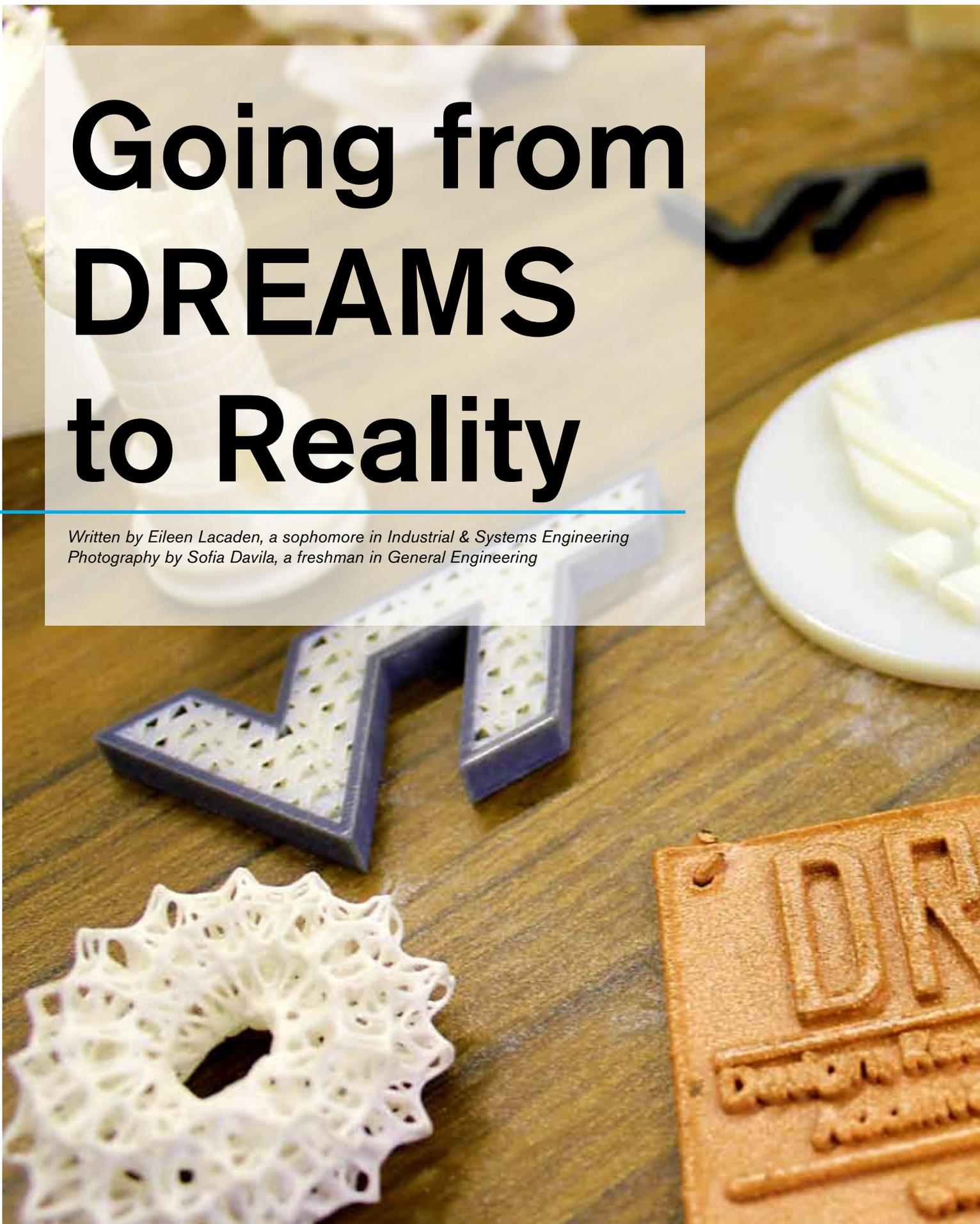


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# Going from DREAMS to Reality

*Written by Eileen Lacaden, a sophomore in Industrial & Systems Engineering  
Photography by Sofia Davila, a freshman in General Engineering*





The Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory, located in Virginia Tech's Randolph Hall, is home to a number of 3D printing technologies. This lab focuses its research on product design, process and materials, and education. Examples of ongoing research in this lab include optimization of customized helmets, using additive manufacturing to create tissue scaffolds (materials to be used in the human body), and nanocomposite 3D printing (a way to 3D print with multiple materials in a single build). Each of these machines has the same basic process: a specific material is chosen for the product, then the machine begins forming the computer-based model from the bottom up, one very thin layer at a time. Imagine having to create a replica of the human skull without a mold. Or build a prototype of a helicopter with every internal and external detail shown. These tasks have been done in the DREAMS Lab with the help of additive manufacturing technologies.

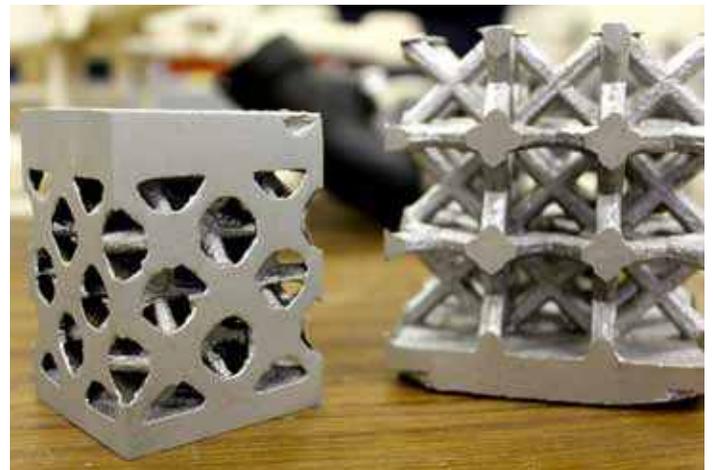
Story Continued on Next Page

# Going from DREAMS to Reality, Continued





Here are a few of the artifacts created in the DREAMS Lab. Notice how unique and complex the internal and external geometries are. Without additive manufacturing technologies, it would be very difficult to form these products.



Left Page Pictures, Clockwise from Left

#### Extrude Hone

Metal 3D printing is made possible by the ExOne R2 system. It dispenses a binder (sort of like glue) between layers of metal powder to form its designs.

#### DreamVendor

Engineering students have access to the small-scale technologies available in this DreamVendor, located in the main lobby of Randolph Hall. The case displays examples of artifacts built by these machines.

#### MakerBot

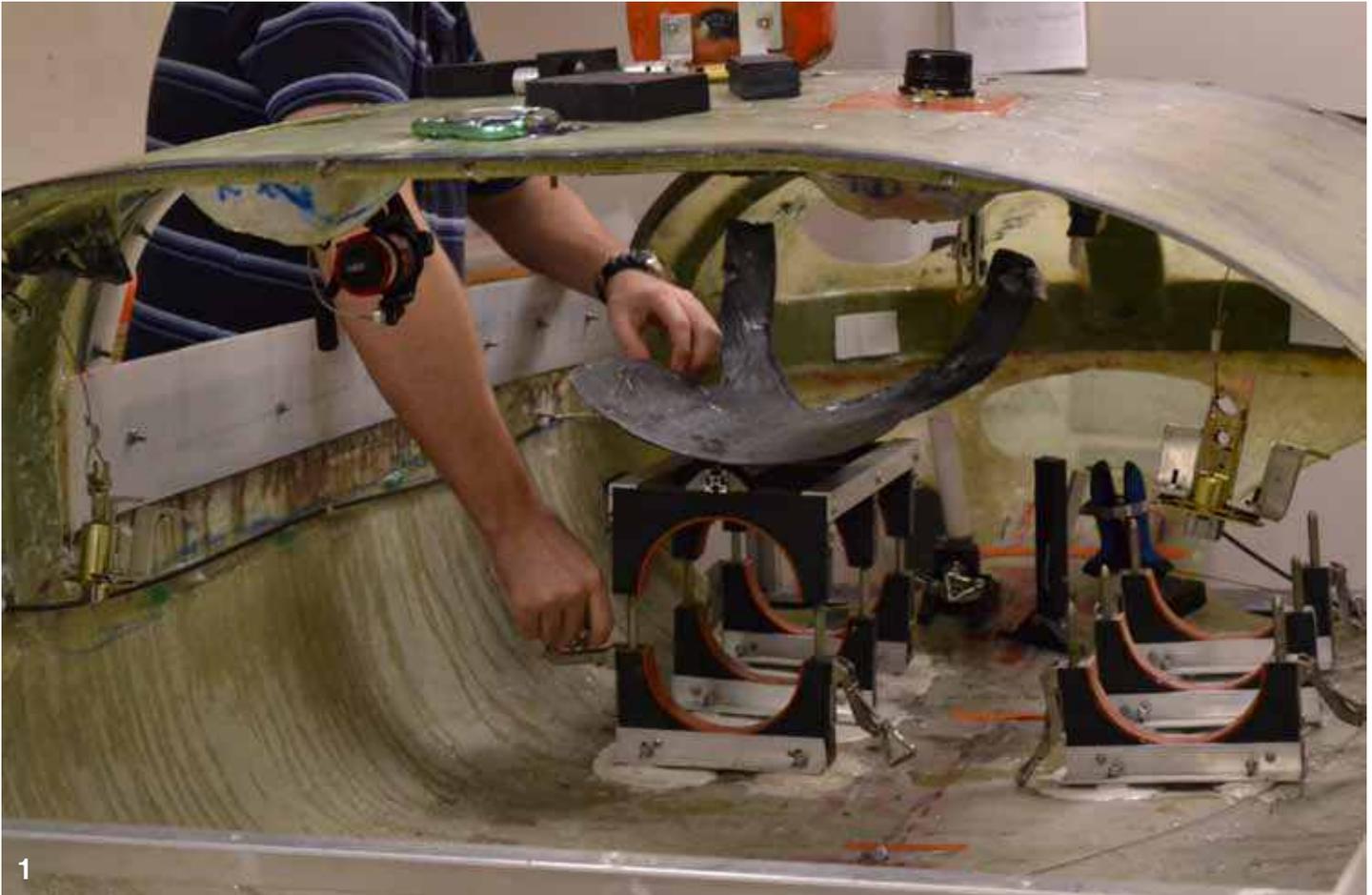
Small-scale 3D printing is made possible by these desktop machines that form artifacts with an Acrylonitrile butadiene styrene (ABS) polymer, a common thermoplastic. The MakerBots are predominantly used for undergraduate research and outreach demonstrations.

#### Stratasys

This Stratasys is also for small-scale modeling and extrudes an ABS polymer. It is useful for prototyping, low volume production, and creating small artifacts with complex geometries.

# Ware Lab: Human Powered Submarine

Written by Dennis Elias, a sophomore in Business Economics  
Photography by Sofia Davila, a freshman in General Engineering



1

Hidden in the depths of the Virginia Tech Ware lab sits one of the university's little known engineering projects. After being recognized many years ago for its great success, the human powered submarine now looks to re-enter the spotlight. The lab for this project sits away from public view in the basement of the university's military building. The lab consists of a dimly lit workshop where several of Virginia Tech's future engineers are working on the sixth installment of Tech's human powered submarine. Expectations for this latest version of the ware labs submarine run high, due to the fact that the last time they competed they took home the awards for best manufactured, overall engineering, and best presentation. Now, after several years of hiatus from their last competition, they hope to have their new submarine up and running by the end of the spring semester this May.

Led by ocean engineering student Brian Cain and electrical engineering student Jeff Smith, the team looks to get back on track with their winning ways this year at the Naval Surface Warfare Center in Carderock, Maryland. Every other year

around thirty national and international teams meet at the center to compete in what is essentially an underwater drag race. During the competition, two people lay face down in the student-built sub and pedal the human powered propellers through the center's water tank as fast as they can. While the premise itself sounds simple, the designing, building, and overall hard work that goes into this project is anything but. Manufacturing the submarine takes approximately two years, and with every new design comes the need for several changes and advancements. The new sub features several new improvements and changes that ought to keep Tech ahead of the curve, even after several years of not competing.

Jeff Smith, the team's vice president, is one of the many members excited over these changes. His knowledge and enthusiasm on the submarine and its inner workings is evident by the vast number of facts he is able to recite on the spot. Smith is developing several of these components himself in the hope that they will help them stay one step ahead of the competition once again. One of these new components is



2

1. Junior electrical engineer Jeff Smith demonstrates the pilots body rests. The space will be a tight fit, but hopefully help them win in competition.

2. Here are the two gearboxes that will work in conjunction with the pedals of the submarine. These gears will play an essential part in channeling the power to the propellers, as well as keeping a steady pace in propeller speed while both riders are peddling.

3. Jeff Smith, vice president of the human powered submarine team stands next to the completed parts of the submarine while sharing his vast knowledge on its components and their goals.



3

a computer system that will be installed into the submarine, which will display depth, direction, and output. Jeff says that this idea is something “that has never even been thought of before.” Eventually, they hope to have this computer control the entire mechanism, making the submarine autonomous. It would only need a few initial inputs from the controllers before being on its way.

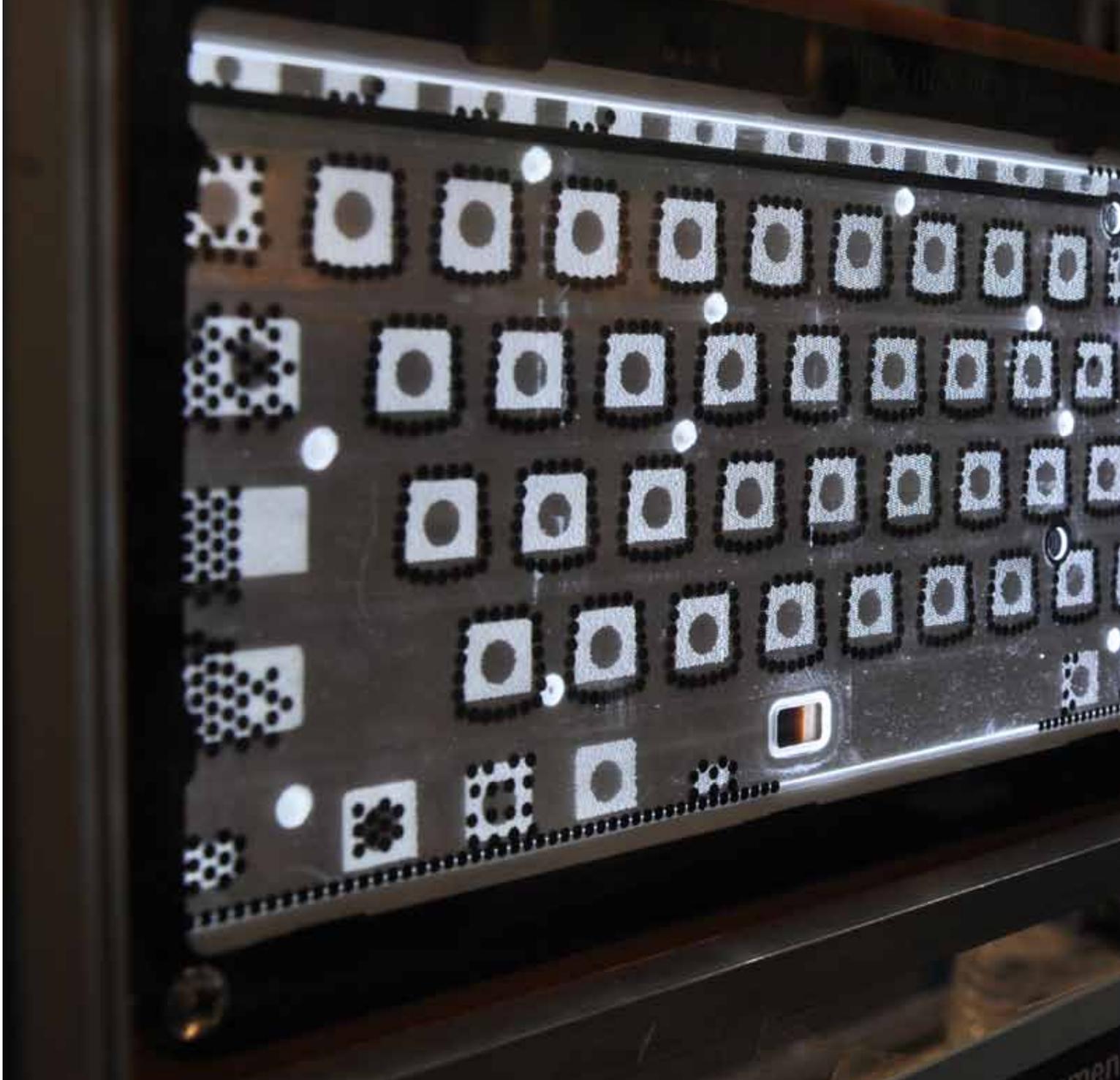
In addition to this possibly revolutionary concept, this new competition will feature two pilots in the submarine. With the addition of this additional pilot, the team has created an innovative solution to the problem of consistent and equal power output by both pilots. The propellers are powered by a pedaling motion comparable to an ordinary StairMaster. In order to control the variance of speed in pedaling from the two pilots, they have created gearboxes that work in conjunction with other gears, rods, and components to make the rotations of the propellers equal in speed. It does not matter how fast either person is pedaling; the components will spread the power evenly amongst both propellers. With both pilots

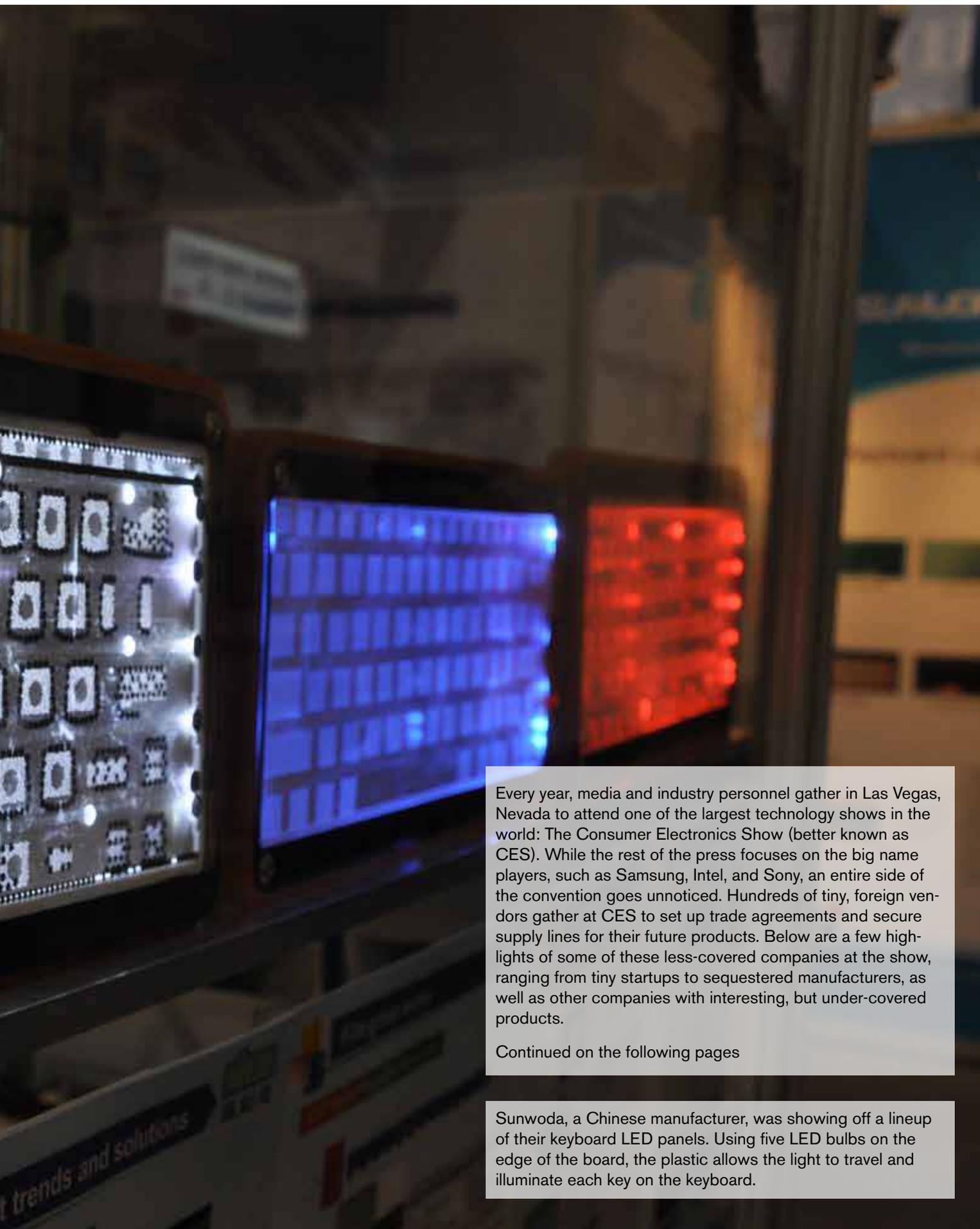
in pedaling in conjunction, this sub will not only be faster but much more advanced.

After visiting this hidden gem hiding in the depths of Virginia Tech’s Ware Lab and the ROTC laundry building there is no doubt that these students are dedicated to inventing the future even without much Hokie recognition. So, for all you out there who might be interested, I highly suggest you pay them a visit and check out this great project.

# Following the Supply Line: A Side View of CES

*Written by Andrew Mussey, a senior in Computer Science*





Every year, media and industry personnel gather in Las Vegas, Nevada to attend one of the largest technology shows in the world: The Consumer Electronics Show (better known as CES). While the rest of the press focuses on the big name players, such as Samsung, Intel, and Sony, an entire side of the convention goes unnoticed. Hundreds of tiny, foreign vendors gather at CES to set up trade agreements and secure supply lines for their future products. Below are a few highlights of some of these less-covered companies at the show, ranging from tiny startups to sequestered manufacturers, as well as other companies with interesting, but under-covered products.

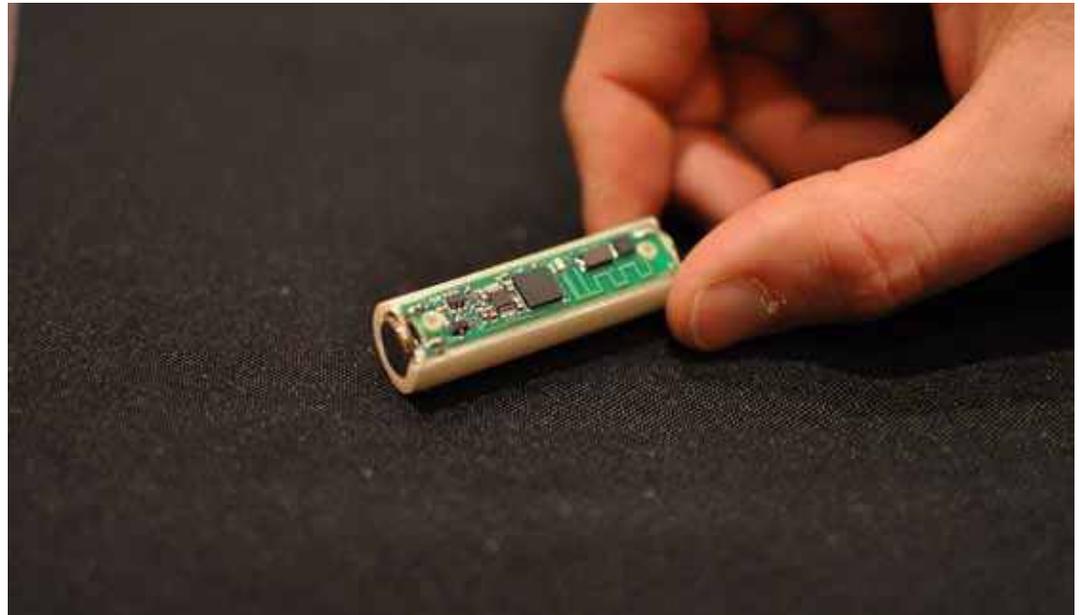
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Sunwoda, a Chinese manufacturer, was showing off a lineup of their keyboard LED panels. Using five LED bulbs on the edge of the board, the plastic allows the light to travel and illuminate each key on the keyboard.

While TCL is far from tiny, this manufacturer has little to no presence in the United States. One of their more interesting recent endeavors is known as the UltraSurface, a massive touchscreen television. The demo unit was running a full version of Windows 8, and provided an impressive Minority Report-esque feel when using broad, swooshy input commands.



Not all gadgets start out "smart." Tethercell is a tiny adapter to make AA battery-consuming gadgets a little more complex. The Tethercell pack houses an AAA battery as well as a Bluetooth chip. The combination allows for someone to use their smartphone to control the gadget that the Tethercell is inside.



When transistors and semiconductors became commonplace, most devices using vacuum tubes were upgraded to those solid-state alternatives. However, with that transition, certain properties of audio changed. Dared's vacuum tube amplifiers attempt to bring back the warmth that audio had when vacuum tubes were the norm.





The PC-CK101 computer case, produced by Lian Li Industrial Co., Ltd., offers storage for all of your system components inside a chassis in the shape of a train. The train comes complete with a motor, and is able to drive back and forth over a small section of track.



Axpro had an entire booth of different flash drive bodies that were waiting to be filled with memory chips by a partner. You might even be able to recognize a model of drive you have used recently!



Barometers? Gas gauges? Compasses? Flash Star Industrial has them all. Their display lined up hundreds of the tiny components side by side, each waiting for a product to be placed in.

# Freshmen InVenTs Workshop in Lee Hall

Written by Sofia Davila, a Freshman in General Engineering



The Lee Hall InVenTs workshop is a new facility, full of state-of-the-art equipment for students to use on class projects and independent design work. It is located on the second floor of Lee Hall, and it is only accessible to four different living and learning communities within Lee. Inside the workshop, students who are part of Galileo, Hypatia, Da Vinci, or Curie have access to 3D printers, various cutters, spacious workshop stations to work on projects, and various computers with AutoCAD programs built into them.

## Freshman Communities in Lee Hall

### **Galileo**

Freshman men in engineering.

### **Hypatia**

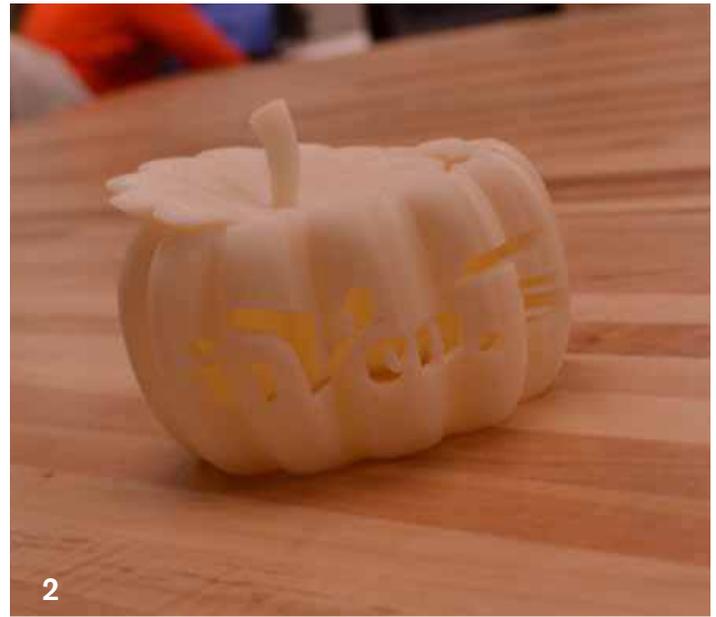
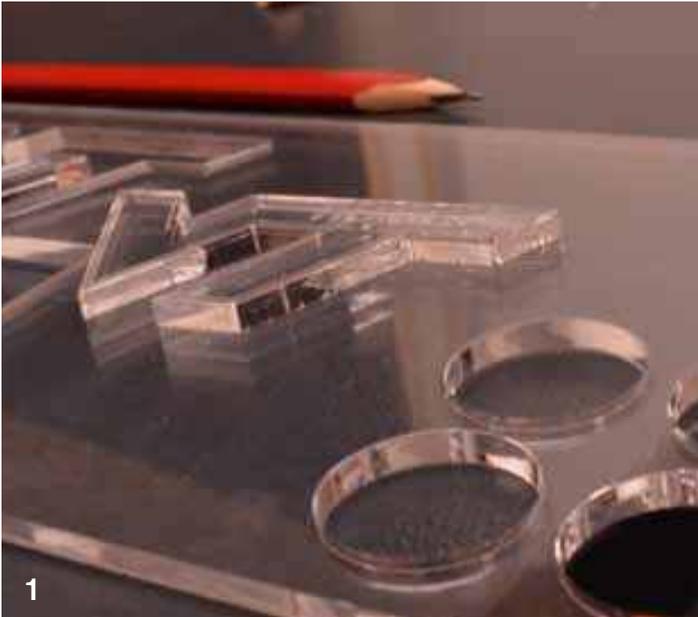
Freshman women engineering.

### **Da Vinci**

Freshman men and women in various biology and chemistry-related science.

### **Curie**

Freshman men and women in "physical and quantitative sciences," including economics, mathematics, physics, and others.



1. An example of the well-defined cuts that the laser cutter in the workshop is able to perform on plastic. This device can be used to cut, engrave, and print on materials other than simple paper.

2. A pumpkin made on Rhino (an AutoCAD program) for Halloween and printed using a 3D printer located in the workshop. Any object can be constructed on an AutoCAD program and printed using the same 3D printer that was used for this object.

3. Joe Cuadrado, one of the two graduate students in charge of the workshop, shows off the laser printer that is housed in the invents workshop which is capable of cutting through plastic, wood, and even metal!

# CES: A Retrospective View of the Last Four Years of Technology

Written by Andrew Mussey, a senior in Computer Science program



**As a staff member of the Engineers' Forum, I've written a piece covering the developing technology at the Consumer Electronics Show (CES) every year for the past four years.**

Each year, the focus on what is up and coming changes ever so slightly; it's such a little shift that it may not even be noticeable on a year-to-year basis. However, looking back over the course of many years, the change has been dramatic. Just as an example, three years ago (in 2010, the first year we reported on CES), the iPad hadn't even touched the market. It would be another 12 months before the product was even announced, despite rampant rumors. The state-of-the-art technology during that time consisted of Windows Vista and netbooks. Now, three years later, the market for these tiny, underpowered computers has dried up, and tablets are the new tool that has arrived to replace them.

The pocket-sized computing power many have come to rely on has taken a very different turn than what was expected at the time. The February 2010 issue of the Engineers' Forum featured a pocket-sized convertible tablet, running what was then the relatively new operating system, Android. At the time, Android held only a 7.1% market share, in comparison to the leader, BlackBerry, sitting at a solid 43% market share. To compare these numbers with more current figures taken in the 4<sup>th</sup> quarter 2012, Android now sits at 70.1% market share, with iOS (the operating system running on the iPhone and iPad) trailing at 22%, and BlackBerry being bunched in with

the "Others," including Windows Phone 7, sitting at only 7.9%.

One prediction that did come true was the rise of e-readers. While many of the novel "LCD on one side, E-ink on the other!" devices never panned out, Amazon has found a niche in mass production of a set of devices with a unified store. The Amazon Kindle has won out as the majority leader for E-ink readers in the United States.

While the hardware world has been a roller coaster ride of gadgets, the software world has had to deal with its own set of changes. The rise of touch screens has ushered in a whole new era of desktop operating systems, most notably in Windows 8. Always-on Internet connections and increasingly connected mobile devices have driven our documents and files to the "cloud." Even our own Engineers' Forum magazine is in the process of making the shift to a more digital format. If anything is for certain about the upcoming years, it is that watching where technology goes will continue to be an exciting and turbulent experience.



Netbooks are much harder to come by these days. Kohjinsha's dual screen portable machine was one such system that never saw commercial success in the United States.



This LonMID device was featured on the front cover of our February 2010 issue of the Engineers' Forum. Whether it was a tiny convertible tablet or a big phone was never officially decided, as it never made it overseas to US carriers.



Viliv's pocketable computers were one of the closest (and one of the most popular) forms of slate computers prior to the invasion of Android and iOS tablets in 2011. This tiny machine sported an Intel Atom processor and ran a full copy of Windows 7.

