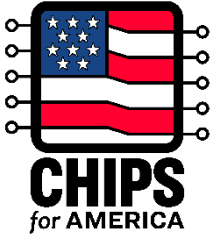


# CHIPS for America Research and Development

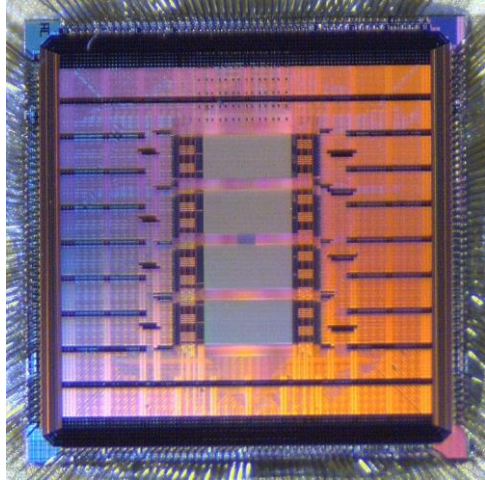
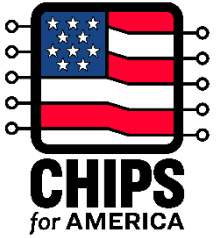


CHIPS Research and Development Office



September 2023

# CHIPS R&D Goals



## U.S. Technology Leadership

The U.S. invents, develops, and deploys the foundational semiconductor technology of the future.



## Accelerate Ideas to Market

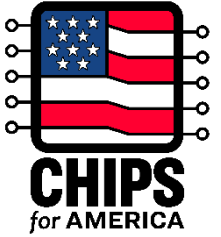
A thriving ecosystem that is focused on getting the best ideas to commercial scale as quickly and cost effectively as possible.



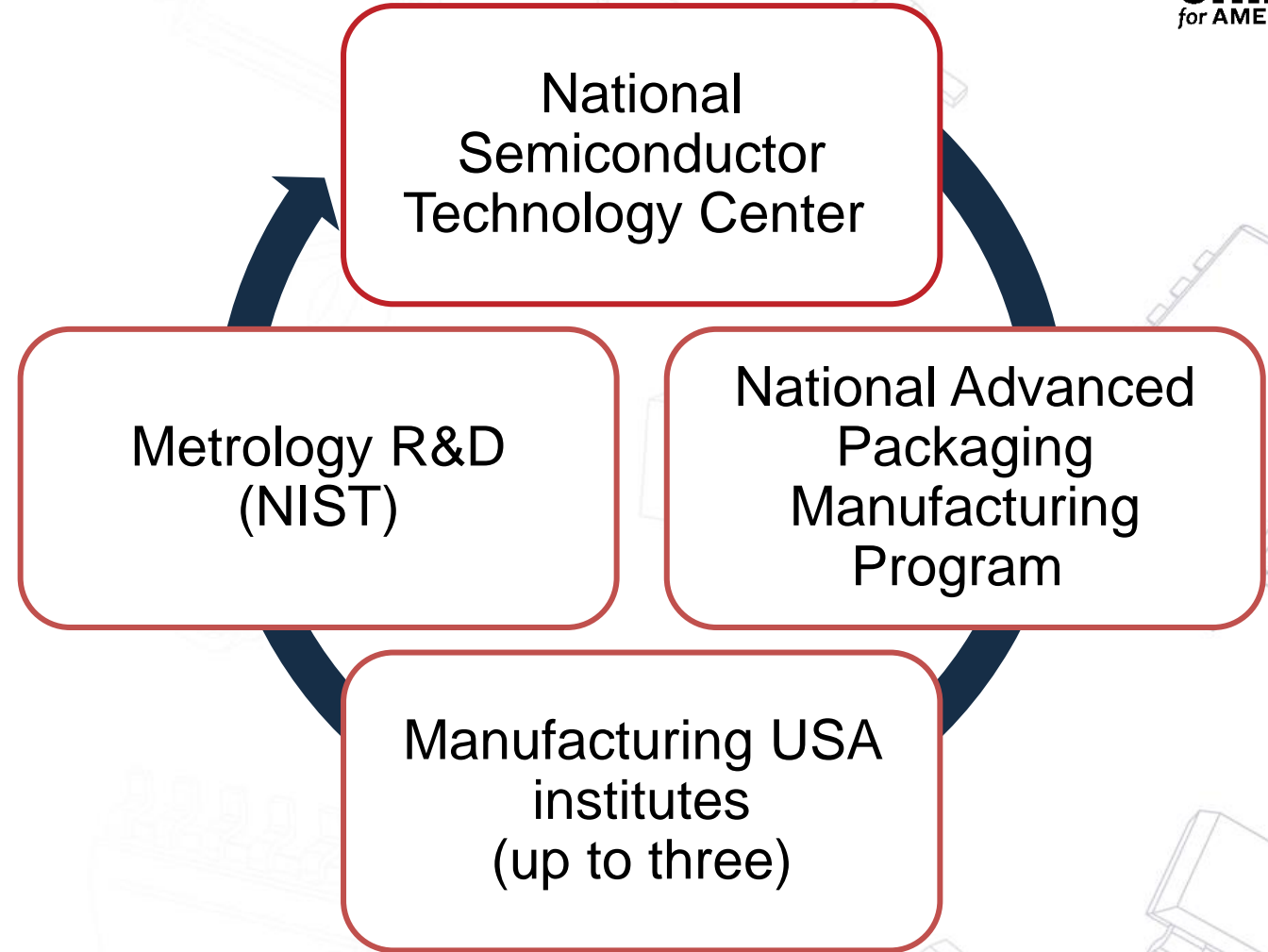
## Robust Workforce

A new generation of skilled workers, inventors, designers, researchers, technicians, and others able to build and sustain semiconductor manufacturing in the U.S.

# CHIPS for America R&D

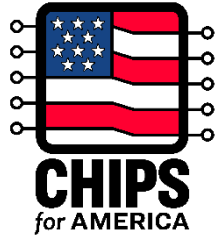


- To strengthen and advance U.S. leadership in R&D
- An integrated ecosystem that drives innovation
- In partnership with industry, academia, government, and allies
- A strategic view of R&D infrastructure, participant value-proposition, and technology focus areas
- Informed by the Industrial Advisory Committee





# Program Development Timeline



SPRING 2023

SUMMER 2023

FALL 2023

WINTER 2023

National  
Semiconductor  
Technology  
Center

Vision/strategy  
paper published

Selection Committee  
identifies Board of Trustees

Establish NSTC

National  
Advanced  
Packaging  
Manufacturing  
Program

NAPMP vision and  
strategy paper

Manufacturing  
USA institute(s)

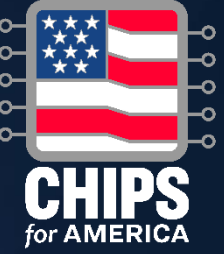
RFI summary  
published

Select topic(s); begin proposal process

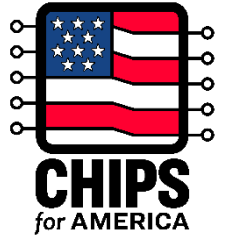
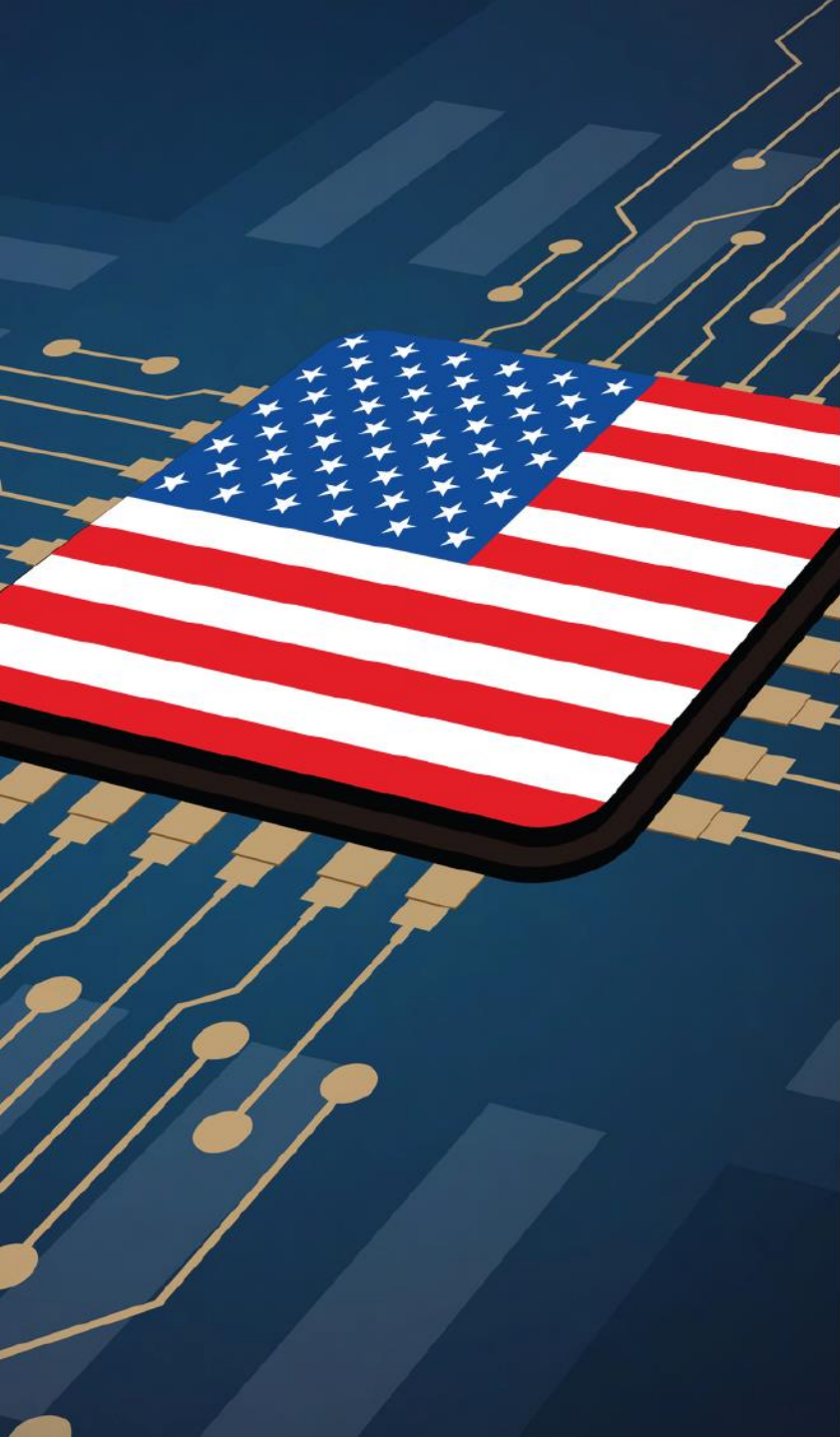
Metrology  
Program (NIST)

Metrology gaps  
report published

Select programs to begin



# National Semiconductor Technology Center

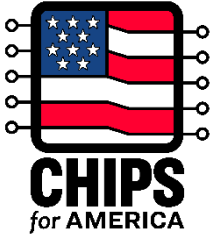


# NSTC VISION

By the decade's end, the NSTC should be viewed throughout the world as an essential resource within the broad semiconductor ecosystem with a network of respected scientists and engineers, state-of-the-art facilities, effective programs, and demonstrated technical achievements.



# Programs



Technology leadership

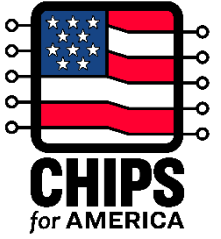


Community assets



Workforce

# Membership



- Businesses of all sizes and at all stages
  - Fabless companies
  - Foundries
  - Integrated device manufacturers
  - Equipment vendors
  - Materials suppliers
- Research institutions, including minority serving institutions
- Community colleges
- State and local governments
- National labs
- Labor unions
- Sector investors





# POTENTIAL AFFILIATED TECHNICAL CENTERS

Design tools

Power

Process and  
production  
R&D

RF, analog,  
and mixed  
signal

Memory

Microelectro-  
mechanical  
systems

Mature node

Bioelectronics

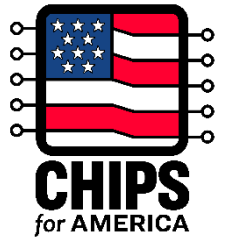
Photonics

Device  
security

Baseline CMOS and CMOS R&D

Advanced packaging

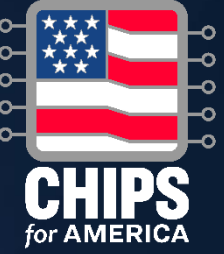
NSTC HQ core functions



# Workforce Programs

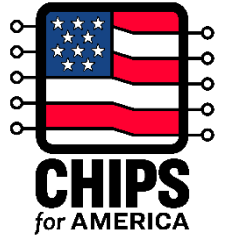
FOR SCIENTISTS, ENGINEERS, AND  
TECHNICIANS

- Outreach to groups, including those traditionally underrepresented
- Support scale-up of existing quality programs
- Develop novel approaches to training

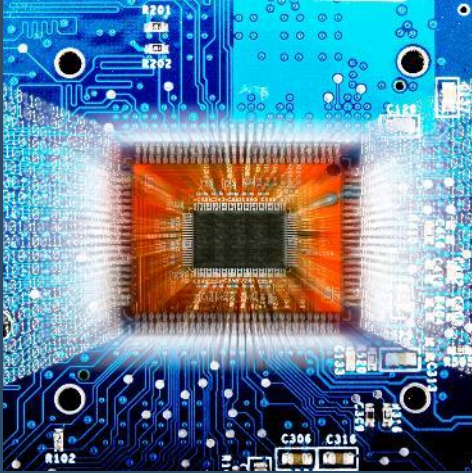


# National Advanced Packaging Manufacturing Program





# National Advanced Packaging Manufacturing Program



- Strengthen semiconductor advanced test, assembly, and packaging capability in the domestic ecosystem
- Leverage public-private partnerships, that can include support for facilities managed by the NSTC and MUSA
- Broad range of technologies:
  - Heterogeneous integration
  - Wafer and panel-based approaches
  - Tooling and automation
  - Substrate technology

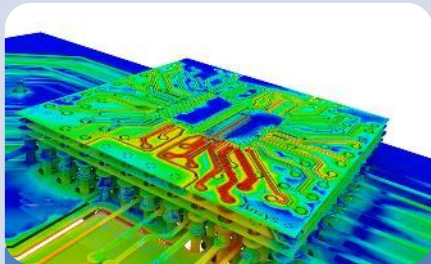
# NAPMP Approach and Target Areas

Technology innovation

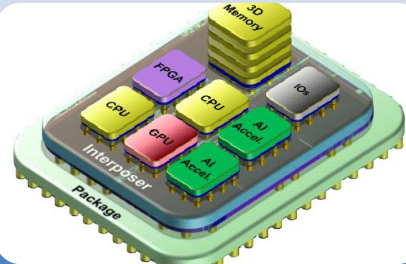
Create an R&D environment advancing the state-of-the art in advanced packaging.

Ecosystem support

Investments to bolster the growth in domestic capacity and enhance capabilities for competitive edge.



Co-design and simulation



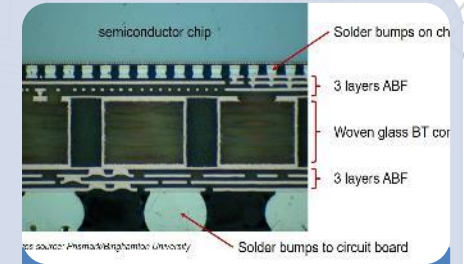
Chiplets



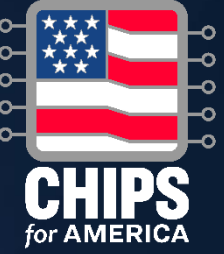
Pilot packaging facilities



Tooling and automation

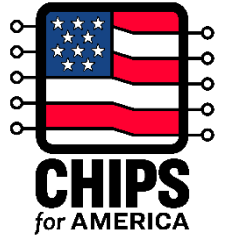


Materials and substrates



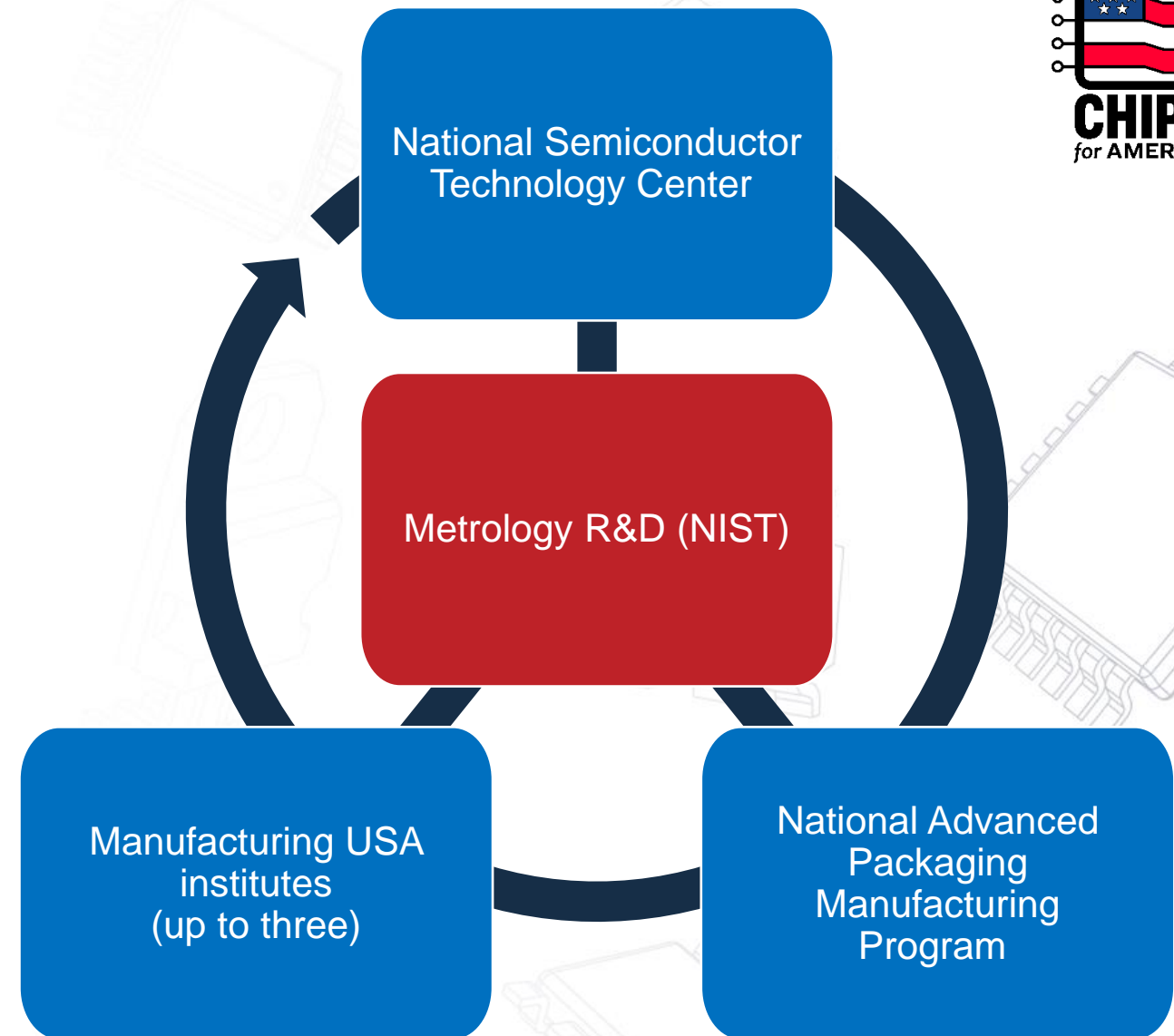
# CHIPS R&D Metrology Program



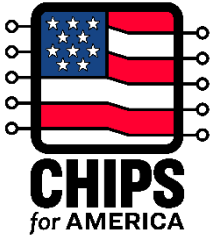


# Maximizing Impact and Speed Metrology R&D

- Metrology is **foundational** and **fundamental** for all R&D programming
- Metrology **tools are delivered** to other CHIPS R&D programs;
- High impact research areas **sourced from industry**
- Metrology technologies should reach **commercial scale**



# Strategic Opportunities For U.S. Semiconductor Manufacturing



← Extensive feedback from stakeholders across industry, academia, and government →

Metrology for materials purity, properties, and provenance

Advanced metrology for future micro-electronics manufacturing

Enabling metrology for integrating components in advanced packaging

Modeling/ simulating semiconductor materials, designs, and components

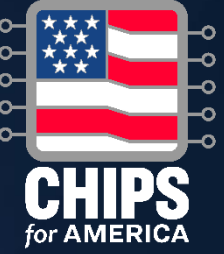
Modeling/ simulating semiconductor manufacturing processes

Standardizing new materials, processes and equipment for microelectronics

Metrology to enhance security and provenance of micro-electronic based components and products



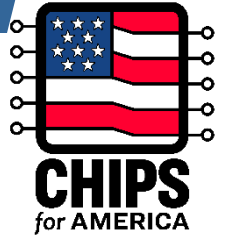
<https://nvlpubs.nist.gov/nistpubs/CHIPS/NIST.CHIPS.1000.pdf>



# CHIPS Manufacturing USA Program



# Manufacturing USA Network



- Electronics
- Materials
- Energy/Environment
- Digital /Automation
- Bio-Manufacturing

**AIM PHOTONICS**  
Integrated Photonics  
Albany, NY  
Rochester, NY

**affoa**  
Advanced Functional Fabrics of America  
Advanced Fibers and Textiles  
Cambridge, MA

**RAPID**  
Transforming Process Industries  
Modular Chemical Process Intensification  
New York, NY

**America Makes**  
Additive Manufacturing  
Youngstown, OH  
El Paso, TX

**biofabusa**  
Regenerative Manufacturing  
Manchester, NH

**NEXTFLEX**  
Flexible Hybrid Electronics  
San Jose, CA

**THE COMPOSITES iacmi INSTITUTE**  
Advanced Composites  
Knoxville, TN  
Detroit, MI

**REMADE INSTITUTE**  
Sustainable Manufacturing  
Rochester, NY

**ARM INSTITUTE**  
Robotics & AI  
Pittsburgh, PA

**NIIMBL**  
Biopharmaceutical Manufacturing  
Newark, DE

**POWERAMERICA**  
Wide Bandgap Semiconductors  
Raleigh, NC

**lift**  
Where Manufacturing Technology and Talent Matter  
Lightweight Materials  
Detroit, MI

**CESMII**  
THE SMART MANUFACTURING INSTITUTE  
Smart Manufacturing  
Los Angeles, CA

**M D**  
The Digital Manufacturing & Cybersecurity Institute  
Digital Manufacturing & Cybersecurity  
Chicago, IL

**BioMADE**  
Bioindustrial Manufacturing  
St. Paul, MN

**NEW— Electrified Processes for Industry without Carbon (EPIXC)**  
Phoenix, AZ

**CYMANII**  
the cybersecurity manufacturing innovation institute  
Cybersecurity in Manufacturing  
San Antonio, TX

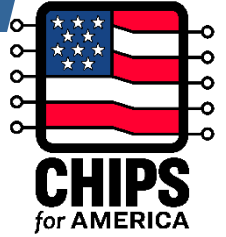


**16 institutes**  
Members in every state  
9 partner federal agencies

**DOC sponsors 1 institute + serves as the overall Program Office**

**DOD sponsors 9 institutes; DOE sponsors 6 institutes**

# RFI for Manufacturing USA Semiconductor Institutes



Purpose: inform design of up to three Manufacturing USA Semiconductor Institutes authorized by CHIPS Act

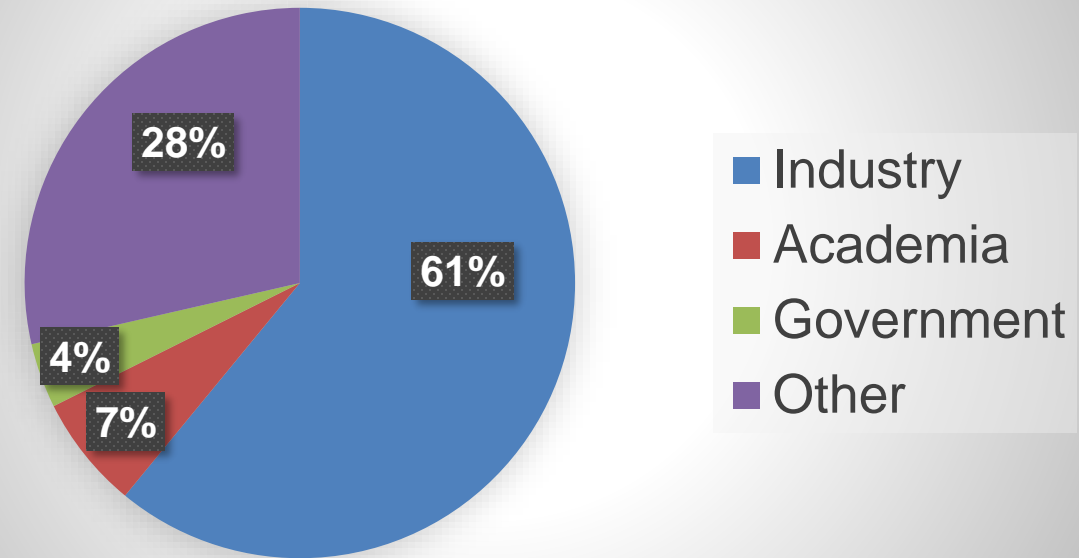
Three public webinars held with 463 registered participants during comment period

Public comment period Oct 13 – Dec 12, 2022

93 comments received\*

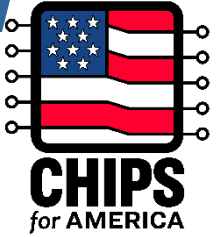
Public report to be released soon

RFI Responders



*\*all comments received are publicly posted at <https://www.regulations.gov/docket/NIST-2022-0002/comments>*

# Semiconductor Institute RFI Key Points



## 1 Institute Scope and Scale

- Several potential topic areas suggested
- No consensus on a single ‘super-sized’ all-topic institute vs. multiple focused institutes

## 2 Structure and Governance

- Consensus that the design framework for Manufacturing USA is sound, with exception of larger scale needed for impact in semiconductor space
- Consensus for tiered membership structures

## 3 Coordination

- Consensus that coordination with other CHIPS initiatives and with existing Manufacturing USA institutes in related sectors is critical

## 4 Sustainability

- Consensus that institutes are likely to need federal funding beyond 5 years
- Consensus that in longer-term, institutes achieve sustainability if focused on industry priorities



# MANUFACTURING USA TOPIC EXAMPLES

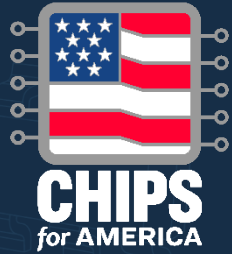
## Cross-cutting technology topics

- Productivity enhancement via early design including co-design, digital twins, and artificial intelligence
- Smart manufacturing and automation
- New and advanced materials
- Metrology and testing

## Focused institute topics

- Substrate manufacturing for advanced packaging
- Sensors and microelectromechanical systems
- Infrastructure to support technology transition to manufacturing

# Next Steps



- CHIPS R&D Standards Summit

- September 26-27, 2023, in Washington, D.C.
- And virtually
- Sign up at [CHIPS.gov](https://CHIPS.gov)

- Learn more

- Visit [CHIPS.gov](https://CHIPS.gov)
- Get the Manufacturing USA RFI summary and NIST metrology strategy
- Read the CHIPS Implementation Strategy and NSTC Vision and Strategy paper
- Join our email list



**CHIPS**  
for AMERICA

**Thank you**