STEM 2023

SET YOUR OWN COURSE

This year has been a celebration of ten years for the Utah STEM Action Center and we want to thank all of our amazing partners and supporters for making this journey with us. We have learned a lot over the past ten years and cannot wait to continue our quest for more STEM, more partners and more exciting ideas.

The stories in this magazine highlight how our experience with STEM can result in fantastic journeys, and the diverse paths we can take in our education and careers. A journey always has a beginning, lots of exploration along the way, and new future directions. The stories that are featured represent individuals that are at each of these points in their STEM journey.

I often wonder what makes this journey worthwhile. I know for many of our partners there is joy in watching that spark ignite in a young child as they use their hands and minds to discover something new in science. There are many who find reward in providing STEM resources for Utah communities to ensure that they have access to lifelong learning opportunities. Is it as simple as a shared curiosity for all things STEM? The STEM Action Center team would love to hear what motivates you and brings that spark to your STEM journey. Please share your thoughts with us at stem@utah.gov.

Again, thank you to all of you that have made the past ten years a wonderful beginning to our STEM journey!

Dr. Tami Goetz, Director
Utah STEM Action Center

STEM ACTION CENTER
U · T · A · H

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ART& STEM

Crafting the Future

by Becca Robison

In a world where cool ideas and creativity come together to make life better, we've got someone special to introduce you to: AJ Mecham.

AJ HAS AN AMAZING TALENT FOR MAKING THINGS THAT WILL BLOW YOUR MIND. THEY'RE NOT JUST ANY ARTIST; THEY'RE A MODERN-DAY CREATIVE MAKER!

STEM AC: ***What is your earliest memory of being creative?***

AJ: I have done art my entire life and have always loved drawing pictures and coloring but I can't remember exactly what I would draw or do. What I can remember is I would always play with Barbie dolls. I would spend hours playing with them and coming up with storylines and dressing the dolls up to match. I also made clothes for them to the best of my ability. I think the fact that I was able to express my imagination with those dolls really helped kickstart my creativity.

STEM AC: ***Tell us about something you made that makes you particularly proud.***

AJ: Something that I've made that makes me proud was a bookmark for a scholarship competition. For the competition you had to make an original bookmark design and submit it. I was in the 9th through 12th grade bracket where I went up against a bunch of teenagers in those age groups across my school district. I ended up winning first place with my design and I am still really proud of that accomplishment.

STEM AC: ***How has being creative/making/ innovating impacted your life?***

AJ: Being creative, making things, and innovating has very positively impacted my life. I've been able to get so much support from so many people because of the things I have done. It has also opened me up to a lot of opportunities, such as the bookmark design scholarship that I wouldn't have even known about if a teacher of mine didn't tell me about it. It also opened me up to be able to work at the STEM Action Center because I had the opportunity to go in with a bunch of my friends and they ended up offering me a job because they were impressed with my work.

STEM AC: ***Why is creativity important?***

AJ: Creativity is important because it gives people an outlet and escape. It allows them to express themselves in ways that they otherwise wouldn't be able to. I know for me, allowing myself to be creative and being able to express myself through different art forms has really changed my life for the better and has made me so happy and proud.

STEM AC: ***What kinds of projects are you working on now?***

AJ: I have continued drawing throughout my free time and have been dabbling in creative writing to go with my illustrations but most recently I've been doing a lot of crocheting. I picked it up about a month and a half ago and I have REALLY gotten into it. I'm planning on making a series of little stuffed animals of characters from a video game so that will be my next big project.

STEM AC: ***What advice would you give to someone wanting to tap into their own creativity?***

AJ: My biggest piece of advice is practice, practice, practice. A lot of people I know have told me that they wish they could do what I do but aren't willing to put in the effort because they are stuck on the fact that at that moment they are "bad at drawing." They don't allow themselves to grow their skills and, on top of that, their self esteem. They think that because they are "bad" it is embarrassing to even try, so they don't. This is why my advice is to practice, because practicing can get you to a point where you can happily show people your creativity.

STEM AC: AJ has shown us that you can take everyday stuff and turn it into something super cool. And you know what? You can do it too! It's not just about making things; it's about letting your imagination run wild, trying new stuff, and leaving your mark on the world.

Creativity is important because it gives people an outlet and escape. It allows them to express themselves…

We hope that AJ's story has given you a burst of inspiration. Young makers like AJ remind us that we can all be super creative.

ENGINEERING & INNOVATION

Unleashing Your STEM Potential

by Kristina Schiffman

High school can be an overwhelming time, especially when the conversation inevitably shifts toward the future.

COLLEGE CHOICES, CAREER PATHS, AND LIFE'S GRAND PLAN suddenly loom large on the horizon. At 15 or 16 years old, it seemed like everyone around me already had an idea of what they wanted to pursue, the impact they wanted to have on the world. Adults I spoke with made it seem that I needed to choose the one thing I needed to do with my life, stick with it, and pursue it for life. I, however, did not want to accept this. I wanted to do everything, learn everything, and explore.

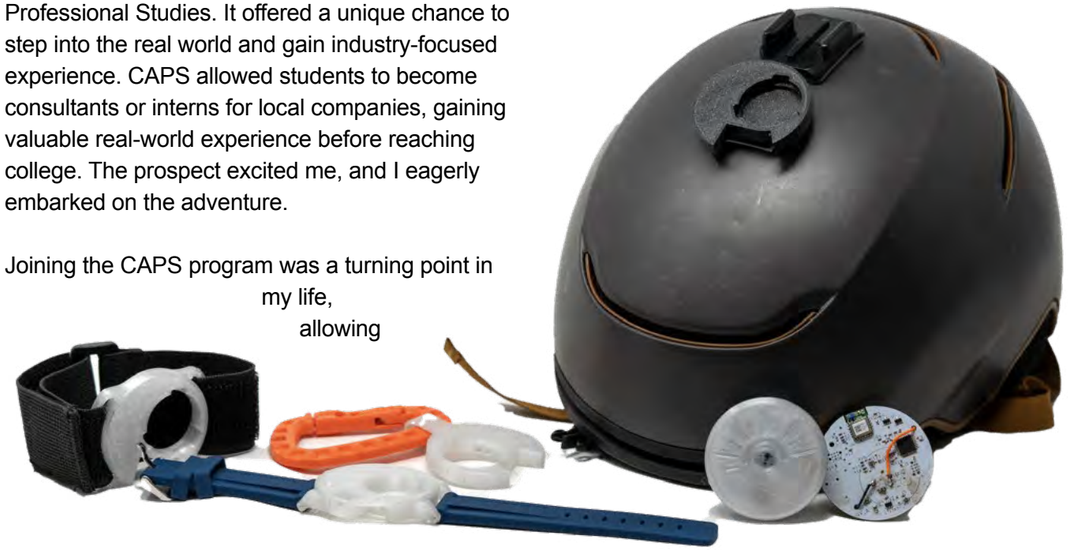
So, what did I do? I chose to embrace opportunities, explore the realm of possibilities, and discover my passion. If you're contemplating a journey into the world of STEM, I'm here to share my story, one filled with seizing opportunities and taking risks to find my passion.

In my sophomore year in high school, I had a vague inkling that STEM might be my calling. But how does a young mind navigate the maze of career choices in such a diverse and complex field? The answer: by diving in and exploring the landscape. That's precisely what I did.

I had heard of a program at my school called CAPS, short for the Center for Advanced Professional Studies. It offered a unique chance to step into the real world and gain industry-focused experience. CAPS allowed students to become consultants or interns for local companies, gaining valuable real-world experience before reaching college. The prospect excited me, and I eagerly embarked on the adventure.

Joining the CAPS program was a turning point in my life, allowing me to understand what the professional world looked like. It marked the beginning of a journey that would ultimately redefine my future. In this program, I was presented with a remarkable opportunity: working on an ultraviolet radiation-detecting wearable sensor, a wellness device with the potential to combat skin cancer. The concept was simple yet profoundly impactful: a small device that monitors an individual's sun exposure while outdoors and provides timely alerts to seek shelter from the sun's harmful rays. It was a challenge worth tackling. I dove into the opportunity, eager to explore my ability to handle engineering, business development, project management, and more.

It's been a thrilling experience, a testament to what can be achieved when you dare to explore and take risks.



The most recent version of UV Sense

Fast-forward five years, and I'm still deeply immersed in the development of the device, now known as UV Sense. Working on the UV sensor has been a journey in itself. I've had the privilege of collaborating with University of Utah dermatologists, delving into the intricacies of skin health and UV exposure. I have also had the experience of assembling and leading a team that has made profound progress toward developing a device that will make a real impact. In the development of UV Sense, we've made remarkable strides. Our focus has been on creating a functional Printed Circuit Board (PCB) encased in modular housing that can be worn in multiple ways. The device interacts

seamlessly with a smartphone application, providing users with real-time data about their sun exposure and advising them when it's time to seek shade. Furthermore, UV Sense has allowed me to participate in a medical device competition, file a patent for our work, and gain invaluable experience. It's been a thrilling experience, a testament to what can be achieved when you dare to explore and take risks.

Today as a student at the University of Utah, pursuing degrees in Mechanical Engineering and Business Administration, I continue to be driven by the passion that ignited my journey into STEM. UV Sense is not just a device; it's a symbol of what can happen when you follow your interests, a reminder that the path to success is often filled with exciting detours and opportunities waiting to be seized.

In this journey, I've encountered countless opportunities to get involved in my community and my academic world. One vital element that has allowed me to discover my passion for medical device development in STEM is my willingness to embrace opportunities.

The key to becoming yourself, and making a difference is to courageously explore the unknown, embrace the opportunities that come your way, and take those calculated risks to discover your true potential.

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Invention, Innovation and Finding 10,000 Ways to Fail

by Tami Goetz

We spend a lot of time using various products that are a result of inspiration from real people—inventors and innovators.

YOU PROBABLY DON'T CONSIDER WHAT IT TOOK TO GET THAT PRODUCT FROM A "TWINKLE IN THE EYE" OF THE PERSON WHO HAD THE IDEA, TO WHERE IT CAN HAVE A POSITIVE IMPACT ON YOUR LIFE. For instance, think about the medical products that have changed our lives. Readily available, and safe, insulin to treat diabetes. The current, and amazing, technologies that can be seen with prosthetics. The array of communication devices and technology and how they enable us to communicate in ways we never thought possible. Innovations in food production that address access to water, humane practices with animals. Did you know that many of these great ideas started in someone's garage? Some were happy accidents? And all were the result of lots of hard work and passion.

The ability to take an idea to a product can be a rewarding, but a risky and nerve-wracking experience. The first, and most important, factor in that process is an entrepreneurial spirit. An entrepreneur loves challenges. They like to put a variety of skills and talents to work to think about the needed research and design, build a business plan and convince potential investors that their idea will make a difference.

Let's take a walk back in time, and consider the history of invention and innovation that is at the heart of being an entrepreneur. You might be surprised to know that our founding fathers held the notion of invention and innovation so priceless that they wrote it into our US Constitution, Article I, Section 8, Clause 8:

"[The Congress shall have power…] To Promote the progress of Science and Useful Arts….by securing for limited Times to Authors and Inventors the exclusive right to their respective Writings and Discoveries."

The Constitution was put into operation in 1789 and one year later the Patent Act allowed for patents to be granted that protected new inventions and works by giving their creators exclusive rights to profit from them for up to 14 years. The language in the Patent Act allowed for the ability of women to secure a patent. This was at a time when women were not allowed to vote, and had limited property rights. That's how important the idea of invention and innovation was, and still is, to our society.

You have heard, I am sure, about all of the cool careers that you can pursue with STEM. There is no doubt a lot of people have incredible stories of the journey they took using STEM skills and knowledge. Your story can include being a STEM entrepreneur. STEM careers are an incredible place to use your entrepreneurial curiosity to invent and innovate. You can explore the stories of men and women who made HUGE differences in how we live—in work and play—and you can learn about those people at the National Inventors Hall

Did you know? A patent protects new inventions, processes and compositions of matter (such as medicines); a trademark protects names, short slogans or logos; a copyright protects original works, such as art, literature, or other created work.

of Fame website or the US Patent and Trademark Office's website.

- Invent.org
- USPTO.gov/learning-and-resources/kids-educators

Are you a big thinker, someone who wants to take that great idea to an amazing invention or innovation? Then here are a few pieces of advice:

- Face your fears. Fears exist for a reason, but they're never unconquerable.
- Take action. It can be hard, but super fun.
- Prepare for financial challenges. Learning to budget is a great skill.
- Find a trusted mentor. They are there to help you.
- Have your goals in mind. Write them down where you can always see them.
- Embrace your mistakes. They will happen and you can learn from them.
- Do work that you love. It's easy to love what you do, when you do what you love.
- Keep on networking. Find friends that can relate to what you are doing.
- Look for tools to use. Don't reinvent the wheel.
- Create a business plan. This helps to communicate your great idea.
- Listen to high quality information. Listen to people with solid experience.

The difference between innovation and invention: An invention is the creation of something entirely new; an innovation involves the improvement or modification of something that already exists

***"I have not failed, I have just found 10,000 ways that won't work."* —Thomas Edison.**

That is how this STEM journey begins—strive for that first way that won't work.

BOOMERANG

Hey there, future scientists and engineers! Ever wondered how those cool boomerangs work? Well, guess what—they're not just awesome toys; they're a super fun way to learn about some really cool stuff in science, technology, engineering, and math, also known as STEM!

When you make and throw a boomerang, you're not just having fun; you're also diving into the world of science, like how things fly and the materials they're made of. Plus, you get to be a mini-engineer by designing your boomerang for the best performance. And math plays a part too, especially when figuring out how to make it come back to you.

MAKER ACTIVITY

So, get ready for an adventure where you'll explore how science and math can make things soar and spin right back to your hands. Let's go!

1. MAKING THE AIRFOIL SLEEVES

We'll start by creating the special wing parts for our boomerang, called airfoils. Imagine these like the wings on an airplane. Here's how to make them:

- Take a piece of file folder material or thick paper.
- Cut out a rectangle that's about 5 inches long and 2 inches wide. You can use a template to help you cut the right shape.
- Tape one long side of this rectangle to a flat stick (like a tongue depressor).
- Now, fold the paper over the stick and make a good crease. It's like folding a piece of paper in half, but with the stick inside.
- Remove the stick, but keep the tape on the paper.
- Put the stick back in the fold you just made.
- Now, fold the other side of the paper over the stick and tape it down too. You've made an airfoil! Make two more just like this.

2. STICKING THE SPARS

Now, let's attach the sticks (spars) to the center of our boomerang. We'll use these sticks to make our boomerang strong:

- Use tape to attach one stick (tongue depressor) to the middle of the pattern you're using.
- Put some hot glue on the center of your pattern.
- Quickly place another stick on top of the hot glue, making sure it overlaps the first one. Press it down before the glue cools. Do this once more for the third stick. These sticks make your boomerang sturdy.

3. ADDING SOME TILT (DIHEDRAL)

Our boomerang needs a slight tilt in its wings. It's a bit like how an airplane's wings aren't flat. We'll check for this tilt:

- Spin your boomerang on a flat surface.
- Flip it over and spin it again.
- See which side spins better.
- Mark the top of the center hub with a "T" to remember it.
- If it doesn't spin well on one side, gently bend the sticks upwards on that side until it spins freely. The "T" side should always face you when you throw.

4. RIGHT-HANDED OR LEFT-HANDED SETUP

Now, let's set up your boomerang depending on whether you're right-handed or left-handed:

- If you're right-handed, make sure the "T" is facing up, and a stick points towards you.
- Slide an airfoil onto the stick so that the tape part is underneath and the hole for the stick is on your right side.
- If you're left-handed, the hole goes on the left side.
- Repeat this for the other sticks.
- Secure the airfoils in place with tape, and your boomerang is ready!
- Time to Throw! Boomerangs are like magic flying objects. Here's how to make yours come back to you:
- Always remember the "T" should face you when you throw.
- Hold one of the wingtips and throw it with a lot of spin.
- Aim it at about 1 o'clock if you're right-handed or 11 o'clock if you're left-handed.
- Throw it straight ahead, no need to throw it up.
- If it's not coming back, gently twist the wings so the flat end is higher, and it should come back to you.

NOW YOU'RE ALL SET TO HAVE SOME FUN WITH YOUR BOOMERANG!
TEMPLATE FOUND HERE: bit.ly/boomerang-template

Adventures at the Smithsonian Environmental Research Center (SERC)

How I traveled the world and started a citizen science program as a Field Biologist

by Monaca Noble, MS

I grew up in Utah and my first summer job was at a fish hatchery in Kamas. I am now employed by the Smithsonian Environmental Research Center—for 20 years now—and I love my job.

I WAS FIRST HIRED AS AN ADMINISTRATIVE ASSISTANT FOR THE MARINE INVASIONS LAB, BUT AS TIME ALLOWED I WAS FREE TO HELP WITH ANY PROJECT NEEDING AN EXTRA HAND. I took full advantage, working a little on every project I could including tending green crab larva in the lab, and sampling ballast water (water held in tanks or cargo holds of ships to provide stability) in ships arriving at the Port of Baltimore.

Just before I headed off to graduate school (Portland State 2003), I went on my first overseas trip to Japan and spent two weeks setting up a new ballast water experiment. This was the first of nine trips across the ocean that I would take on commercial ships. The ship was called the Lilly Fortune. We traveled from Haramachi, Japan, to Vancouver, Canada. Over the six days at sea, we collected over 320 ballast water samples. The crew were from the Philippines, and the cook prepared rice, squid, and eggs nearly every morning. The captain entertained us with stories of life at sea.

Over the next two years I headed trips on a cargo ship called the Cicople. Two of these were from Adelade, Australia, to Bluff, New Zealand, with a few stops along the way including a stop in Tasmania, where I got to see my first kiwi and platypus at a local science center.

After the Cicople, I rode two container ships (from Seattle to Los Angeles) and an oil tanker (from San Francisco Bay to Valdez, AK). Riding these ships was a completely different experience from coal and general cargo ships. The container ships were Danish, and on these ships the crew had Sunday dinner together and dressed for the occasion in their uniforms. The 26-person crews were from many different countries. They were immaculately clean, and I needed a couple of pairs of shoes to make sure nothing was being tracked into our quarters. The tanker was an American ship and much less formal, but just as clean.

From the early days of travel and adventure, to compelling desk work, to projects that engage a broader audience, I couldn't ask for more.

After my years of riding ships, SERC shifted the focus to surveying ports. From 2006 through 2009 I traveled to many different ports to collect water samples. We chartered boats and collected water from many different ports and bays along the West Coast, from the Salish Sea in Canada to San Francisco Bay and Los Angeles. Next, we traveled to Asia where we partnered with local universities to survey ports in Hong Kong, Taiwan, and Korea. I saw areas that most tourists never see and met some wonderful people who taught us about their countries and their cultures and shared their delicious food.

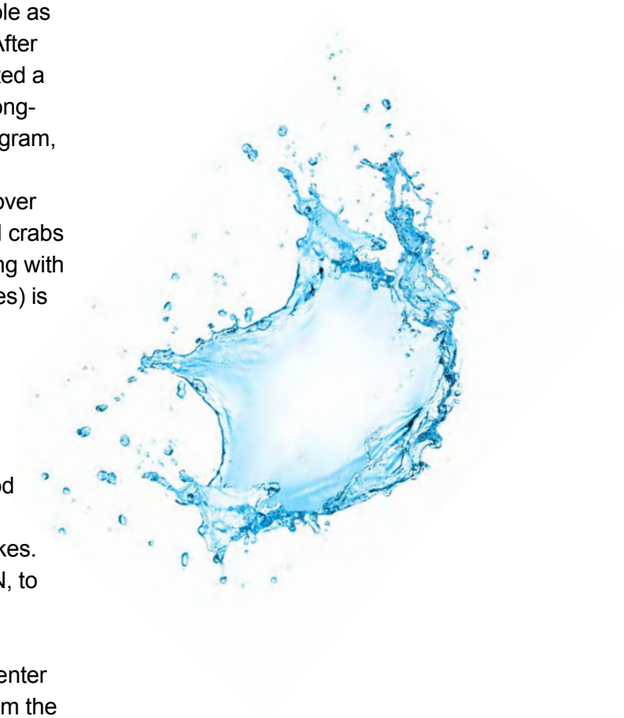
In 2010, I went on my final ballast water-related research trip. I traveled to Auckland, New Zealand, for three weeks to board and collect samples from as many ships as I could. In three weeks we boarded 30 ships and were able to collect samples from most of them.

I was married in 2011 and had my first daughter in 2012. By then I had transitioned into a new role as the lab's public outreach and science writer. After my second daughter was born in 2014, I started a new project combining public outreach with long-term research. The Chesapeake parasite program, or mud crab project[1], as it is more commonly known, is a citizen science effort. Each year over 100 people visit SERC to help us survey mud crabs and search for an introduced parasite. Working with our volunteers (high school students to retirees) is now the best part of my job!

In 2021, as soon as the pandemic slowed, I joined yet another research project called GLISSNet, or the Great Lakes Invasives Sentinel Site Network. We use sample method developed in Chesapeake Bay to collect and monitor benthic invertebrates in the Great Lakes. I travel a couple of times a year to Duluth, MN, to work in the Saint Louis River.

The Smithsonian Environmental Research Center has been an ideal place to build a career. From the early days of travel and adventure, to compelling desk work, to projects that engage a broader audience, I couldn't ask for more.

[1] https://twitter.com/SERCinvasions/



Meta

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COMMITTED TO ENERGY EDUCATION

The Utah Office of Energy Development (OED) is focused on educating and advancing Utah's energy future and building the energy workforce of the next generation.

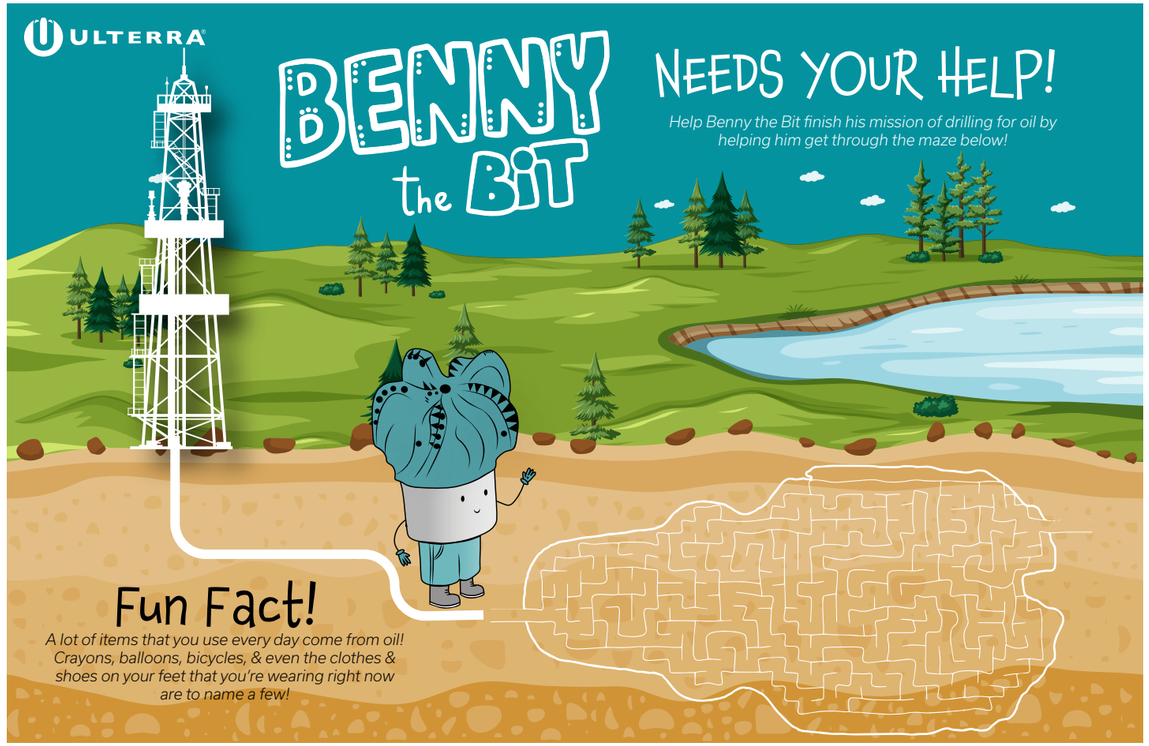
ENERGY CURRICULUM AND PROFESSIONAL DEVELOPMENT

Energy jobs in Utah pay, on average, three times what jobs in other industries pay. This is possible because Utah is a national leader in energy research, innovation, and workforce development. OED has partnered with the Utah Science Teachers Association (UtSTA) to provide more than 35 energy lesson plans that meet state SEEd standards. This curriculum is available for free at ***energy.utah.gov/curriculum***.

OED also sponsors teacher training events that walk through the energy curriculum. These professional development opportunities include lunch, lesson supply kits, substitute costs, and re-licensure credits. In 2019, OED created the Energy Educator Award to recognize teachers for excellence in science and energy education. Four teachers have since been honored with a $500 award.

UTAH ENERGY WORKFORCE SCHOLARSHIP

In partnership with Chevron, OED has provided over $135,000 in scholarships to students pursuing STEM education at Utah institutions of higher learning since 2016. This includes colleges, tech/trade schools, and universities. If you are a high school senior or first-year college student interested in applying, please visit ***energy.utah.gov/scholarships***



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Become an Engineer; See the World!

by Douglas Hendricks

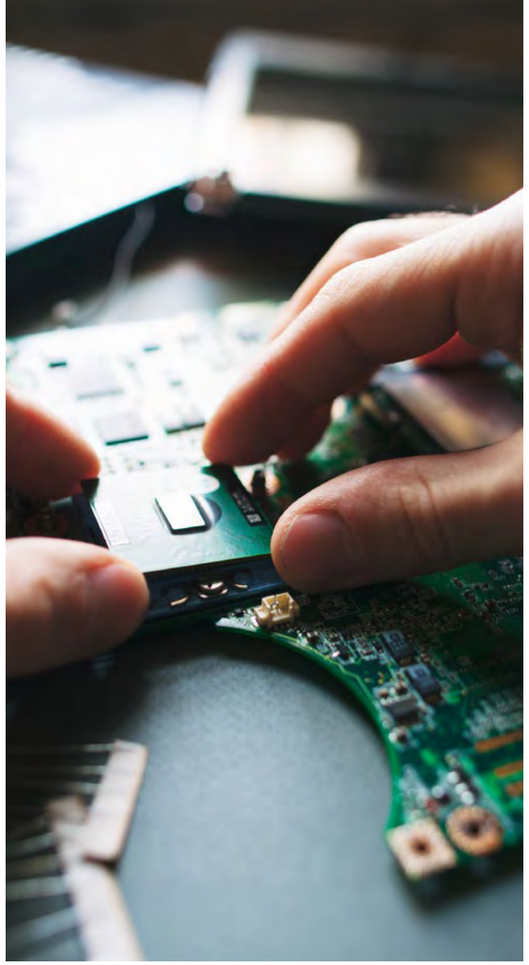
When most people think of engineering careers, “seeing the world” isn’t something they picture as part of the job. But sometimes it is.

APPLICATIONS ENGINEERING ISN’T A FIELD YOU’LL SEE LISTED IN A UNIVERSITY CATALOG. Electrical engineering, chemical engineering, civil engineering, and other such engineering specialties are ones that you may have heard about and are ones that you could major in at a university, but you can’t major in “applications engineering.” So what is it then, and how can it allow you to see the world?

An applications engineer is someone who has worked for a while as a “regular” engineer, and then after they’ve gained enough expertise, they are assigned to travel around and help other people use technology they’ve helped develop.

In my case, it was semiconductor manufacturing equipment. I graduated from the University of Utah with two bachelors’ degrees, one in chemical engineering and the other in physics, and then went to work for a company in Silicon Valley, California, making computer chips based on semiconductor technology. The equipment and processes that my company used to make computer chips was so advanced that, without the science and engineering skills I had acquired at the U, I never would have been able to solve the problems I was asked to tackle. After working at that job for a couple of years, I decided that I wanted to be one of the people who made the equipment that makes the computer chips, not one of the people who just uses that equipment. I wanted to design and build equipment that was capable of making the next-generation computer chips. To do that, I realized I needed more schooling, so I went back to graduate school. A year and a half later, armed with a master’s degree in optical sciences from the University of Arizona, I finally went to work for a company that made semiconductor manufacturing equipment.

My job title at my new company wasn’t “Chemical Engineer” or “Physicist,” like it had been at my first engineering job, or even “Optical Engineer.” My new job title was “Applications Engineer.” My job description was to take what I’d learned about the limitations of semiconductor manufacturing equipment while working at my first job, and then work with other engineers and scientists to design and build next-generation



equipment that overcame those limitations. Once the new equipment was working properly, my job was to travel all over the world to train engineers how to use our new equipment.

This is where world travel finally comes into the picture.

It’s unlikely that you’ve ever heard of the companies that I worked for as an applications engineer (KLA Instruments, and then later, Applied Materials), but I’m sure you’ve heard of the computer chip makers who bought equipment from my company and then needed my help to use it. Intel, Samsung, Micron, Advanced Micro Devices (AMD), Taiwan Semiconductor Manufacturing Company (TSMC), Toshiba, Sony, Siemens, Philips, and many others all bought my company’s equipment and needed the help of applications engineers to use it. It’s not an

exaggeration to say that every semiconductor device inside your computer or your phone… no matter where in the world that device was produced… was made using equipment that my colleagues and I designed and built.

To do my job I got to travel to Japan, Korea, Taiwan, France, Germany, Holland, Israel, Italy, England, India, Hong Kong, and many other places. One time I got on a plane headed east, spending time at various places in the USA, then crossing the Atlantic over to western Europe, then eastern Europe, then mid-east Asia, then far-east Asia, and then continuing east across the Pacific until I finally arrived back home in Silicon Valley where I had started. I spent an entire year living in Japan, and a half a year living in Israel.

I can't guarantee that if you become an engineer then you'll get to travel the world but I can tell you that it's certainly possible. I know people in industries completely different from mine who work as applications engineers and who travel like I did. They work for mining companies, or chemical manufacturers, or food and drug producers, or oil companies, and many others. They have degrees in Chemical Engineering, Mechanical Engineering, Electrical Engineering, Physics, and other "normal" disciplines, but their job titles now are "Applications Engineer."

So… although you won't see "Applications Engineer" on the list of possible disciplines to choose from when picking a major in college, you should know that it's a job you might choose after you get your diploma. It's a career path that's available to most, if not all, engineering disciplines and it's also available to people with degrees in physics, chemistry, computer science, and other STEM majors.

An engineering job really can be a great way to see the world.

Q: How does STEM inspire innovation?

A: STEM encourages finding creative solutions to real-world issues. Students solve open-ended problems without simple answers, but instead require innovation and experimentation. A first solution might not work, but that's OK, as long as the students keep trying.

BLENDING SCIENCE & ART

An Interview on Exhibit Design with Nate Hawks

Nate Hawks is an Exhibit Designer and Illustrator from Utah. When he's not working on exhibit design or illustration projects, he enjoys teaching design at the university level, spending time with his family, and caring for a small herd of tortoises.

Most recently, Nate created a new wall display about the whale sharks at Georgia aquarium in Atlanta.

What is an Exhibit Designer?
Most exhibit designers work for places like zoos, aquariums, and museums to create interactive spaces for learning. As an exhibit designer, I've worked with all kinds of different places on everything from signs to animal enclosures and playgrounds. No two projects are the same, and they all are challenging in their own way. I sometimes describe it as a job that combines a lot of different areas—art, construction, science education, and a whole lot of fun.

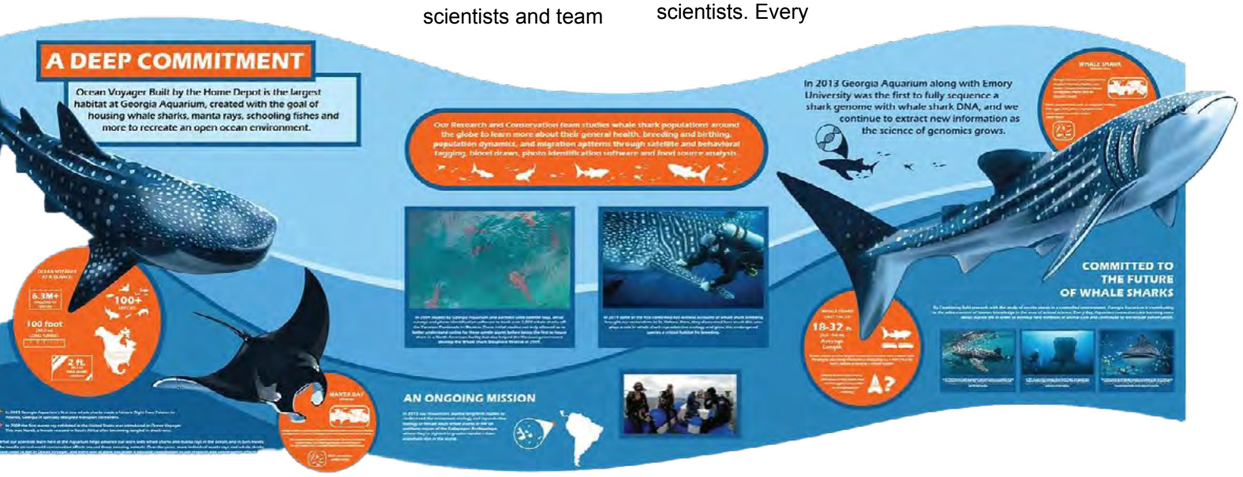
How did you become an Exhibit Designer?
Ever since I was a little kid I had two loves – art and animals. I wasn't sure how I was ever going to find a career path that combined both of them. When I was a teenager, I was able to volunteer at Utah's Hogle Zoo as an educator. I got to experience a lot of what it was like to work in a place like a zoo and see all of the work that goes into not only taking care of the animals but the zoo as a whole. When I got older, I went to college at BYU and majored in Illustration. While I was in school, I got a job at the Monte L. Bean Life Science Museum working as an educator, giving presentations all around Utah to school groups on biology and ecology subjects. Eventually, I had the opportunity to be mentored by both the museum's exhibit designer and graphic designer and began working on projects like murals, signs, and exhibit construction. It was an amazing experience that opened my eyes to the idea of working as an exhibit designer myself, combining so much of what I loved. Before leaving school, I was hired as an Exhibit Designer by the Loveland Living Planet Aquarium in Draper where I met some incredible people (not to mention fish) and learned a lot. I worked there for a couple years before leaving to begin working as a consultant for different aquariums and zoos.

How can art and science work together?
Art and science in my mind aren't all that different. For me, they are both excellent methods for learning about the world around us. Most of what I have learned about the natural world I've learned through drawing. Everything from the patterns and colors of bird feathers to the number of legs on insects and arachnids – through drawing these things I've been able to learn a lot about them.

What kind of technology do you use in your work?

Technology plays a big part in what I do. Even though most of my projects start with sketches on paper, most of the time I end up creating the final files for printing on a computer. I typically use my iPad or a drawing tablet to draw directly. These devices make it easy for me to interact directly with my work and draw in a digital space. If I were to create everything traditionally it definitely would be possible but much slower. I love using traditional tools but things like paint need time to dry, have to be scanned for printing, and overall slows me down.

For the whale shark wall at Georgia Aquarium, everything started in my sketchbook as doodles with a pen. Then, after working with the scientists and team



members at Georgia Aquarium to finalize the design, I created the illustrations by drawing and painting in Procreate on my iPad. I finalized the files for printing and installation in programs like Photoshop and Illustrator.

Even basic tools like a measuring tape are really important for everything I do. It's really hard to make a sign for a specific space or create a design for a mural if I'm not sure how big it needs to be. Getting little things like the measurements just right are some of the most important steps in the design process.

What kind of advice would you give to someone who wants to go into exhibit design?

Everyone's path is a little different but I would encourage an aspiring designer to learn as much about art and design as possible. Spend as much time drawing as you can and don't be afraid to mess up. If you can, get experience working in different places like zoos and museums as a volunteer. Try to meet people who work in the field and ask them questions. A lot of people who become exhibit designers have a professional background in art and design and have worked in zoos and aquariums in some way. Some have been zookeepers; others have been educators or scientists. Every experience you have will help you learn about the field as a whole and contribute to your overall exhibit design education.

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