

IEEE REACH Educational Partnerships

Opportunities for districts, states, & independent schools



IEEE
REACH

Raising Engineering
Awareness through
the Conduit of History



Driving Transformation

Solving the world's most pressing global challenges requires a new generation of innovators ready to rise to the challenge.

As the world's largest technical professional organization with nearly 400,000 members, **IEEE is uniquely positioned to take action.**

IEEE is a 501(c)(3) charitable organization

reach.ieee.org



IEEE is committed to using its influence to meet pressing national and global challenges by implementing programs that:



ILLUMINATE – the possibilities of technology by using it to address global challenges

EDUCATE – the next generation of innovators and engineers

ENGAGE – a wider audience in appreciating the value & importance of technology

ENERGIZE – innovation by celebrating technological excellence



The importance of technological literacy

One of the 21st century skills students need to be responsible citizens is technological literacy. Every aspect of the world we live in today is impacted by technology.

“In order to be a technologically literate citizen, a person should understand what technology is, how it works, how it shapes society and in turn how society shapes it.”

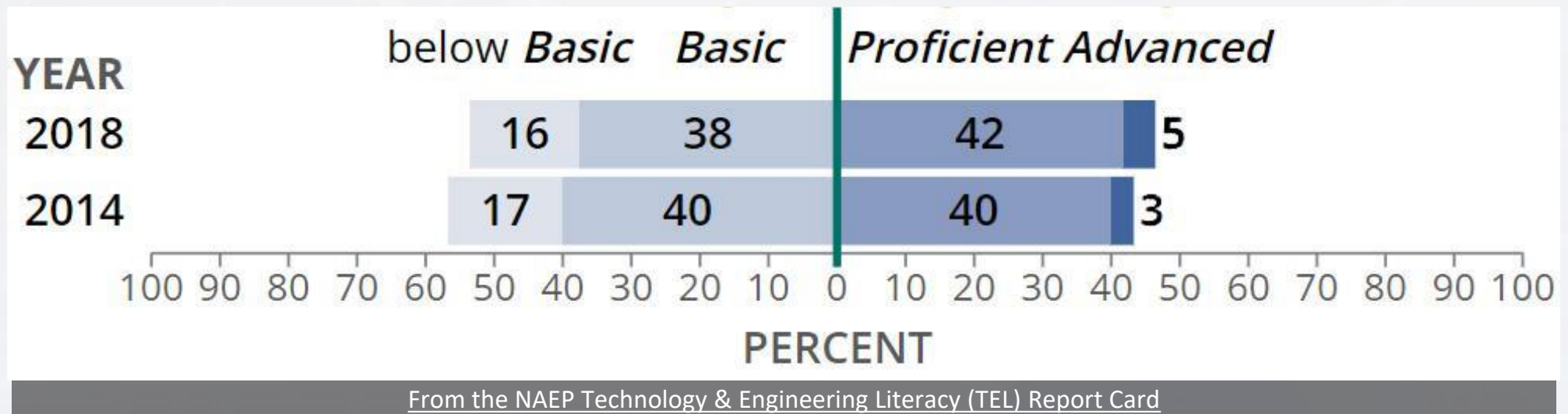
- International Technology and Engineering Educators Association (ITEEA)

Yet many students fall below technological literacy proficiency levels.







Technology Learning Gap – Hard Facts

54% of 8th grade students assessed in 2018 for technology and engineering literacy were *Not Proficient*.



Technology Learning Gap – Hard Facts

Students who are not proficient in technology literacy score significantly lower than their peers and are unable to explain basic concepts of technology's impact on society and stakeholders.

Task Questions	Students below 25th percentile	Students at or above 75th percentile	Difference
Evaluate the interests and priorities of stakeholders involved in society-technology decisions	 16 %	 96 %	-81
Explain the unintended consequences of a new technology	 6 %	 86 %	-80

From the NAEP Technology & Engineering Literacy (TEL) Report Card



Technology Learning Gap – Hard Facts

Students who are not proficient in technology literacy **score significantly lower** than their peers and are **unable to explain basic concepts** of technology's impact on society and stakeholders.

Discrete Questions	Students at or above <i>NAEP Proficient</i>	Students below <i>NAEP Basic</i>	Difference
Compare environmental effects of alternative technologies and provide reasoning for which choice is best	78 %	5 %	73
Understand that differences in societal factors can influence people's technological choices and opportunities	81 %	25 %	56
Perform a logical process of troubleshooting to identify and repair a problem	79 %	27 %	52



Barriers expressed by teachers to integrated technology/society lessons

- 1. Lack of curricular planning time*
- 2. Lack of support networks in schools*
- 3. Teacher preparation programs lacking relevant pedagogy*
- 4. Anxiety regarding classroom implementation*



The science-technology-society framework for achieving scientific literacy: an overview of the existing literature – European Journal of Science and Mathematics Education



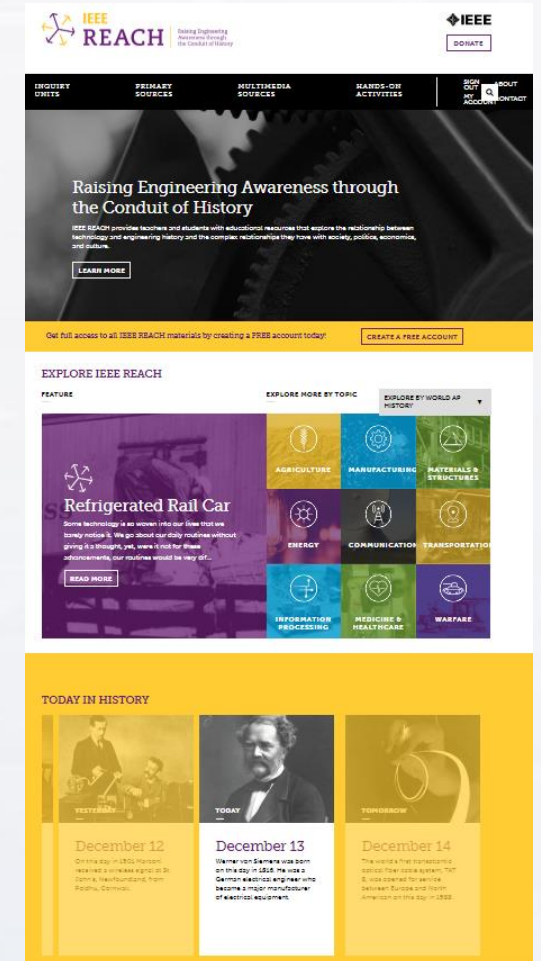


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Addressing the Technology Learning Gap

IEEE REACH provides 6th-12th grade teachers with free, multimedia curricular materials that explore the history of technology and address its social, political, economic, and cultural contexts. Students obtain a greater understanding of how technology and engineering are relevant to their lives and their future.

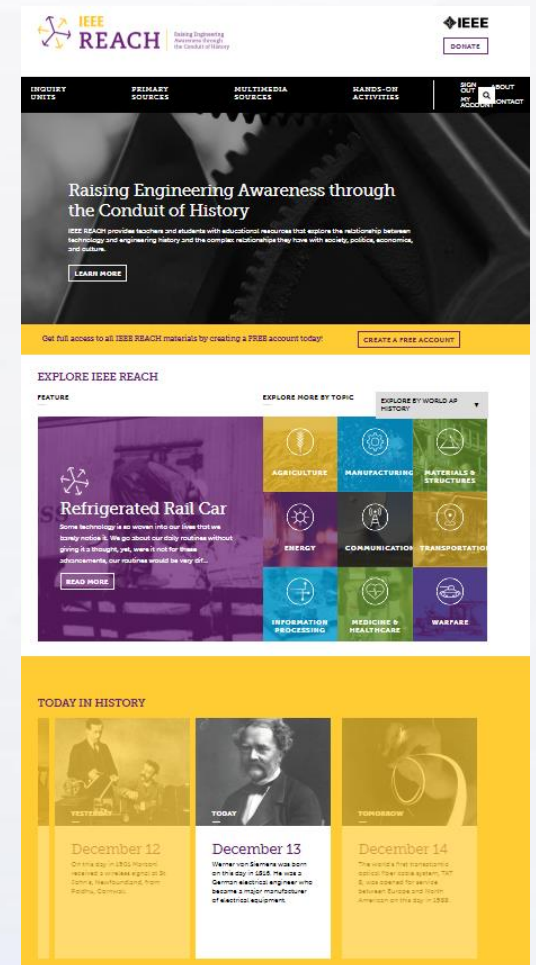


REACH helps Educators Bridge the Gap

REACH uses the lens of history to engage students in technology narratives that allow for critical analysis about how technology has, and will continue to, impact their lives.

REACH is designed to assist both social studies and STEM teachers to make the crucial cross-cutting connections needed to bridge the technology literacy learning gap.

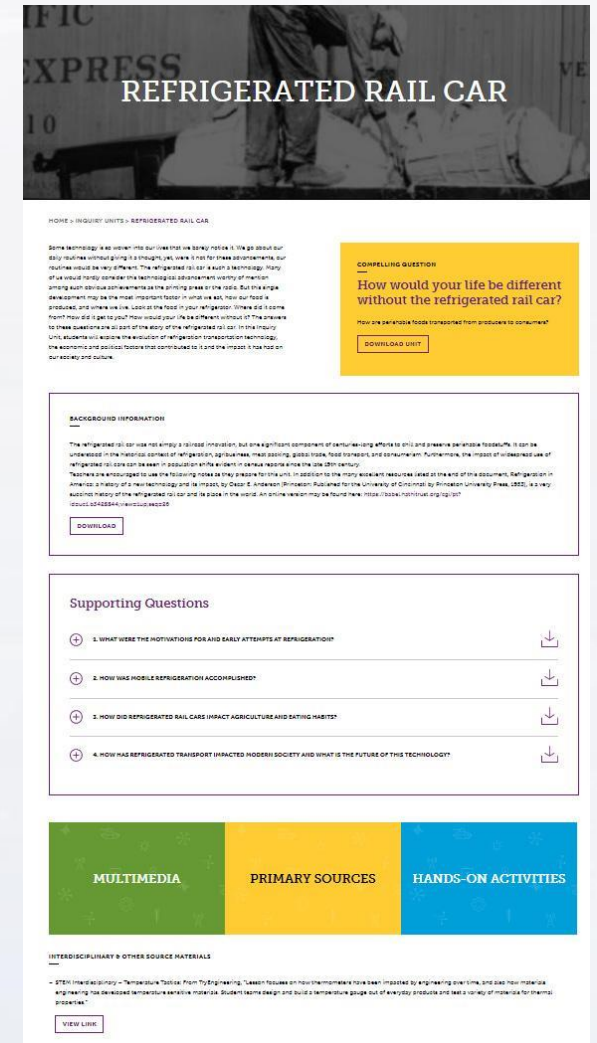
REACH was developed to correspond with the National Council of the Social Studies' C3 (College, Career, Civics) Standards; Common Core Standards; and World History Standards; the resources also meet the Next Generation Science Standards (specifically ETS2.B); and Standards for Technology and Engineering Literacy as defined by ITEEA



REACH Provides a Complete Toolkit

Each REACH Inquiry Unit provides necessary tools for both teachers and their students:

1. Inquiry-designed, standards-aligned, **lesson plans** built around the history of a specific technology and its societal implications
2. Detailed **background information** for the teacher
3. Digitally accessed **Primary source** materials (original sources of evidence, such as an artifact, document or recording, created during the time of study) for students to analyze
4. **Multimedia** resources - proprietary REACH historical videos
5. Engaging **hands-on activities** for students, which bring the lesson plan to life



HOME » INQUIRY UNITS » REFRIGERATED RAIL CAR

Some technology is so woven into our lives that we barely notice it. We go about our daily routines without giving it a thought, yet when it fails for these commonplace, but essential, reasons we are often frustrated. The refrigerated rail car is a technology history of us used to rely on for the technological advancement history of nation, among many other things, and it's been a part of our lives for a long time. But the single development may be the most important factor in what we eat, how our food is produced, and where we live. Look at the food in your refrigerator. Where did it come from? How did it get to you? How would you live if there weren't refrigerators? The answers to these questions are all part of the story of the refrigerated rail car. In this inquiry, UHCL students will explore the evolution of refrigeration technology, the history of the refrigerated rail car, and the impact it has had on our daily lives.

CONPELLING QUESTION
How would your life be different without the refrigerated rail car?
How are perishable foods transported from producers to consumers?
[DOWNLOAD UNIT](#)

BACKGROUND INFORMATION
The refrigerated rail car was not simply a technological innovation, but the significant component of early 20th-century efforts to grow and preserve perishable foods. It is the backbone of the modern food system, agriculture, food processing, global trade, food transport, and consumerism. Furthermore, the impact of widespread use of refrigerated rail cars can be seen in education and the development of science and technology in the late 19th century.
Students are encouraged to use the following resources for their inquiry. In addition to the primary source materials listed at the end of this document, background information is available in a variety of multimedia and primary sources by David S. Anderson (Professor, Published for the University of Cincinnati by Princeton University Press, 2015), a newly published history of the refrigerated rail car and its role in the world. An online resource may be found here: <https://www.history.com/story/1915-05-15-refrigerated-rail-car>

[DOWNLOAD](#)

Supporting Questions

1. WHAT WERE THE MOTIVATIONS FOR EARLY ATTEMPTS AT REFRIGERATION?
2. HOW WAS EARLY REFRIGERATION ACCOMPLISHED?
3. HOW DID REFRIGERATED RAIL CARS IMPACT AGRICULTURE AND EATING HABITS?
4. HOW HAS REFRIGERATED TRANSPORT IMPACTED MODERN SOCIETY AND WHAT IS THE FUTURE OF THIS TECHNOLOGY?

MULTIMEDIA **PRIMARY SOURCES** **HANDS-ON ACTIVITIES**

INTERDISCIPLINARY & OTHER SOURCE MATERIALS
- STEV Interdisciplinary - Temperature: From To Engineering, "Lesson focuses on how temperature has been impacted by engineering over time, and how modern engineering has developed temperature sensitive materials. Students learn design and build a temperature gauge out of everyday products and test a variety of materials for their thermal properties."
[VIEW LINK](#)



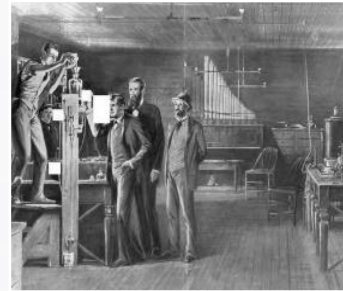
REACH: Current Inquiry Units Span Time, Space, and Technology



UAV (Drones)



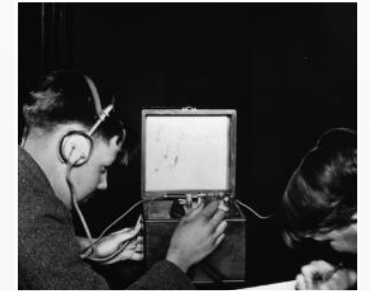
Early Maritime Navigation



Electric Lighting



Printing Press



Radio



Refrigerated Railcar



Skyscrapers



Trireme



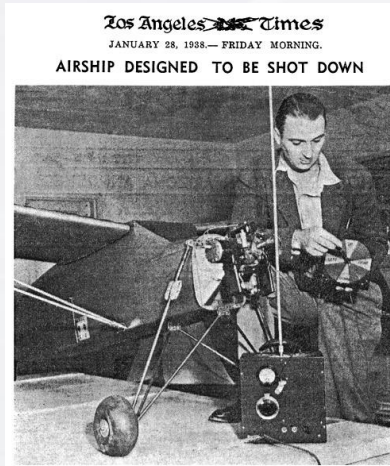
Electronic Music

ADD INFORMATION THEORY



REACH: Primary and Secondary Sources

Original sources such as an artifact or document that was created at the time of study



Paul Whittier, co-builder of the radio-controlled model airplane to be tested Tuesday by Coast Artillerymen, the plane and his ground control equipment. (Times photo)

ARMY TO TEST MODEL ROBOT PLANE AS ARTILLERY TARGET

With elaborate ranging equipment, a unit of the Sixty-third Coast Artillery under Lieut. Col. Claude M. Thiele will go to Marine Dry Lake next Tuesday to test its marksmanship against a radio-controlled model airplane.

If successful, trial flights of the miniature craft will pave the way for general use of such machines to train anti-aircraft and coast artillerymen.

RADIO CONTROLLED
Paul Whittier, veteran National Guard aviator, and Reginald Denny, actor-model-maker, constructed the gasoline-powered plane, climaxing two years of intense experimentation before they were successful in building a delicate radio mechanism which permits control of the model aloft.

The craft's wing span is twelve feet. From tail to propeller, it measures eight and one-half feet.

IMPULSES CONTROLLED
Once the model's three-horsepower engine pulls it skyward, the radio controls go into action. In the fuselage of the plane, the builders have installed a three-

tube receiving set, which relays impulses to tiny electric motors. These operate the tail rudder and elevators.

Ground equipment consists of an observer sending set and a control box, with contact points which modulate the wave-lengths of the radio impulses. These send the model up, down, left or right.

DEVELOPMENT PLANNED
Eventually, and Whittier, who served as chief engineer of the project since its inception in 1935, they hope to create the small craft in intricate loops, falling leaves, and spins.

Earlier flight tests have indicated that the Whittier-Denny model will travel sixty miles an hour. Its tiny engine will haul its forty-two pounds to an altitude of 8000 feet—far enough to put the plane out of sight of the naked eye.

COPPER CUP IDEA
Two years ago, over the coffee cups, Denny broached the idea of making such a ship for anti-aircraft artillery use. Frac-ture procedure for the Army today demands the day-and-night service of an observation plane

and a skilled pilot. This costs the government \$200 an hour.

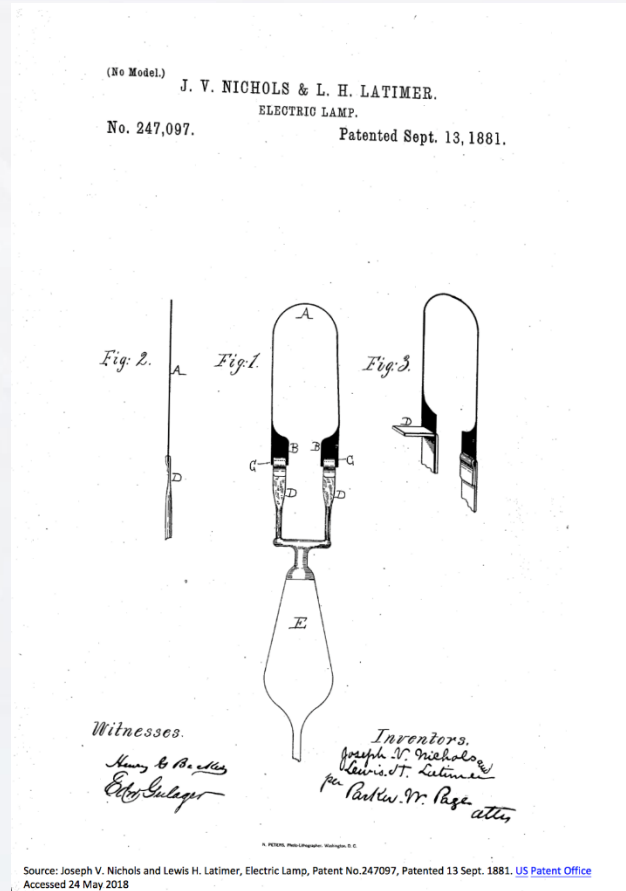
The model, proven successful, will permit coast artillerymen to train their ranging-finding for a very small sum.

RANGE PLANNED
Its design aims at producing a miniature whose speed-also radio-controlled, nearly to fill-sized ships. Thus, as the model becomes old, they will probably be used directly as flying targets for the artillerymen.

On a production basis, Whittier said, the craft will fetch \$500. The experimental model, however, represents a \$2000 investment.

ALL-DAY TEST
Col. Thiele announced he will take his high-speed, speed detector and other equipment to Marine Dry Lake for an all-day test Tuesday.

He admitted freely that perfection of such a model will provide the Army with something it has sought for years.



REACH: Multimedia

Short engaging videos for use in the classroom or in a flipped classroom environment




MULTIMEDIA

Drones from the Civil War to Today

UAV (Drones) Inquiry Unit

Historic insights into unmanned aerial vehicles (UAVs), from the Civil War through to today. See how aerial balloons were an integral part of early UAV, or drone, development, and follow the technol...

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MULTIMEDIA

Longitude

Early Maritime Navigation Inquiry Unit

Solving the Longitude problem was necessary to navigating the worlds oceans and opening the door to global trade. Click here to download this video from the REACH Vimeo page...

LEARN MORE




MULTIMEDIA

A Pre-History of Radio (Part One)

Radio Inquiry Unit

Join historian Alex Magoun on a journey through the history of radio technology from James Clark Maxwell's theory of electromagnetism to Guglielmo Marconi's use of that theory in long-distance radio...

LEARN MORE



REACH: Hands-on Activities

Captivates students and brings the lesson to life



HANDS-ON ACTIVITY

Testing Insulation for Refrigerated Rail Cars

Refrigerated Rail Car Inquiry Unit

Refrigerated Rail Car Inquiry Unit Download PDF Testing Insulation for Refrigerated Rail Cars Prompt for the students: Joel Tiffany has just hired your team to engineer his first Tiffany Refri...

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HANDS-ON ACTIVITY

Original Radio Program

Radio Inquiry Unit

Radio Inquiry Unit (Featured Sources, Supporting Question 3) All of the information below is also available in the pdf linked below. ORIGINAL RADIO PLAY: Create an original radio program using the...

LEARN MORE



HANDS-ON ACTIVITY

Compass Hands-on Activity

Early Maritime Navigation Inquiry Unit

Early Maritime Navigation Inquiry Unit Compass Lesson Plan - Supporting Question 3 Task With a towel placed over their heads and the only visual being that of a magnetized needle, set on a plasti...

LEARN MORE



Growth of REACH

REACH was launched by IEEE in 2016 and is currently used by a highly diverse population of educators and students in schools across the US.

In 2022:

- **2,600+ downloads of Inquiry Units and supporting materials via REACH website**
- **1,700+ subscribers to educator's email monthly newsletter**
 - 85% of REACH Newsletter subscribers surveyed have used REACH in their classroom during the most recent school year. Of those, 41% used it 3 or more times.
 - While REACH is targeted towards secondary education classrooms, it is also heavily used by both primary and postgraduate educators.
- **300,000+ students served with REACH**
- **10,500+ site visitors**
- **REACH population of students is highly diverse**
 - 49% minority population of students in schools served by REACH
 - 52% of public schools served by REACH are Title 1



Educational Partnership Opportunities



Special programs for state, district, & independent organizations

For state, district, and independent school organizations, REACH offers no-cost partnership opportunities that provide significant additional value to your teachers and students.

Partnerships include:

1. Teacher training webinars on how to implement the REACH lesson plans into your classroom instruction.
2. Opportunities for teacher learning sessions and Q&A with Michael Geselowitz, PhD, Senior Director of the IEEE History Center.
3. Bring the lessons to life for your students with an “engineer in the classroom”. With nearly 400,000 members, IEEE has engineers from a wide range of disciplines in almost every city and region who can come to your classrooms and engage with your students on the life of an engineer.



Educational Partnership Opportunities



Special programs for state, district, & independent organizations

We have a limited number of partnerships available for 2023/24. For more information or to discuss opportunities for your district, please contact us.

IEEE REACH

Michael N. Geselowitz, Ph.D., Senior Director
IEEE History Center
(732)562-6022
m.geselowitz@ieee.org

reach.ieee.org

