



C5ISR CENTER STEM@Home

Welcome to STEM@Home!

As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.



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VOL 2, Issue 2

Brain Teaser

I have some candy in a bowl. It is all purple and green.

There are 3 times as many green pieces as there are purple pieces.

If there are 28 pieces of candy all together, how many are green and how many are purple?

Answer on Page 3



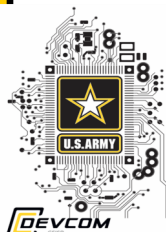
Now is a great time to get involved in STEM...

The C5ISR Center Community Outreach Office is pleased to announce our programs for November 2021:

- STEM Story Hour (Grades K-2) – Nov. 17 at 5 p.m.
- High School Life Hacks (Grades 9-12) – Nov. 3 at 6 p.m.
- Middle School STEM Night (Grades 6-9) – Nov. 10 at 6 p.m.

Visit our registration page for more details:

<https://usarmyc5isrcenter.submit.com>



OUTREACH

*Due to COVID-19, programs are currently virtual.

Technology in the Army

Army Engineers and Researchers Process of Designing New Technology

If you have been to one of the C5ISR Center's STEM Outreach programs, you may have heard the expression, "A great engineer uses the engineering design process." This process involves these steps: ask, research, imagine, plan, create, test, and improve. Engineers and researchers in the Army use this process to develop technology that enhances the Soldier's effectiveness and safety.

C5ISR Center employees Dr. Todd DuBosq and Dr. John Graybeal use the engineering design process to produce the best equipment possible for our nation's Soldiers. DuBosq, the C5ISR Center Field and Measurement Support branch chief, oversees the organization branch that has a perception lab, where they do human perception experiments, and has a team of psychologists that work in the lab.

According to DuBosq, "Engineers understand the science of how a sensor works, but the interaction with a human touch is where the psychologists come in." These psychologists are not your typical psychologists in the sense that you would be able to go them for counseling, but they have a background in how humans use automation.

Additionally, Graybeal has more than eight years of experience in designing experiments.

One of their pieces of equipment helps Soldiers to see in the dark, otherwise known as night vision. This equipment required some testing to be done to make sure everything was working correctly and was ready to be used out in the field. With the help of Army Soldiers, DuBosq and Graybeal conducted a week-long study to test this equipment. These testing events are held four times a year, allowing experts a chance to get feedback on prototypes that have already been developed and to give the engineers ideas to make predictions for new technologies.

"We're trying to get the best sensors into the hands of Soldiers to perform their missions in day- and night- time environments," said DuBosq.

During these tests, DuBosq and Graybeal gather both qualitative and quantitative data. Quantitative data consists of data that can be counted and measured, while qualitative data is less structured and typically takes the form of words or text. Not only did DuBosq and Graybeal measure scores from the study, but they also interviewed Soldiers to gather additional data.

"We want to be building exactly what Soldiers need and what they want," said Graybeal. "The best way to do that is to simply ask them."

This type of experiment helps DuBosq, Graybeal, and their team collect accurate data that can be used and applied in the real world, like improving their equipment and systems. With the results they collect, the C5ISR Center night vision team can give the Soldiers an advantage in performing their jobs.

With the help of the engineering design process, DuBosq, Graybeal, and their team have invented, developed, and tested technology that help our Soldiers carry out their missions and be as safe and effective as possible while doing it. Their knowledge, determination, and ability to collaborate as a team have made it possible to see their mission through at home from start to finish.

Resource: <https://www.army.mil/article/247129>



STEM Challenge

Ghost in the Graveyard

With spooky season upon us, can you take on the challenge of getting as many ghosts as possible from the graveyard?

Materials:

- Popsicle sticks
- Cardboard
- Small cup or bowl
- Yarn or string
- Paper clip
- Tape
- Glue
- Plastic bottles
- Aluminum foil
- Pipe cleaner
- Straws
- Other items in your home

Testing Materials:

- Cotton balls
- Marshmallows

Mission:

Hank the friendly ghost has reached out to you to see if you can create a ghost transport device to lift as many ghosts as possible from a graveyard using a pulley system.

Requirements:

Transport the maximum number of ghosts from the graveyard (cotton balls, marshmallows) using a pulley system.

Design Process:

ASK: What is the problem you need to solve? What is something in your school or community that you would like to solve or improve?

RESEARCH: Research what products or solutions already exist and find technologies that might be adaptable to your needs for the problem that you are trying to solve.

IMAGINE: Brainstorm and decide on one idea. How will your new technology solve the problem that you have identified?



PLAN: Draw a picture of your ghost transport device. What does your design look like and how does it work?

CREATE: Use the materials to create a prototype.

IMPROVE: How can you improve your ghost transport device? Use the suggested testing materials to test out your ghost transport device.

Questions to ask: If you had more choices of materials, what would you use and why?

SHARE: Show your family and friends your ghost

STEM HUMOR

Q. What position in hockey does a ghost play?

A. *Ghoulie*



SAFETY FIRST!

You Must Have Adult Supervision To Complete This Activity.



Ask an adult to Share your STEM on Facebook.

[Facebook.com/DEVCOM.C5ISR](https://www.facebook.com/DEVCOM.C5ISR)

#C5ISRCenterSTEM

Answer from page 1: There are 21 green candies and 7 purple candies.

Math explained: Let number of green candies be x and purple be y . $x = 3y$ and $x + y = 28$; substitute value of x from equation 1 and 2. $3y + y = 28$; balance the equation; $x = 21$ and $y = 7$.

Mini Highlights



Todd DuBosq

Job Title: Chief, Field and Measurement Branch

C5ISR Center: 14 years

SME Performance Modeling: 5 years

Branch Chief: 4 years

Education:

B.S. Physics, Stetson University

M.S. Physics, University of Central Florida specializing in Optics

Ph.D. Physics, University of Central Florida, specializing in Optics

1. What drew you to the STEM field originally?

As a kid, I always wanted to understand how things around me worked. When I took my first physics class in high school and saw that a scientific equation could predict the outcome of an experiment, I was hooked and knew that I wanted to be a scientist. My passion for optics and lasers began when I built an optical system in college, producing my first hologram.

2. Why is STEM important to our national security and our national future?

STEM education teaches critical thinking skills that can be applied to our most difficult national security problems. STEM also instills a passion for innovation that will continue to push the limits of state-of-the-art technology while maintaining the importance of following the scientific method. These innovations will allow us to create advancements for generations to come.

3. How can students further their interests in a STEM field?

The main thing I would recommend is to always ask questions and pursue a love for learning. Once you find a topic that interests you, search for resources to explore it further such as books, articles, videos, or science kits. There are also many STEM clubs and groups at the local level to explore coding, robotics, chemistry, engineering, and other science topics.



John Graybeal

Job Title: Engineering Psychologist

Number of years: 4.5

Education:

B.S. Psychology, Bridgewater College

M.A. Psychology, Biopsychology Concentration, George Mason University

Ph.D. Psychology, Cognitive and Behavioral Neuroscience Concentration, George Mason University

1. What drew you to the STEM field originally?

I was drawn to the field by passionate mentors. I started my educational focus on psychology because I wanted to be a counselor. I wasn't really sure what I wanted to do with my life, but I figured if I was able to learn more about how people think and act, I'd be able to help in some way. Passionate teachers exposed me to the rigorous scientific experimental methodologies we've developed to explore how people think and perform. I fell in love with the field and have been conducting research ever since. Psychology has a reputation as a soft science, but I use the scientific method and complex statistical analyses daily. STEM is vital to ensuring that the technologies we develop work properly and help Soldiers in the ways that we intend for them to.

2. Why is STEM important to our national security and our national future?

STEM is critical to our national security. The technology gap we have enjoyed between our armed forces and our adversaries has narrowed. Future STEM leaders are needed in order to maximize the safety of our service members by developing innovative technologies. For my part, I leverage scientific best practices to develop quantitative and qualitative experiments that capture Soldier performance data and Soldier feedback. This data is used to test and improve emerging sensor and display technologies.

3. How can students further their interests in a STEM field?

One of the best ways to learn about STEM is to try and use your knowledge to solve real-world problems. We frequently learn deeply when there is a meaningful problem to solve and we have a vested interest in the outcome. This could be something as simple as trying to apply a math formula you learned in school to your own personal circumstances. Or, it could be as complex as participating in science fair projects or internships.

STEM Experiment

Materials:

- 2/3 cup of all purpose flour
- 1/3 cup of baking soda
- Towels
- 2 tbsp of melted vegetable oil or coconut oil
- Small bowl with vinegar
- Syringe or spoon
- Candy eyes or googly eyes
- Measuring cups and spoons
- Baking dish or baking sheet with small lip to hold your bubbly experiment



Fizzing Ghost Experiment

With Halloween in just a few days, try this fun experiment with a spooky twist that will make you want to say BOO! Before you can see your fizzing friendly ghost, you need to make your moon dough using some common household items.

Directions:

1. Find an area where you have space to work. Lay down a towel to protect your work surface then place your baking dish or sheet on top of it.
2. Using your hands or a spoon, mix flour and baking soda in your dish.
3. Pour in the oil and mix together with your hands. Make sure to mix until the mixture has a soft, crumbly texture to allow you to mold it into different shapes.
4. Shape your moon dough into ghostly shapes and add your eyeballs to give it a spooky look.

Resource: www.steampoweredfamily.com/activities/fizzing-ghosts-moon-dough/

SAFETY FIRST!



You Must Have
Adult Supervision
To Complete This
Activity.

How Does This Work?

When you mix the two common household ingredients of baking soda and vinegar together, there are actually two reactions taking place. The first is an acid-base reaction with the baking soda being the base and vinegar as the acid. The hydrogen atoms in the vinegar react with the sodium and bicarbonate ions in the baking soda, which results in the two new chemicals carbonic acid and sodium acetate.

The second reaction that takes place is a decomposition reaction. The carbonic acid that was formed immediately begins to decompose into water and carbon dioxide gas. The carbon dioxide that formed rises to the top of the mixture. This is what creates the bubbles and foam you saw in the experiment when you added the vinegar to the baking soda.

The following is the chemical formula of this reaction:



Vinegar + sodium bicarbonate \rightarrow sodium acetate + water + carbon dioxide



Learn more at <https://www.usaeop.com/program/ecybermission/>

The Army Education Outreach Program (AEOP) eCYBERMISSION registration is open for students, team advisors, and volunteers! eCYBERMISSION is a web-based STEM competition that helps students grades 6-9 learn about real-life applications of STEM. Teams of three or four students are instructed to ask questions or define problems and then construct explanations or design solutions based on identified problems in their community.

- Nov. 15, 2021 – Mini-grant application deadline
- Nov. 23, 2021— Early registration closes and deadline to receive a free STEM kit (students must be on a team to qualify)