BACKGROUND
BACKGROUND

- STEM and GIS can be incorporated into just about any class. It especially creates possibilities for cross-curricular projects.

- In STEM the idea of project-based real-world learning matches with the capabilities of GIS.
• Teaching with GIS employs an inquiry-based, problem-solving approach to learning that also promotes valuable spatial thinking skills. This approach not only benefits the teaching of geography but also science, technology, engineering, and mathematics (STEM), as well as the humanities.

“Today, spatial thinking is more relevant than ever before as issues such as climate change, economic globalization, urban sprawl, biodiversity loss, sustainable agriculture, water quality and quantity, crime, cultural diversity, energy, tourism, political instability, and natural hazards grow in importance on a global scale but also increasingly affect our everyday lives.”
– Joseph Kerski, ESRI
NAVAL STEM

• The Department of Defense (DoD) has long supported STEM education and outreach activities throughout the nation.

• Naval STEM supports the Department of the Navy (DoN)’s Navy and Marine Corps education and outreach programs.
Three focus areas of Naval STEM programs include:

- Inspiring, engaging, and educating the next generation of scientists and engineers, technology professionals, and medical professionals
- Employing, retaining, and developing a diverse civilian and military technical workforce
- Collaborating across the Naval STEM communities and with other agencies to maximize benefits to the DoN
LET US STATE IT UP FRONT AND IN UNMISTAKABLE WORDS: STRONG NAVAL STEM EFFORTS ARE CRITICAL TO AMERICA’S FUTURE, AND ARE A MATTER OF NATIONAL SECURITY.

-Chief of Naval Research Rear Adm. Lorin Selby, Naval STEM Executive
• Children learn in a variety of ways, but **visual learning** is especially effective. Using maps in the classroom illustrates geographic context, helping students connect lessons with **real places**.
GEOSPATIAL TOOLS ENHANCE STEM ACTIVITIES

- Promotes student engagement and develops critical thinking skills.
- The “rise of drones” has captured the attention and imagination of students worldwide, enabling geospatial technology to be placed in the hands of students of all ages using an engaging and fun 'toy.'
FREE GIS SOFTWARE (FOR EDUCATORS)

ArcGIS Online is a mapping platform freely available to public, private, and home schools.

A school subscription provides additional security, privacy, and content features.

Learn more about ArcGIS Online and the school subscription at http://www.esri.com/schools.
EXAMPLES OF GIS STEM ACTIVITIES

GIS Scavenger Hunts

D-Day STEM GIS Activity

Fundamentals of GIS & Location Intelligence
The Office of Naval Research (ONR) manages the Department of the Navy STEM coordination office, to foster student interest in the sciences and hence build the future science and technology workforce.

ONR requires Naval labs to track and report STEM outreach metrics; Naval STEM is continuously assessing which projects to grow, sustain or reduce.
## CURRENT PROCESS

[Manual and prone to human error]
CHALLENGES OF CURRENT PROCESS

• Reporting STEM metrics is very time consuming for leadership.
• Prone to human error and inconsistencies with data making it difficult to compile reports.
• Inability to ‘quickly answer’ questions about STEM Outreach efforts.
• STEM leadership supports with the idea of geo-enabling the metrics collection effort.
GOAL AND OBJECTIVE

To geo-enable the collection and reporting of Naval STEM metrics while providing leadership with an intuitive and interactive data visualization tool.
PROJECT OVERVIEW

• STEM Mapping and Reporting Tool (SMaRT)

• Provides STEM leaders the ability to collect important and consistent event metrics throughout the Naval STEM community.

• Collect STEM event data via mobile device or web browser.

• Built on the Esri platform using ArcGIS Survey123 and ArcGIS Survey Connect (SaaS) geospatial technology.

• Reports generated using ArcGIS Survey123 website.

• Operations dashboard for visualization by STEM leadership.
PROPOSED METHODOLOGY
ARCGIS SURVEY123

- Capture STEM metrics, and upload data securely for further analysis.
- Data collected is immediately available within the ArcGIS platform.
SURVEY123 CONNECT

• Allows for advanced development.
• Provides full XLSForm authoring.
• Full control over the design of the survey and its behavior.
• Works from any device and supports offline data collection.
All Survey123 items (e.g., forms, web maps, tabular reference data, survey records) are stored in ArcGIS Online.
ARCGIS DASHBOARD

- Interactive display of critical metrics such as upcoming and past events, event locations, dates, attendance totals (and more), with ability to filter by region, event type, etc.

- Communicates STEM Outreach metrics to leadership in easy-to-read visual format.
ARCGIS STORYMAPS

- Create a StoryMap with instructions on how to use SMaRT
  - How to install Survey123 app (iPhone/Android) or use the web version.
- Provide link to SMaRT Operations Dashboard (based on access).
- Embed a Survey123 form for requesting a user account.
- Include QR codes.
- Contact information.
SOURCING DATA: OPEN DATA

Homeland Infrastructure Foundation-Level Data (HIFLD)

Open Data

This site provides National foundation-level geospatial data within the open public domain that can be useful to support community preparedness, resiliency, research, and more. The data is available for download as CSV, XML, Shapefile, and accessible via web services to support application development and data visualization.

For updates about HIFLD data, guidance on metadata, and known Shapefile conversion issues, please access the HIFLD notifications page.
DATA ATTRIBUTES

**Event:**
- Region
- Type
- Name
- Dates
- Venue Type
- Location (lat/lon)
- Attendance Type
- Attendance Count

**School:**
- Type
- Name
- Address
- Phone
- Location (lat/lon)

**Volunteers:**
- Count
- Hours
- Name?
SMART TIMELINE

• **(AUG 2023)**: Verify the metrics details required to be provided in the reports to ONR with STEM leadership.

• **(AUG 2023)**: Review a proposed data collection workflow with STEM leadership.

• **(AUG-SEP 2023)**: Develop SMaRT Survey using ArcGIS Survey123 Connect.

• **(SEP-OCT 2023)**: Develop SMaRT Operations Dashboard using ArcGIS Dashboards, including design of featured web map showing event locations (and test).
SMART TIMELINE

- **(OCT 2023):** Develop SMaRT sample reports using Survey123 (and test).
- **(OCT 2023):** Develop SMaRT StoryMap with documentation and user account request functionality (Survey123).
- **(OCT 2023):** Present at NCGE – (see next slide)
- **(NOV 2023):** Soft launch SMaRT to small STEM volunteer audience.
- **(DEC 2023):** After user input and testing by leadership and other STEM leads, start collecting initial metrics.
CAPSTONE PRESENTATION

• Submitted a proposal for presenting capstone at the 2023 National Council for Geographic Education Conference held October 27-28th in Columbia, SC.
ANTICIPATED RESULTS
WHAT WILL SMART ‘LOOK LIKE’?

• SMaRT will consist of key geospatial tools combined to track, visualize and report STEM metrics.

• Web and mobile versions of Survey123 forms used for collecting STEM event details.

• Operations dashboard used to visualize upcoming and completed STEM events.

• Reports generated using filtered STEM event data.
HOW WILL IT BE TESTED?

- Past and present STEM event data will be captured using SMaRT Survey.
- SMaRT Operations Dashboard will be populated with this data.
- Data interrogation by filtering and selecting data points will allow leadership to query and QA/QC the data.
- Reports will be generated and reviewed for monthly, quarterly and annual metrics.
- STEM Outreach Leadership can compare existing manual reports with geo-enabled SMaRT output.
QUESTIONS?

Todd Remmel, GISP
Penn State University – MGIS Program
College of Earth and Mineral Sciences
Department of Geography | GEOG 596A - Spring 2 2023
Esri’s ArcGIS Survey123 is an easy-to-use mobile application that asks a series of questions to collect data and geospatial information using a smartphone or any other mobile device equipped with GPS.

The Survey123 app can be designed for many types of projects, requires little training to use, works from any device, and supports offline data collection.
SCHOOLS MAPPING SOFTWARE BUNDLE

• FREE
• ArcGIS Online is cloud-based = no software installation necessary
• Share maps and apps with secure logins for all students and teachers.
• Ready-to-use web and mobile apps
• Robust online data analysis apps
• Visualize, analyze, create and share 2D and 3D data

https://www.esri.com/schools
• asdf
NAVAL STEM ECOSYSTEM

- DoD
- ED
- NSF
- NASA
- NIH
- NOAA
- Smithsonian Institution etc.

- ASN (M&R/A)
- ASN (RD&A)
- BUMED
- CNIC
- DC (MR&A)
- DCNO (MPTE)
- DON CIO
- MSCC
- MCU
- N94
- NAVAIR
- NAVFAC
- NAVSEA
- NAVSUP
- NAVWAR
- NPS
- NRL
- ONR
- SSP
- USNA

- Academia
- Community Colleges
- Industry
- K-12 Schools
- Local Government
- Nonprofits
- State Government
- etc.

- U.S. Air Force/Space Force
- U.S. Army
- U.S. Navy/Marine Corps
- 4th Estate

Naval STEM Coordination Office

Apprenticeships
Community Outreach Events
Fellowships
Internships
Naval STEM Initiatives
Naval STEM Grants
Scholarships

Naval STEM Stakeholder Working Group

DoD STEM Development Office
DATA PREP USING ALTERYX DESIGNER

• Will need to blend and analyze school data in order to create school categories:
  • Elementary
  • Middle
  • High
  • Other