

# Natural Hazards and Disasters

U.S. Army Corps of Engineers

**STEM**  **Program**

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In coordination with the Department of Defense Education Activity

## Top Global Issues

The Department of Defense has identified a number of concerns impacting the nation and are seen as jeopardizing our position as the global economic and political leader.



- **STEM** and Cyber Security
- Obesity and Health Concerns
- Terrorism and Safety
- **Environment Issues** and Climate Change
- Energy Use and Conservation

## “TOP Global Concerns”

**Environment Issues** are jeopardizing our position as the global economic and political leader.

These issues typically center around **natural hazards** which are naturally occurring events that poses a danger to human life or property.



## Why are Natural Hazards and Disasters a Top Concern?

The official, DHS's assistant secretary for policy David Heyman, testified before the Senate Committee on Homeland Security and Governmental Affairs.

The cost of responding to 14 **natural catastrophes in 2011** exceeded a billion dollars each and there were 98 presidentially declared disasters, a record number.



***“Without a concerted effort -- national resilience effort, the trend is likely to continue,” he warned.***

## Billion-Dollar Weather/Climate Disasters

Years (1980 - 2011)

**Fig. 1** US Billion-dollar Weather and Climate Disaster time series from 1980-2011 indicates the number of annual events exceeding \$1 billion in direct damages, at the time of the event and also adjusted to 2011 dollars using the Consumer Price Index (CPI)

	Number of Disaster Events	Adjusted Damages (\$ Billions)	Percent Damage	Percent Frequency
Tropical Cyclones	31	417.9	47.4%	23.3%
Droughts/Heatwaves	16	210.1	23.8%	12.0%
Severe Local Storms	43	94.6	10.7%	32.3%
Non-Tropical Floods	16	85.1	9.7%	12.0%
Winter Storms	10	29.3	3.3%	7.5%
Wildfires	11	22.2	2.5%	8.3%
Freezes	6	20.5	2.3%	4.5%
<b>Total</b>	<b>133</b>	<b>881.2</b>	<b>100.0%</b>	<b>100.0%</b>

**Table 1** Damage, percent damage, frequency, and percent frequency by disaster type across the 1980-2011 period for all billion-dollar events (adjusted for inflation to 2011 dollars)

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### Reference

Smith, A., and R. Katz, 2013: U.S. Billion-dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases. Natural Hazards, DOI 10.1007/s11069-013-0566-5.

## News Flash

In 2013, NOAA's National Climatic Data Center (NCDC) reported there were 7 weather and climate **disaster** events with losses exceeding **\$1 billion** each across the United States.

These events included five severe weather and **tornado** events, a **major flood** event, and the western drought / heat wave. Overall, these events killed 109 people and had significant economic effects on the areas impacted.



*\*Further data and figures on individual events will be announced later in the year.*

## Defining the Problem?

Every year in the United States and throughout the world, **natural hazard events** threaten lives and livelihoods, resulting in deaths and billions of dollars in destruction.

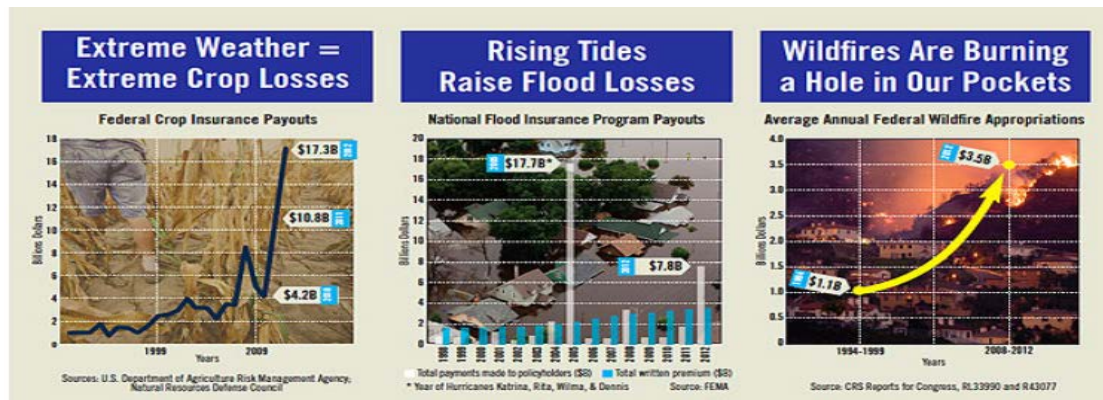


Image credit: Ceres

Public disaster-relief and -recovery programs have been slow to recognize that worsening **natural hazards** that lead to disasters drive up future losses to unsustainable levels.

## Top Global Concerns



An important opportunity exists for how the US Army Corps of Engineers (USACE) and DoDEA can make a difference by addressing two of the **“TOP Global Concerns”**

**But how?....**



## Getting Started

Natural hazards and disasters affects everyone throughout the world, in some way.

**USACE**, the Nation's leading **public engineering agency**, works with other federal agencies to provide:

- Support to domestic and international disasters including the Midwest flood fights, gulf coast oil spill, the earthquake in Haiti and the recent tsunami in Japan.
- Drinking water and ice, cleans up debris, provides auxiliary power, inspects and assesses damaged areas, and
- engineering expertise to state and federal officials.

## DoDEA Students

**You** are the problems solvers of today and tomorrow...and have the potential of engineering the future....



## U.S. Army Corps of Engineers (USACE) DoDEA Partnership

- In May 2013, the U.S. Army Corps of Engineers (USACE) decided to take a more direct approach to increase college and career readiness and student interest in Science, Technology, Engineering and Mathematics (STEM) by establishing a one-of-a-kind partnership with the Department of Defense Education Activity (DoDEA).



- The partnership resulted in a USACE specific STEM outreach program, **STEM ED**, which advances STEM education in communities where DoDEA and USACE activities are co-located.

## What is STEM ED?

STEM ED is a unique program of rigor that adds **engineering design concepts** to the Natural Hazards and Disasters curriculum.



1. Sets forth a learning platform for how the world works within and across the interrelated disciplines through content and conceptual understandings coupled long-term interactions with STEM professionals;
2. Students work with a minimum of two **USACE volunteers—military** and civilian engineers and scientists—to explore a STEM project with the concept to build strong structures that withstand forces of nature.

## What Makes STEM ED a Unique Program?

- Inclusive Program (in classroom) **STEM professionals"** Involvement
- Efforts Cross walked to **Standards**
- **Problem/Inquiry** Based Learning
- **Evaluation** and Metrics
- Consistent **Sustainable** Program



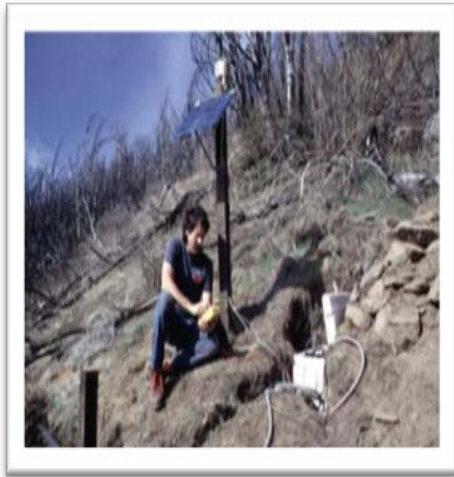
## What is STEM?

STEM is an acronym for four disciplines: the study of mathematics, science, engineering and technology.

- There are clear **connections** between all of these disciplines, with an interplay that generally varies as the context.
- Even though the **four related disciplines** all overlap, STEM is not a unique entity unto itself.
- STEM is driven by a national demand to produce students who are able to **apply** understanding of **how the world works** within and across the interrelated disciplines.
- Students engage in project or problem –based learning that infuses the disciplines through the application of engineering and design.

## Technology and Applications of Science

**How we build resilience rather than just focusing on public disaster-relief and -recovery programs?**

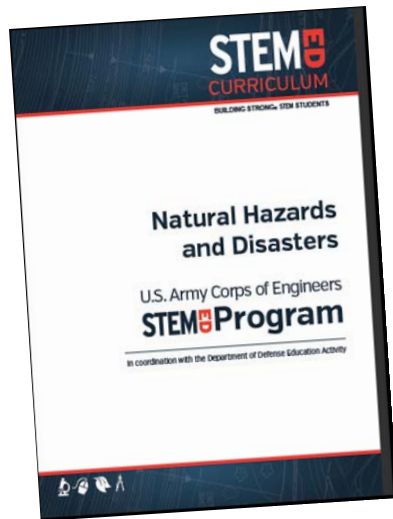


Science, technology and engineering play an important role in reducing risks and building the resilience by finding new ways to:

- prepare for climate change and extreme weather
- expand renewables and energy efficiency
- renew and strengthen infrastructure
- create “new” innovative solutions of inventions

# The Natural Hazards and Disaster Unit

Aligns with DoDEA Grade 7 Science Standards, and the goal is for students to understand that:



- Natural hazards present high risk to human lives and infrastructure
- A key aspect of natural hazard mitigation is the implementation of adequate strategies for data collection, processing, and sharing, and
- Multiple federal agencies work together as a team to provide support when a disaster occurs.



## DoDEA Students

**You** are the problems solvers of today and tomorrow...let's work together...and engineer the future....by learning to **build strong!**



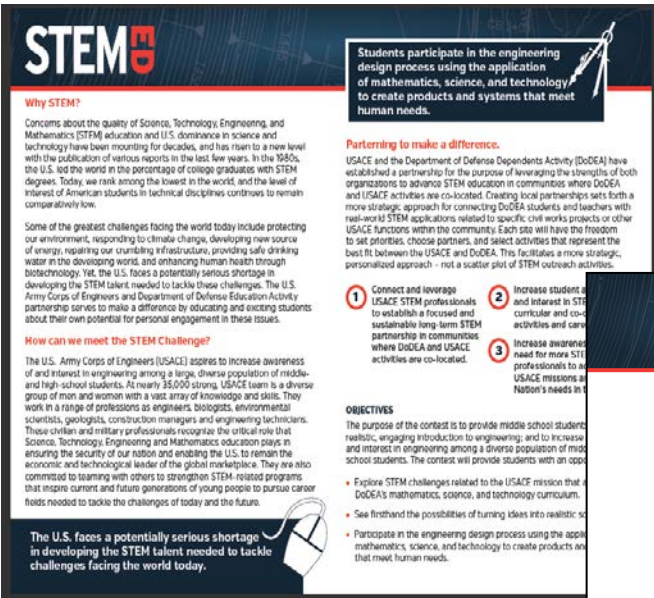
## The Plan

The USACE professionals will work in classrooms one to two hours per week for approximately six weeks, addressing challenges that relate to the **USACE** mission and align with the DoDEA grade 7 science curriculum and STEM applications.

### **The USACE STEM Volunteers will:**

- Demonstrate the real-world relevance of science, technology, mathematics, and engineering (STEM) topics that are being taught in the classroom;
- Make specific connections between what students are doing in class and what they will be doing in the world of work and higher education;
- Discuss the STEM field they represent, including different jobs within the USACE, levels of required education, expected compensation, and DoD's short- and long-term needs for civilian workers; and
- Describe the importance of perseverance and hard work in STEM-related fields, the process of working as part of a team, and the importance of critical thinking, knowledge application, and communication skills to solve problems collaboratively.

## Program Components



**STEM CURRICULUM**  
BUILDING STRONG STEM STUDENTS

**Why STEM?**  
Concerns about the quality of Science, Technology, Engineering, and Mathematics (STEM) education and U.S. dominance in science and technology have been mounting for decades, and has risen to a new level with the publication of various reports in the last few years. In the 1980s, the U.S. led the world in the percentage of college graduates with STEM degrees. Today, we rank among the lowest in the world, and the level of interest of American students in technical disciplines continues to remain comparatively low.

Some of the greatest challenges facing the world today include protecting our environment, responding to climate change, developing new source of energy, repairing our crumbling infrastructure, providing safe drinking water in the developing world, and enhancing human health through biotechnology. Yet, the U.S. faces a potentially serious shortage in developing the STEM talent needed to tackle these challenges. The U.S. Army Corps of Engineers and Department of Defense Education Activity partnership serves to make a difference by educating and exciting students about their own potential for personal engagement in these issues.

**How can we meet the STEM Challenge?**  
The U.S. Army Corps of Engineers (USACE) aspires to increase awareness of and interest in engineering among a large, diverse population of middle- and high-school students. At nearly 35,000 strong, USACE team is a diverse group of men and women with a vast array of knowledge and skills. They work in a range of professions as engineers, biologists, environmental scientists, geologists, construction managers and engineering technicians. These civilian and military professionals recognize the critical role that Science, Technology, Engineering and Mathematics education plays in ensuring the security of our nation and enabling the U.S. to remain the economic and technological leader of the global marketplace. They are also committed to learning with others to strengthen STEM-related programs that inspire current and future generations of young people to pursue career fields needed to tackle the challenges of today and the future.

**The U.S. faces a potentially serious shortage in developing the STEM talent needed to tackle challenges facing the world today.**

**Students participate in the engineering design process using the application of mathematics, science, and technology to create products and systems that meet human needs.**

**Partnering to make a difference.**  
USACE and the Department of Defense Dependents Activity (DoDEA) have established a partnership for the purpose of leveraging the strengths of both organizations to advance STEM education in communities where DoDEA and USACE activities are co-located. Creating local partnerships sets forth a more strategic approach for connecting DoDEA students and teachers with real-world STEM applications related to specific, civil works projects or other USACE functions within the community. Each site will have the freedom to set priorities, choose partners, and select activities that represent the best fit between the USACE and DoDEA. This facilitates a more strategic, personalized approach – not a scatter plot of STEM outreach activities.

**1** Connect and leverage USACE STEM professionals to establish a focused and sustainable long-term STEM partnership in communities where DoDEA and USACE activities are co-located.

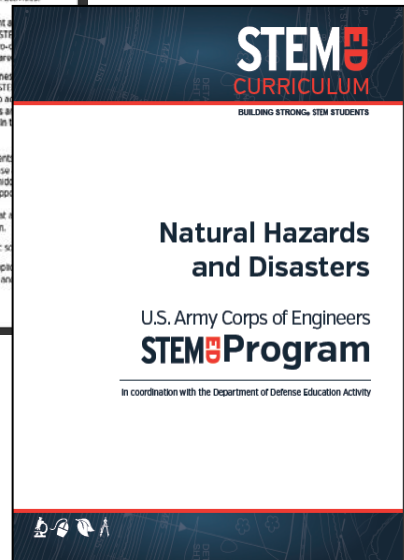
**2** Increase student awareness and interest in STEM curricular and co-curricular activities and careers.

**3** Increase awareness of the need for more STEM professionals to address USACE missions as a Nation's needs in the future.

**OBJECTIVES**  
The purpose of the contest is to provide middle school students realistic, engaging introduction to engineering; and to increase awareness and interest in engineering among a diverse population of middle school students. The contest will provide students with an opportunity to:

- Explore STEM challenges related to the USACE mission that address DoDEA's mathematics, science, and technology curriculum.
- See firsthand the possibilities of turning ideas into realistic solutions.
- Participate in the engineering design process using the application of mathematics, science, and technology to create products and systems that meet human needs.

Brochure




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**Natural Hazards and Disasters**

U.S. Army Corps of Engineers  
**STEM Program**

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Curriculum



**STEM CURRICULUM**  
BUILDING STRONG STEM STUDENTS

**U.S. ARMY CORPS OF ENGINEERS**  
BUILDING STRONG STEM STUDENTS

**Why STEM?**  
Concerns about the quality of Science, Technology, Engineering, and Mathematics (STEM) education and U.S. dominance in science and technology have been mounting for decades, and has risen to a new level with the publication of various reports in the last few years. In the 1980s, the U.S. led the world in the percentage of college graduates with STEM degrees. Today, we rank among the lowest in the world, and the level of interest of American students in technical disciplines continues to remain comparatively low.

In order to increase college and career readiness and student interest in STEM, the U.S. Army Corps of Engineers (USACE) and the Department of Defense Education Activity (DoDEA) established a partnership in May 2013. Unlike other STEM activities, this program is embedded in the classroom and tied to the DoDEA curriculum. The program provides integrated conceptual understanding and face-to-face, long-term interaction with teachers and students.

**The Partnership**  
USACE and the Department of Defense Dependents Activity (DoDEA) have established a one-of-a-kind partnership for the purpose of leveraging the strengths of both organizations to advance STEM education in communities where DoDEA and USACE activities are co-located. Creating local partnerships sets forth a more strategic approach for connecting DoDEA students and teachers with real-world STEM applications related to specific, civil works projects or other USACE functions within the community. Each site will have the freedom to set priorities, choose partners and select activities that represent the best fit between the USACE and DoDEA. This facilitates a more strategic, personalized approach.

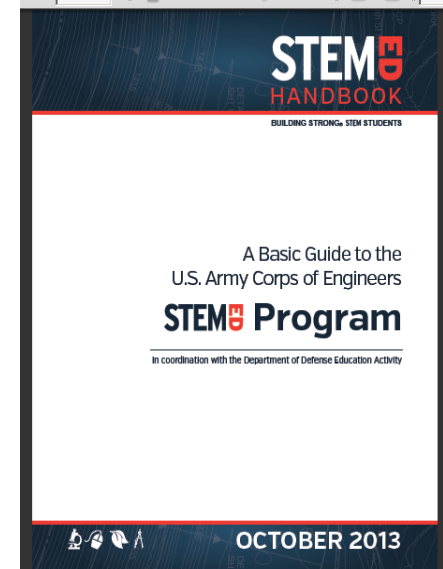
**Objectives**

1. Connect and leverage USACE STEM professionals to establish a focused and sustainable long-term STEM partnership in communities where DoDEA and USACE activities are co-located.
2. Increase student awareness and interest in STEM curricular and co-curricular activities and careers.
3. Increase awareness of the need for more STEM focused professionals to address USACE missions and the Nation's needs in the future.

**Why Forward**  
Students will work with a minimum of two USACE volunteers—military and civilian engineers and scientists—at seven pilot schools to explore a STEM project with the concept: Building strong structures that withstand the forces of nature. The STEM professionals will be in the classroom one to two hours per week for approximately six weeks addressing STEM challenges that relate to the USACE mission and align with DoDEA's curriculum. The program will culminate in a competition and award ceremony during National Engineers Week in February of each year.

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www.usace.army.mil

Fact Sheet



**STEM CURRICULUM**  
BUILDING STRONG STEM STUDENTS

**STEM HANDBOOK**  
BUILDING STRONG STEM STUDENTS

A Basic Guide to the  
U.S. Army Corps of Engineers  
**STEM Program**

In coordination with the Department of Defense Education Activity

OCTOBER 2013

Handbook

