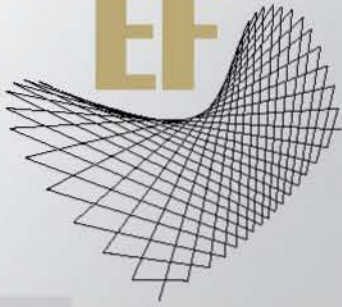
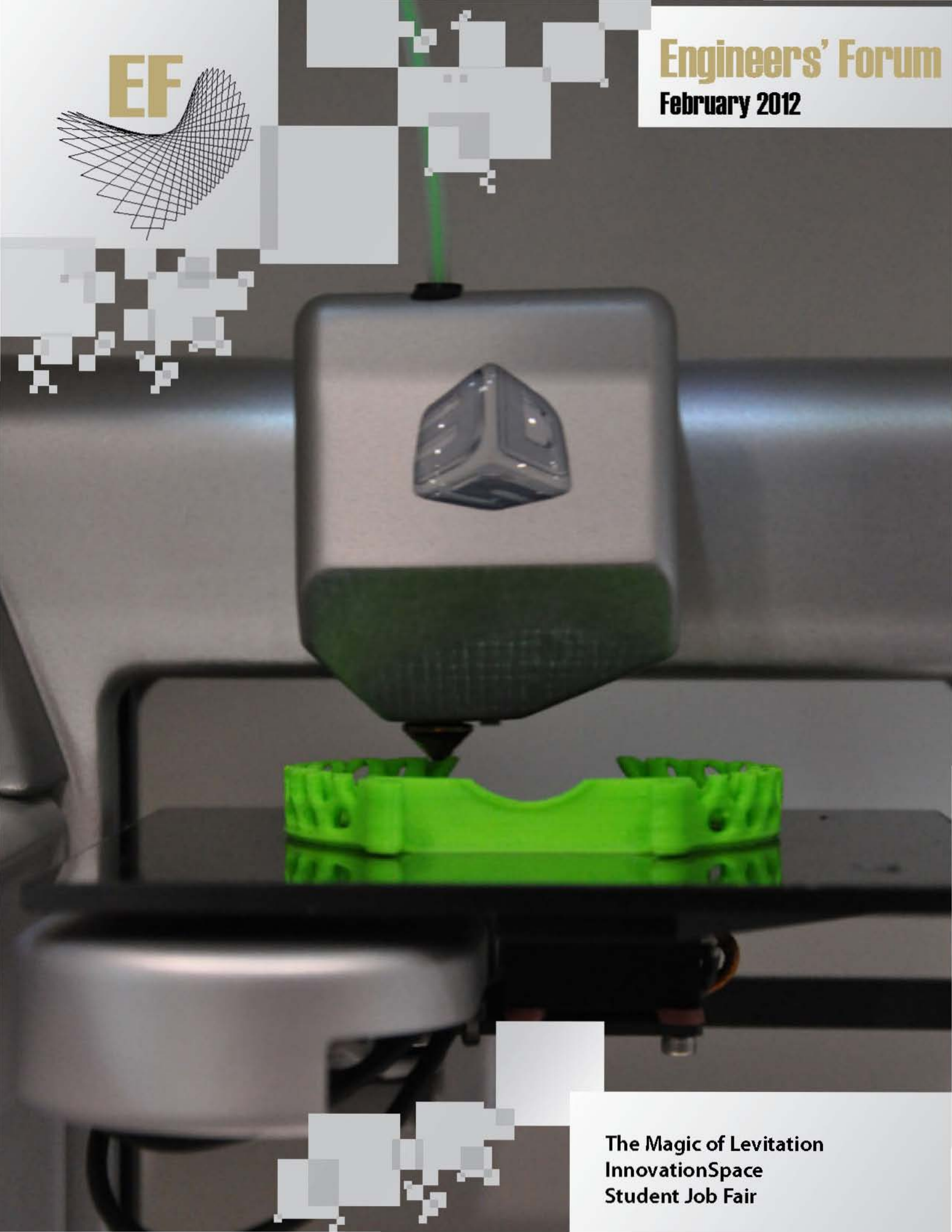


**EF**




**Engineers' Forum**

**February 2012**



**The Magic of Levitation  
InnovationSpace  
Student Job Fair**

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## Letter From the Editor

My Dear Hokies,

WELCOME BACK!

I hope everyone had a restful break and is now ready to face the new semester and the winter with both excitement and woolens. As always, this issue also contains many interesting articles on a range of topics. If you missed the CES in Las Vegas this year, no worries. We have some spectacular photos to share with you. For those of you interested in summer employment and internships, check out the article about CAMEO upcoming job fair. In addition, our new series on engineering minors provides options that will boost your resume without piling onto your workload.

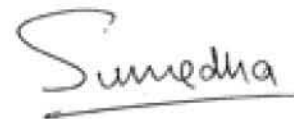
On the geekier side of things, you can find out what Marty McFly and quantum locking have in common, as well as the top five pieces of technology bound to change the world as we know it. For you NASA-minded folks, we have the conclusion to the Race to Mars series that was introduced in the September issue.

Engineers' Forum always welcomes some new faces on its editorial board. We are constantly looking for fresh faces of all different majors for filling our writers' and photographers' position. Shoot us an email, and we will involve you in the job you like. Please do not hesitate to contact us if you have any questions or suggestions, and feel free to check out our website at <http://www.ef.org.vt.edu/> the next time you're avoiding your homework.

Thanks,

Sumedha

(Editor-in-Chief)



Sumedha Mohan

URL:<http://www.ef.org.vt.edu/>

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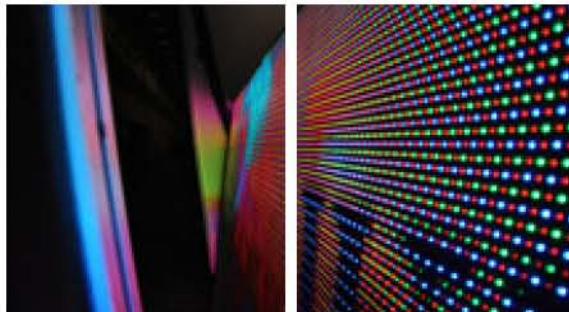
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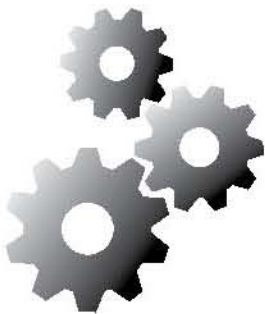
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## Upcoming job fairs for Students

### CAMEO Engineering CareerFest

For all you engineers worrying about your plans after this semester, it's not too late! Even if you missed the Engineering Expo in the fall, there is still an opportunity to find your perfect internship, co-op or full-time job. In mid-February, The Council for the Advancement of Minority Engineering Organizations (CAMEO) will sponsor an annual CareerFest for all College of Engineering Students, both graduate and undergraduate. CareerFest is a great opportunity for engineering students to find potential employment and network with peers and company representatives. If the allure of employment isn't enough, however, students will also have a chance to win door prizes like gift cards or an iPad.

In preparation for the event, students are encouraged to register and upload their resume on the CAMEO website (<http://www.cameo.org/vt.edu>) for the employers to browse. The website is also an excellent resource to see what companies will be attending, thus allowing you to be better prepared for the CareerFest. Students will also be able to browse what engineering major the different companies are looking for and the type of employment they have available. A little bit of research makes for a great introduction, and shows representatives that you're serious about being employed.

The companies that attended CareerFest in the past include Microsoft, Tennessee Valley Authority, Bechtel, Northrop Grumman, URS Corporation, Volvo, National Instruments, MIT Lincoln Laboratory, and over 80 other companies looking for students in various engineering fields. The official CAMEO website will post the companies attending this year, as

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well as the details on information sessions that many companies hold prior to CareerFest.

Whether or not you have already found employment, CareerFest also needs volunteers for tasks like driving, checking in students and employers, and answering general questions. Volunteers will receive a free T-shirt and lunch for their troubles. More information about volunteering can be found on the website, or you can send an email to [cameo@vt.edu](mailto:cameo@vt.edu).

For non-engineers, there is another opportunity to find an internship or co-op for the summer. Career Services sponsors "Connection Co-op and Internship Job Fair" for all majors including undergraduates and graduate students.

The companies that have attended in the past include Ingersoll Rand, Northrop Grumman, Danaher, Altria, and many more. The list of employers attending this year is available on the Career Services website (<http://www.career.vt.edu>).

Career Services will also be hosting prep workshops before Connection for resume writing and interviewing tips. The date and location for the workshops can also be found on Career Services website. Once there, you can find more information about other spring career and job fairs that are major specific.

*Aneela Mousam is a Junior Biological Systems Engineer*

### CAMEO Engineering CareerFest

#### WHEN

Thursday, March 1st, 2012  
(10:00 am - 4:00 pm)

#### INTERVIEWS

Friday, March 2nd, 2012

#### WHERE

Squires Commonwealth Ballroom

### Connection Co-op and Internship Job Fair

#### WHEN

Tuesday, February 14, 2012  
(10:00 am - 4:00 pm)

#### INTERVIEWS

Wednesday, February 15, 2012  
(8:30 am - 5:00 pm)

#### WHERE

Squires Student Center





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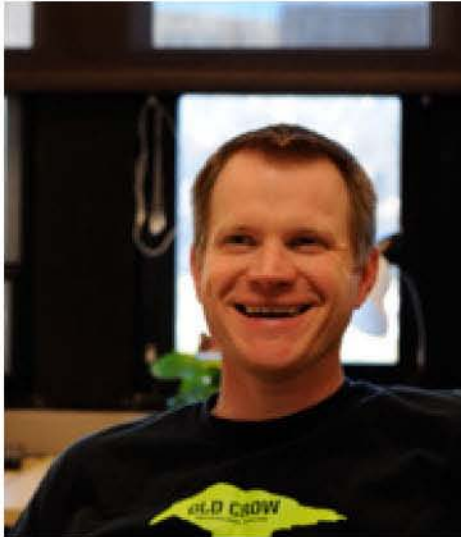
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# Innovation Space

Need a video camera for a class project? Or a sound booth where you can record your next hit single? How about a machine that'll transform those ancient slides from your parent's attic into digital images? Or maybe you'd just like to borrow an iPad for a week. For all this and more, look no further than Tech's Innovation Space (IS), located in Torgersen Hall. In addition to offering classroom space and equipment loans, Innovation Space offers lessons for Tech's students and staff on how to use new technology and existing software programs such as Photoshop and Dreamweaver. And the best part of all? It's absolutely free.

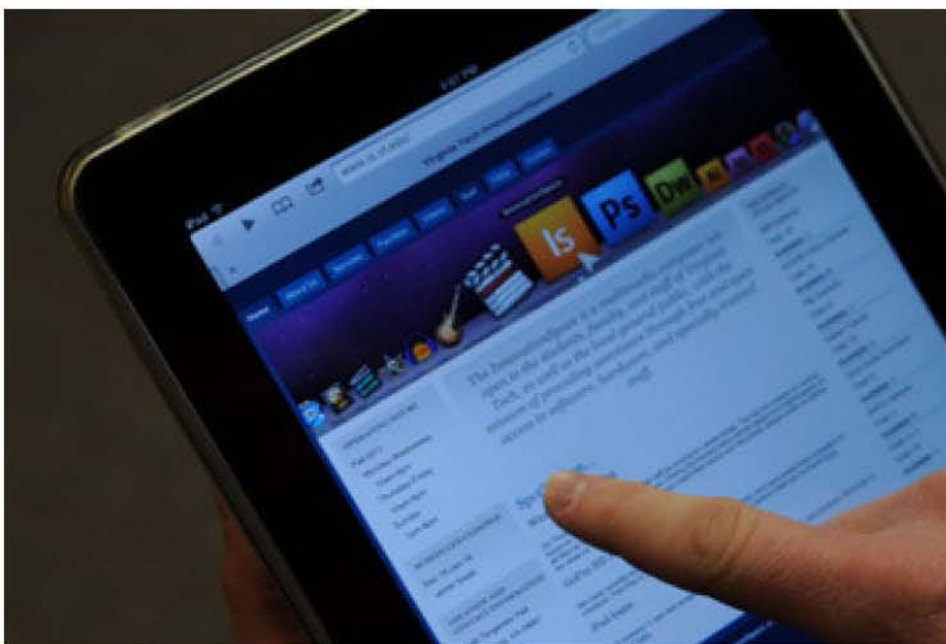


Virginia Tech was chosen among 10 other universities in the early 1990s by now-international software companies that wanted to implement use of their products and technology into schools. These corporations - Sony, Macromedia, and Adobe, gave the university educational discounts and started what was then called the New Media Center in the Newman Library at Tech. When the Center first opened, the idea was to get students both aware of and interested in the new technology. In the beginning, students went in to work on projects that usually involved making websites, or scanning images. According to James Dustin,



Operations Coordinator at the Innovation Space, the first uses of the New Media Center were for "multi-media in general. We did a lot of Photoshop work, we had flatbed scanners, which at the time were \$700. People would come in just to use the scanners, to scan their images and take their images home with them and do whatever with later. We did very little video editing at the time, because it was a very slow process. I remember the first video I did was probably 14 minutes long and it took like 2 days to compress. We also did a lot of PDF creation, which at the time... wasn't as easy as it is."

Now, the IS helps students from all majors coming in to learn how use certain programs for class projects. On-site technology includes sound recording booths, Wacom drawing tablets, computers equipped with Adobe Photoshop and Dreamweaver software, and much more. Students who need help on a project, or who just want to explore new software can simply walk in, and an instructor will help get them what they need. Dustin enjoys working with those who come in to the Innovation Space to work on projects and borrow equipment. When asked about the assortment of customers the IS has, Dustin says, "we run the gamut." Since its inception, the number and variety of people who take advantage of all the Innovation Space has to



*Above Left:* James Dustin, Operations Coordinator of Innovation Space.

*Above Right:* Innovation Space's handheld waterproof Kodak Playsport.

*Left:* iPads are available for check out for up to one week at a time.

*Images by Katherine Eckenfels*

offer has only increased. In November of 2010, a record-breaking 2,077 people were served, which includes those who came in for equipment rentals, software use, or workshop participation. The Innovation Spaces, in keeping with its original purpose, has a multitude of gadgets and devices stocked and available for loan. According to Dustin, the IS "started out really slow, with two video cameras. We progressed slowly and crept into other areas now [...] like a year and a half ago starting with iPads. The numbers will keep increasing every semester, as long as the demand keeps up. It's all about getting as much stuff into people's hands as possible." Current equipment loans include still cameras, AVCHD Video and Flip cameras, Velbon tripods, Zoom Audio Recorder, GoPro cameras, and iPads. Students, faculty, and staff may check out any of this equipment, and it can be used for a variety of reasons. For example, a corps cadet once cleverly borrowed a GoPro camera to capture unique shots of a football game and

parade, taken from the top of his tuba. This handy gadget is a small, square camera that can be mounted to a number of different surfaces, making it both portable and versatile. A member of Tech's wakeboarding club used the same device in a competition, which also produced pictures with perspectives that could not have been taken with other equipment. Lending out cool equipment isn't all the Innovation Space does, however. The IS also has three classrooms that serve a variety of functions. For example, The Faculty Development Initiative holds informational sessions just for Virginia Tech faculty that teaches professors how to use Scholar, as well as how to make and manage their own website. Sometimes professors will reserve use of the rooms for their classes, when assorted high-end machines are needed for a project. When not in use by faculty, these rooms also offer special courses for students in a program called SpaceCamp.

Space Camp is a program both made for and taught by students. It is a peer-led and operated program that teaches both grads and undergrads how to use Photoshop and Dreamweaver (among other software). The first ever Space Camp was in the Spring of 2010, when 19 sessions were held and there were 154 attendees. On average, there are about 20 Space Camp sessions every semester, and participation has been growing ever since.

In the future, Tech's Innovation Space will acquire more top-of-the-line technology for students to test out, including Apple's iPad 2. In the meantime, be sure to head over to Torgerson and take advantage of everything the IS has available. It is a great resource for both students and faculty here at Tech. Check them out online at <http://www.is.vt.edu/>.

*Kristin Sorvson is a Sophomore in Sports & Professional Writing.*

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# Race to Mars- Part 3

Due to my departure to Georgia Tech, this will be the last installment of this series. If you're interested in more information, feel free to contact me at [vvislubokov@vt.edu](mailto:vvislubokov@vt.edu) -Val

Before the signature logos of United and Lufthansa graced the empennages of Boeing's birds, flight was much like space travel is today: uncomfortable and expensive endeavors primarily backed by governments and their militaries, executed by eccentric men and women with iron gullets and nerves as hard as steel. So too began the internet; some of our older readers will remember having to use command line interfaces to access a server on old 1980s Usenets for information. Modern spaceflight will follow a similar path.

None of us, except perhaps China, with its unwavering commitment to sacrifice anything for greatness, will see the brown and green continents and magnificent blue waters of Earth from anywhere beyond Low Earth Orbit. Unless of course, spaceflight takes a page from the history of flight and the internet, and the simplest of tasks in the industry are handed off completely to the base private industry. Until such a time, space travel is in a precocious

position, bending to the will of political winds, prone to rise and sink at the slightest turbulence, and constantly at risk of being permanently grounded. Like the Marines when it comes to areas of science and technology, governments break through barriers with unprecedented speed and force. The private industry, like the army infantry, can then establish a permanent presence. If protected by the mighty, omnipresent, and mysterious arm of the free market (laugh if you must), space travel would instead become eternal.

Barring a second Cold War or a sequel to the space race, the only path to take lies in the private sector. Companies such as the heavyweight Orbital Sciences as well as fresh startup Space Exploration Technologies (SpaceX) were recently hired by NASA to take the reins of its International Space Station cargo delivery program.

Orbital Sciences, an industry veteran, is salivating like a starved dog to finally do something other than loft hunk-of-junk satellites into space. SpaceX, while only established in 2006, is led by CEO Elon Musk; you may know him from such technological tour de forces as Paypal, the

world's first online banking system and the only one to this day to be all online. Tesla Motors, another one of his pet projects, is known for developing and manufacturing the world's fastest electric car, the Tesla Roadster, which can go from 0 to a scorching 100 miles per hour in 12 seconds flat.

And that's not all, folks. In addition to the cargo program, Elon Musk is running a second NASA program called Commercial Crew Development where SpaceX and three other companies are competing to develop capsules and miniature space planes for delivering into orbit not things, but people - all for less money per flight than the annual salary of an NFL quarterback.

As promised for the last part in this series, I have told you what the future will hold if properly pursued. It's clear that the future of spaceflight will be controlled by airlines like Delta and Airbus, and that large defense contractors like Lockheed Martin and Northrop Grumman will be in charge of getting people to new destinations. But no one knows who will first leave Low Earth Orbit, or whether they will go to an asteroid, or Mars, or Europa. What is guaranteed though, is that once that first step is taken, someone will afterwards be able to go further, explore the unexplored, and pave the way for future voyagers. And that's the way the cookie crumbles (in zero gravity)

Except for one molecular detail: the entire point of what I have just expounded is completely moot... for most people, that is. Arguing about the next step to take in space doesn't make sense for those with a critical eye for NASA and space travel in general, who confess that they don't see a point to it all. These are Americans who insist they are being robbed \$50 a year so that 35 of NASA's astronauts can sit around in an international orbiting facility, and the other astronauts can spend their time training to do the same, ad infinitum. Many charismatic men and women sit down with these skeptics and tell them magnificent tales of how NASA is saving America with indirectly developed technology and national security and "gosh darn it would you just look at how bright, shiny, and cool that lift off is?!"







*Above: SpaceX's Falcon 9 Heavy, a tripling of its so far successful Falcon 9 rocket for the heavy lifting capabilities needed for long distance flights.*

*Below Left: Sierra Nevada's Dream Chaser spaceplane for NASA's CCDev program.*

When it comes to advocating space exploration, the real and maybe the less exciting truth is that we are explorers - not as a nation, but as a species. Everyone forgets that at some point, we stopped chasing bison and mammoths and learned how to will wholesome, nutritious food from the earth, and for a few thousand years, it was good. But eventually, we stood on sandy beaches while staring at the oceanic horizon and decided it wasn't enough, not for a human being. Multitudes of men jumped onto ships, regardless of the ocean floor teeming with enough carcasses of naval crafts to make the Bermuda Triangle blush. These men did not hesitate, and many of them reaped the discovery of terra americana as a result. And for a few hundred years more, it was good.

But the likes of those sailors have reappeared again. People like Wernher von Braun who climbed televised soap boxes and mesmerized the public with technical tales of what could be, and Elon Musk who recently looked straight into the camera while publicizing his Falcon 9 Heavy rocket and said he was going to put millions of people on Mars, Congress' deadlock

over his funding be damned. For the few of us left, the explorers willing to follow our primal instincts, it put a shiver in our spine to hear triumphant men like Musk and Richard Branson and Robert Bigelow promise to make space their next success. So it is for the 6 men and women currently floating in space, waiting for a president, a business executive, or somebody to pick up the phone, call, and to tell them:

"This is not what you are going to do. This is what everyday people will do. They will dimb aboard their star flights and vacation in space while touring the world in 90 minutes or less. But it is not what you are going to do. You explorers who risk your very existence where others wouldn't will go to Mars. You will put carbon dioxide factories on its surface and begin the long process of turning the planet into our second home. Others will go to Europa and find life as we have never observed it in its underground oceans. We will do this because we are capable of it, and because that is our eternal purpose."

*Valery Vislobokov is a senior in Aerospace Engineering*

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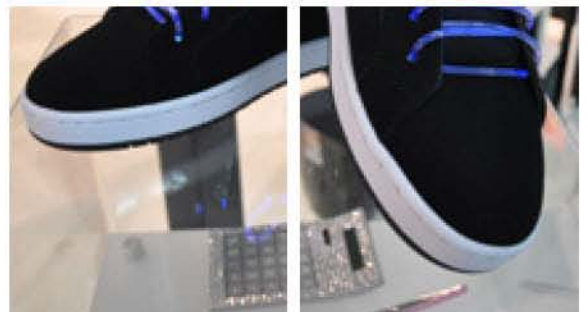
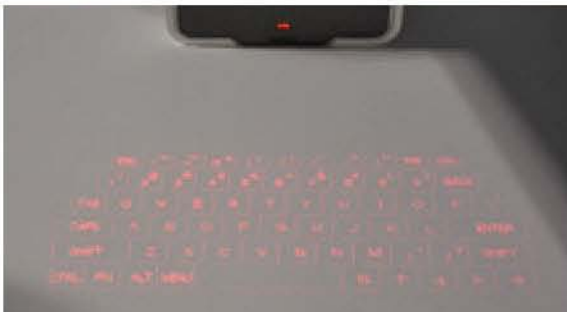
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# CONSUMER ELECTRONICS SHOW 2012

**Below:** Fujitsu showed off an entire lineup of waterproof Android devices. These phones and tablets are covered in a protective coating that prevents water from damaging any of the components. To see a video of the devices being dunked in and out of a vat of water, visit the Engineers' Forum website.

**Below:** Taking on the challenge of adding a bit of "smart" into the rest of the home, Thermador's Freedom Induction Cooktop hopes to change the way you make your dinner. Using a series of sensors and inductive coils, the Cooktop is able to detect where a chef places a pan and map it on a 6.5" touch screen. The user can then tap on the pan on the screen, and adjust things such as how hot the pan should be or how long it should cook. Unfortunately, the device comes with a fairly prohibitive price tag of \$4,949. It is set for a July 2012 release.



**Left and Above:** The CTX Technologies SEF Computer is packed with tons of different features. In this tiny box, there is a 4.3 inch touch screen, a PICO projector with the ability to display up to a 88" screen, a full Intel Atom computer (later to be updated to an i-Core processor), a projected keyboard/mouse combo, video input, a webcam, and an iPod dock. All of this is able to run for 3 hours off of the built-in battery. That time nearly doubles when the projector is turned off. For more information, visit their website at [ctxtechnologies.com](http://ctxtechnologies.com).

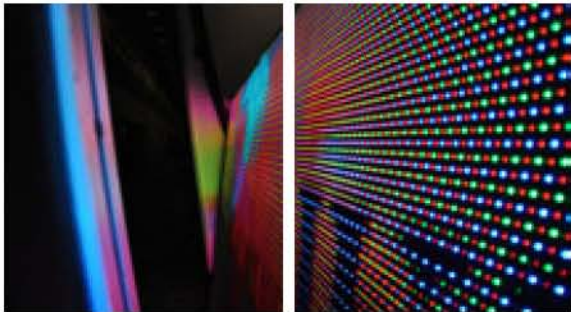
**Right and Above:** DGL Group's lighted shoe laces are offered in two colors: blue (pictured) and orange. Both lighted strands keep your shoes tightly laced and glowing using a band at the top with an on/off switch.

**Above:** This elaborate octopus model was generated using a 3D cloud printing service from Sculpteo. Rather than purchasing the printer and all of the raw materials yourself, Sculpteo allows you to upload a 3D file from your desktop or iOS device to their website and have a finished, printed model mailed to you. Their service also allows for printing using multiple different materials, such as silver and plastic. For more information, visit their website at [Sculpteo.com](http://Sculpteo.com).

**Right:** Mohz's loop wearable micro-USB bands show that fashion and tech can mix. The bands come with an adapter for iOS devices. Unfortunately, they are not yet available inside of the United States.



**Below and Right:** During their introductory press conference, Intel made a huge deal about the rise of Ultrabooks and a "better user experience". In previous years, Intel has had a display that featured some sort of fancy graphics or feat of processing to show how far their new chips had come. This year, they simply created this arch with each of the upcoming Ultrabooks on suspended platforms around the brim. It created an interesting vibe that varied from the standard "look what we can do!" into a more inviting "try to do what you normally do, and see how much better it is."



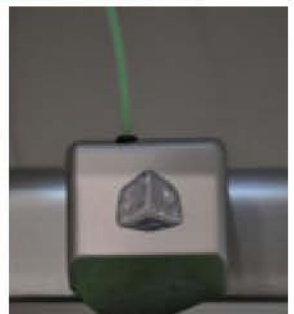
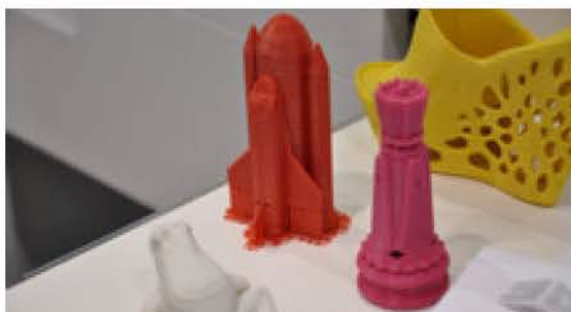
**Above:** This close-up photo of an LED panel shows how the combination of red, green, and blue bulbs are being used to produce a larger image. This display was so blindingly bright that it illuminated all of the other booths in the aisle.



**Right:** Harman/Kardon's GLA-55's came to market originally came to market in early 2008. These \$1000 speakers were on display at the latest Show. Their impressive blue LED lighting illuminates the crystalline structure, proving an incredibly gorgeous-looking speaker. The sound coming from the amplified speaker set is as high quality as their appearance.

**Below and Right:** One of the largest sectors of unexpected innovation came from 3D printers. Multiple models appeared up on the show floor. Cubify's Cube was one of the lowest price models on the show floor, falling in at \$1299. The system uses a plastic thread to print models line by line. Single-colored thread cartridges, costing around \$49 each, are loaded in one at a time. A video of the machine in action is available on the Engineers' Forum website. More information on the Cube can be found at Cubify.com.

Images by Andrew Mussey



# More than a Major

Most engineering majors feel that they are always busy, pressed for both time and brain space. As a result, it often seems difficult for engineering students to supplement their college educations with more than just an engineering degree and required CLE courses.

How many of you have you given up on the idea of a minor? Go ahead, raise your hand (but not if you're reading EF in class!). After a few semesters in your chosen field of study, you maybe thought to yourself, "I can't afford to add another major or even a minor. It'll be too much extra work." If that statement sounds familiar, don't give up yet! Many minors and other educational programs tie into an engineering major with as little as two extra courses outside your major, and many of those credits can also fulfill CLE requirements.

A minor, as defined by Virginia Tech's Academic Advising Index, is a collection of courses with fewer credits than a major. Minors are designed so students can "develop expertise or pursue an interest in some subject in addition to their major."

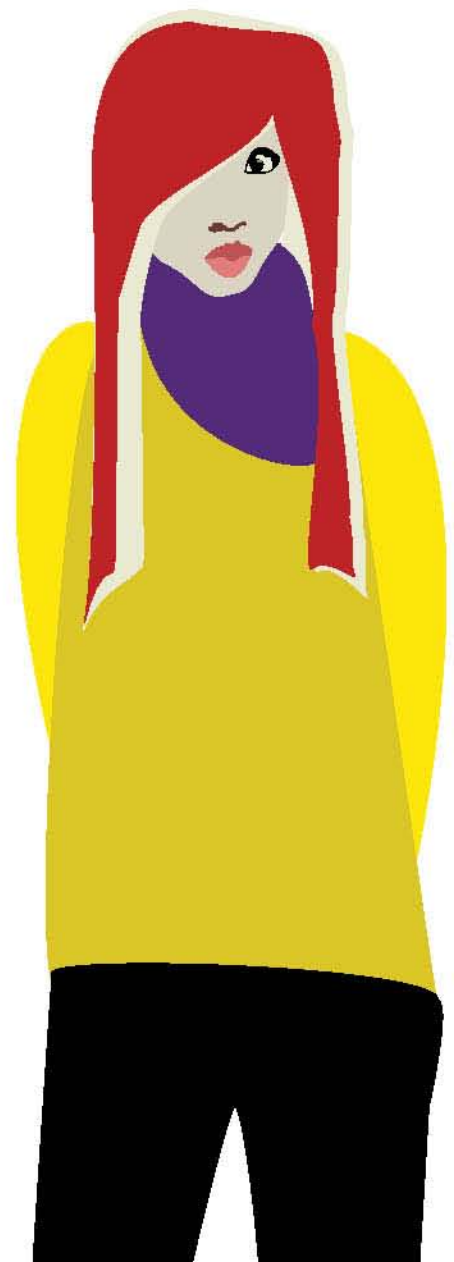
If you have read this far and still think that a minor isn't worth the effort, please consider the following:

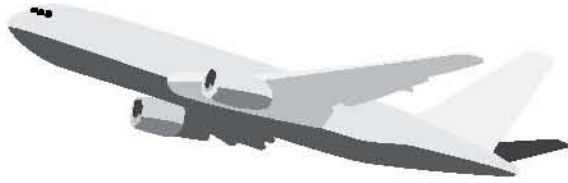
- Even though some engineering minors have relatively high credit requirements (21 credits or more), many of those credits overlap electives and core courses from similar engineering majors.
- Minors can be and often are worked into senior capstone projects, which can give the project a more distinct spin. In return, senior capstone courses may also count toward the minor.
- There is no shame in taking an extra semester to make enough room for other classes, whether it's a minor or a double major. The extra effort will make you more valuable and desirable as an employee.
- With some minors, it's completely possible to declare the minor and begin the coursework as late as junior year.

With that said, take a look at the minors described on the right. You might find one or two that suit your major or interests.

In upcoming EF magazines, I will explore each of the above minors far more in depth, including detailed course descriptions and interviews with staff and students. If you would like a more detailed article about any other minor, please make a suggestion to EF magazine.

*Avery Nelson is a Freshman in General Engineering*





### **Engineering Science and Mechanics**

Credits: 21

Similar to: Aerospace, Ocean Engineering

This flexible minor is capable of covering anything from hydrodynamics to biomedical engineering. An ESM minor will take up space, but will also provide an excellent challenge.



### **Naval Engineering**

Credits: 18

Similar to: Aerospace, Ocean Engineering

Covers a broad spectrum of engineering disciplines and involves all engineering departments at Virginia Tech. Focuses mainly on development and maintenance of the Navy's ships, planes, and other vehicles.

### **Green Engineering**

Credits: 18

Similar to: Biological Systems, Civil, and Mechanical Engineering

Focuses on product and process life cycles and environmental awareness. Due to its focus on prevention and sustainability, this minor looks excellent to employers.

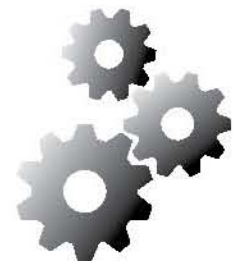


### **Computer Science**

Credits: 18

Similar to: Electrical and Computer Engineering

Much like the microelectronics minor, a computer science minor is an easy grab for those with similar fields, but a stretch for others.

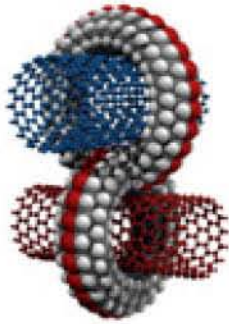


### **Microelectronics Engineering**

Credits: 21 hours

Similar to: Electrical, Material Science Engineering

For those who aren't majoring in the above fields or physics, this course will have little overlap.



# Future Tech Top 5

If you're a fellow engineer and you're reading this, you probably got butterflies in your stomach just by skimming the title. It's a characteristic we all share as the world's technical workforce, we get excited when we hear about an amazing new piece of tech, and count down the days until we can fiddle with it ourselves. The following technologies are several grades above the newest smartphone, but not quite products of science fiction (although many of them got their start there.) All of these products would have seemed impossible up until a few years ago, and more importantly, their arrival is just around the corner. We hope this list fills you with engineers' glee as we start off the list:

## 5 Holographic Technologies

Members of the Old School will immediately think of Princess Leia's garbled message delivered by the faithful R2-D2 during the Rebel crisis. Younger readers will probably think of Duke Nukem 3D's "HoloDuke", or maybe that nifty little device from Brookstone that floats custom text messages by rapidly moving a LED light back and forth.

One thing is for sure, though: holographic technology is nothing new. First making its entrance in the stories of science fiction, holographic technologies became popular as presentation holograms, three-dimensional portrayals of objects composed entirely of light. These days the systems for such displays are much smaller, but they make up for it with realism by adding a second or third color to the spectrum.

Despite the improved visuals being made possible, the real applications for upcoming holographic technologies won't be focusing on looks. One of the more popular ideas is the creation of projected keyboards. Some of us have still not quite adapted to using our thumbs to compose full-length documents on phones, and carrying a Bluetooth keyboard is a hassle. One answer to this is to project a keyboard made of light onto a flat surface in front of the phone. Once the keyboard is in place, a sensor would track your finger placement and movement as you tap on the virtual keyboard superimposed onto a nearby table or wall. For the application of holographic technologies, it is possible to do the same thing, but without the surface. New technology would allow your phone or tablet to float a keyboard several inches above your lap.

The other use of holography is more unconventional. After Blu-ray became the norm for HD media, companies began developing the next format for holding movies, songs, and data: the Holographic Disk. While it looks almost exactly the same as a CD or DVD, a single Holographic Disk is capable of being read or written from by three lasers at the same time. This advanced process creates a disk capable of holding hold up to six terabytes of data. For reference, the average DVD-R could hold about six movies - a Holographic Disk could easily hold at least 8,000. Unfortunately, this technology is arriving by the end of optical media era. As online storage or "cloud" services become more popular, physical storage is becoming moot, and the Holographic Disk may never get its chance to shine.

## 4 Optical Computing

Taking a look at another light technology, everyone knows that computers, like most gadgets, run on electricity. This has been the case for over the past 60 years, because making a faster computer processor required bringing transistors together, the more transistors you could connect, the faster you could get. If you ran out space or if the processor got too big, you made each transistor smaller, the smaller you made the transistor, the more you could fit into a particular space.

However, a common problem that computer engineers have been running into in the recent past is heat. You can make transistors smaller and smaller, but eventually you end up packing a large amount of electricity into a very small space. Server rooms often have dedicated air conditioning units for each server stack, and computer gaming enthusiasts outfit their computers with liquid cooling technology, a technique more commonly found in cars. Researchers at IBM labs are proposing a different way to go: optical computers. The concept is simple: instead of having electricity running over the circuits in a computer, use light signals instead.

A very primitive form of this technology is already being used. If your cable guy convinced you to sign up for a fiber internet connection like Comcast's Xfinity or Verizon FiOS, you're already using optical computing! Fiber cables are made up of a special material that can carry light via light signals, and they connect much faster than a regular old copper cable can. Something similar can be done with CPUs by replacing a computer board's silicon circuits with optical ones, and your processor's electrical transistors with optical connections. By doing so, optical computers will be capable of much greater speeds than electrical designs while operating at much lower temperatures. Light doesn't need much heat in order to move quickly. In fact, initial designs from IBM reported problems where the light traveling along optical circuits was too fast, and that receiving modules on the computer (like memory) were unable to interpret them, so they had to cool the circuits' temperatures in order to slow the light down.

Use of this tech will require processors to be designed completely different from those today, which means all of today's software would also have to be changed in order to run on these new processors. Because of the overhaul necessary to implement this technology, optical computing is getting its start in mobile phones, where software is often rewritten for constantly changing hardware. The average consumer probably won't notice the difference, either; it's just one more way for new phones to be faster.



### 3 3D Printing

When's the last time you felt excited about a printer? This tech has less to do with words on paper and more about manufacturing, design, and medical revolution!

The concept is fairly simple. Like a regular ink printer, a printer head goes back and forth over a surface but with two key differences: instead of ink, the printer uses a special plastic material, and instead of moving back and forth along one axis, the printer head can move along all three axes. Combine this with a computer loaded with a 3D model, and you have a miniature manufacturing machine capable of putting together tons of different items, layer by layer. As these printers get better, the objects they make will become more detailed and defined, resulting in very high quality products.

Not only does this make way for cheaper manufacturing capabilities, but it also has the potential to change to the manufacturing industry as a whole. Instead of having certain items in your home made on an assembly line thousands of miles away, 3D printers could mean a miniature factory in every home. Imagine buying a computer model from designers for pennies on the dollar, then printing it yourself in as many quantities as you need. If 3D printers become popular enough, this may mean an end for cheap, small size manufacturing, but designers will also have instant access to a national market without the costs of shipping and accessibility.

Another use of the 3D printer that may be even more dramatic is its application in the field of organ replacement. It is currently possible to grow whole organs using only a few existing cells of the original and then bringing it into life. But for this to succeed, you must develop a cast for the organ to grow around which automates the process and gives the organ the correct shape. The best way to quickly and feasibly make these casts would be to use a 3D printer, which may soon find a home next to the X-ray machine.

### 2 Nano Technology & Engineering

This may be the innovation farthest from general public use, but its success could mean fundamental changes in the way people live, breathe, and go about their daily lives. Nanotechnology encompasses the sphere of engineering that involves anything and everything made on a near-invisible scale. Two particular niches of this field are of great interest: molecular nanoengineering and nanocomputers.

The former is all about engineering a new machine, such as a gear, but on a scale so small that the gear may only be one molecule of metal wide. If you design such a machine just right, you can make something very small that does one very simple thing, such as stimulating human muscle every time the gear and the muscle come into contact. Imagine that this machine was small enough to become lost in the overwhelming size of the human body and deployed in large quantities. The result is constantly stimulated muscles by hundreds of tiny machines. Looks like that toned, muscular body might not be that hard to get! Or maybe they could be designed to stimulate your eyes so that your vision gets better. They could even be used to target cancer cells.

One of the non-medical applications lies in construction. Small, tiny machines can collect microscopic building materials out of the atmosphere and deposit them into the shape of a building, practically making a structure appear out of thin air. It gets even better if you can combine such a machine with a nanocomputer. Transistors will be able to shrink by half at least every 13-18 months, which means that eventually they will be small enough to attach to molecular nanomachines, one transistor per machine, and become capable of precise targeting. The only issue left is how to power all those little machines...

### 1 Wi-Tricity

Nikola Tesla was an electronic engineering mastermind who invented the alternating current technology that provides power to most homes in the world. Yet some of his feats still puzzle today's most brilliant minds. In the early 20th century, Tesla was able to power gigantic machines wirelessly from many miles away. Wireless electricity, sometimes known by its portmanteau Wi-Tricity, is destined to cause one of the greatest changes in our lives. Only just (re)discovered by MIT scientists in 2007 by powering a light bulb from a few feet away, the technology still has a ways to go. Someday though, we'll forget what it was like to have to charge our cell phones. Duracell has already released its Powermat product capable of topping off the battery on accessories like smart phones and MP3 players when they are put directly on top of the charging pad.

The good news is that the distance away from the power source and amount of power provided will only become greater. The newest homes will likely have a centralized power unit for powering everything in the home from lamps to laptops. In time, it will also be able to discriminate what it provides power to (similar to the way Wi-Fi is password protected.) Eventually, we may never have to worry about where our power comes from, not only from which energy source (fossil fuels, nuclear, renewable) but also where exactly it's located.

How far away is such a technology? No one really knows. It all depends on how much the federal government is willing to invest in infrastructure in the coming years. Once it does come around though, wires will be one of those things you tell your grandkids about, in addition to the wonders of dial-up internet, and how Pluto was a planet.

*Valery Vislobokov is a senior in Aerospace Engineering*

# The Magic of Levitation



*By coating a crystal sapphire wafer with a copper oxide, and dipping it in liquid nitrogen, they've made a subzero puck with all the characteristics of a superconductor, capable of operating at room temperature.*

For years, we nerds have eagerly waited in front of our televisions and computers in the hope that we might someday observe the majesty of levitation devices. Since the dawn of sci-fi, fans have anxiously awaited the day when they could get their hands on a personal hoverboard, landspeeder, or jetpack. The Star Wars movies showed average citizens riding on floating landspeeders with ease. The Back to the Future movies proposed that the technology of hoverboards would be common by 2015. While we're still years off from ever seeing these fabulous technologies in popular society, 2011 brought us one step closer to the day when we can all own a personal hoverboard.

At the 2011 Association of Science - Technology Centers' annual conference in Baltimore, Tel Aviv University Professor Guy Deutscher and his students showed off quantum levitation. The university's website provides the following definition of quantum levitation: "Quantum physics tells us that the magnetic field penetrates into the superconductor in the form of discrete flux tubes. The superconductor strongly pins these tubes, causing it to float in midair. This effect is called 'quantum levitation.'" In slightly plainer English, quantum levitation is the way in which the qualities of a superconductor can be used to perfectly suspend that superconductor floating in a magnetic field.

Despite its name, the science behind the quantum levitation is quite simple. The properties of a superconductor are such that when a magnetic field is introduced to the superconductor, the magnetic field lines shift - pinching together in certain places and spreading apart in others as they pass through the superconductor. This causes the superconductor to be "locked" in place at whatever position in the x, y, and z planes the magnetic field created around the magnet. This is called quantum locking, and it's strong enough that passing an object under the superconductor will not affect its position.

Now this all looks nice on paper, but the process behind creating quantum locking is far more complex. Simply put, superconductors are devices that transport electrons and electrical charge with zero resistance and therefore zero energy loss. To achieve this, they need to be kept at extremely low temperatures that simply do not exist outside of laboratories. To solve this problem, the students at Tel Aviv created a new superconductor, and at a balmy  $-301^{\circ}\text{F}$  ( $-185^{\circ}\text{C}$ ), it's the warmest one yet. By coating a crystal sapphire wafer with a copper oxide, and dipping it in liquid nitrogen, they've made a subzero puck with all the characteristics of a superconductor, capable of operating at room temperature. And by doing so, they reinvented the wheel.

However, what good are wheels without a road? In addition to a simple plate, the Tel Aviv University students also created a magnet in the form of a large circle. The puck can easily float above or below the magnet at any angle or position you can imagine, and will glide so smoothly that it puts figure skaters to shame. Because there is no physical contact between the puck and its track, there is no friction (besides air resistance) And if you can have one puck float smoothly along a track, why not four? Due to quantum locking, the height of each puck is kept in place, and multiple pucks can glide above and below each other with no interference.

This technology gives hope to every person who has ever dreamed of a better, brighter future for levitation, and a mode of transportation that is just plain awesome. Personally, I dream of a day when train tracks can be outfitted with the magnetic field, and the underside of trains will be outfitted with the superconductor in order to form frictionless transportation. This would mean spending less energy, less fossil fuels, and less money on trains that can move passengers and goods faster and smoother than ever before.

*Matthew Dowdle is a Freshman in General Engineering*



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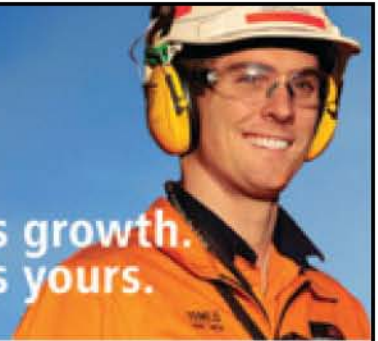


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