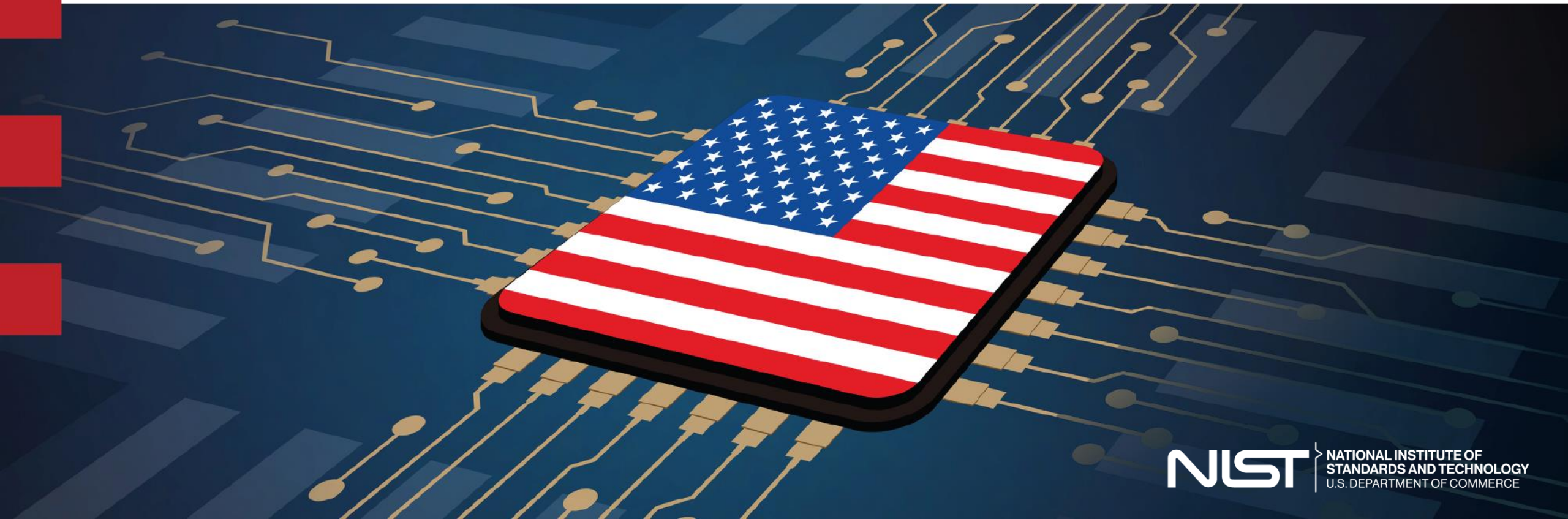
CHIPS for America
Overview of 2024-NIST-CHIPS-NAPMP-01 Review Process

NAPMP Materials and Substrates NOFO



NAPMP Program Manager

Aaron Forster
Program Manager
Materials and Substrates

Agenda & Expectations

Agenda

- Recap of CHIPS R&D & NAPMP
- Concept Paper Review Process
- Themes Across Concept Papers

By the end of this webinar, attendees should understand:

- The scope and processes for the Concept Paper Review and NOFO decision-making processes
- Common themes across successful Concept Papers
- Commonly seen gaps across Concept Papers

Overview of CHIPS R&D Office Goals

Vision

A vibrant and self-sustaining U.S. domestic semiconductor ecosystem that revitalizes American manufacturing, grows a skilled and diverse workforce, and leads the world in semiconductor research and innovation.

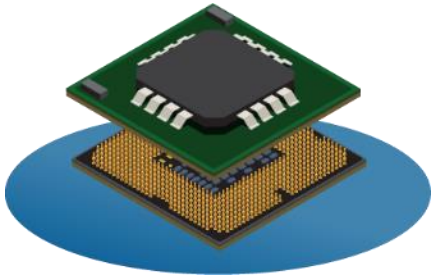
Mission

Accelerate the development and commercial deployment of foundational semiconductor technologies by establishing, connecting, and providing access to domestic tools, resources, workers, and facilities.

2030 Goals

- **U.S. Technology Leadership:** The United States establishes the capacity to invent, develop, prototype, and deploy the foundational semiconductor technologies of the future.
- **Accelerated Ideas to Market:** The best ideas achieve commercial scale as quickly and cost effectively as possible.
- **Robust Semiconductor Workforce:** Inventors, designers, researchers, developers, engineers, technicians, and staff meet evolving domestic commercial-sector and government needs.

CHIPS R&D Programs



CHIPS National Semiconductor Technology Center (NSTC) Program

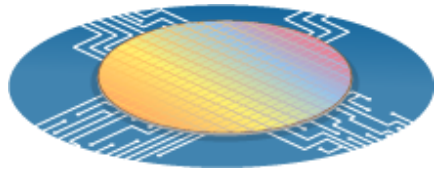
Natcast

Natcast is an independent nonprofit organization and operator of the NSTC consortium

CHIPS Metrology Program

Manufacturing USA

CHIPS Manufacturing USA Program



CHIPS National Advanced Packaging Manufacturing Program (NAPMP)

Workforce Initiatives

Substrates and Substrate Materials Program

Vision & Mission

- The Program vision is to drive **U.S. leadership** in advanced substrates manufacturing for advanced packaging in the United States
- The program mission is to develop **critical and relevant innovations** for advanced substrates to enable **cutting edge** advanced packaging applications and **scale up** substrate innovations **into U.S. manufacturing**

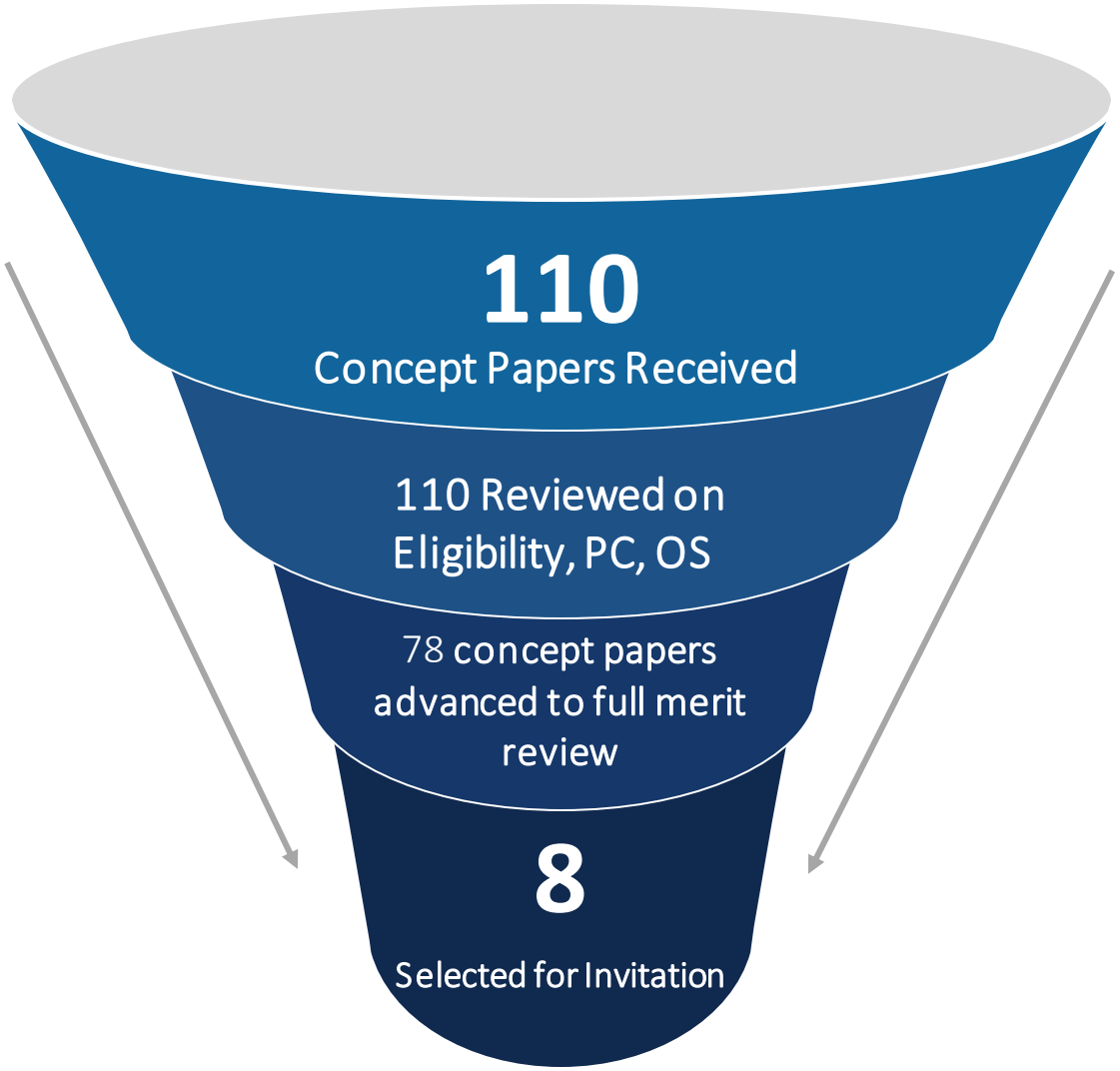
Objectives

1. Accelerate domestic R&D and innovation in advanced packaging materials and substrates;
2. Translate domestic materials and substrate innovation into U.S. manufacturing, such that these technologies are available to U.S. manufacturers and customers, including to significantly benefit U.S. economic and national security;
3. Support the establishment of a robust, sustainable, domestic capacity for advanced packaging materials and substrate R&D, prototyping, commercialization, and manufacturing; and
4. Promote a skilled and diverse pipeline of workers for a sustainable domestic substrate manufacturing sector.

Materials and Substrates NOFO Application Process

Step	Purpose	Outcome
1 Concept Paper	The purpose of the Concept Paper phase is to identify applications that are most able to meet NOFO and NAPMP goals. Concept Papers are designed to be simplified methods to solicit information required for an initial evaluation.	A subgroup of applicants (~10%) have been invited to submit a Full Application
2 Review Process		
3 Full Application		
4 Review Processes		

Concept Papers Were Highly Competitive



- **110 Concept Plans** were submitted. Lead applicants from 28 states and many more including subrecipients.
- **8 Concept Papers** were extended invitations to the Full Application.
- The Department has reserved **up to $300 million in total funding** for multiple awards up to **$100 million per award** for the substrates program. The selection of Concept Plans for invitation to full application was highly competitive.

Concept Paper - 4 Stages of Review

Concept Paper

1. **Scan for Eligibility, Prototype Capability, and Oversubscription**
2. **Merit Review**
3. **Evaluation Panel**
4. **Selection Official**

Administrative Review of Concept Papers

- Each Concept Paper was evaluated for eligibility, completeness, responsiveness (including prototype capability), and oversubscription limits.

Concept Paper Requirements

	Key Forms and Documents	Description
A	**Cover Sheet**	A one-page document that does not contribute to concept paper narrative page limit
B	**Executive Summary**	Executive Summary is a one-page summary/abstract suitable for dissemination to the public. It should be a self-contained document that broadly describes project team, objectives, impacts, and education/workforce goals.
C	**Quad Chart**	Quad chart format selected by applicant that contains problem statement, proposed solution, concept of project, technical objectives and key participants.
D	**Table of Contents**	For concept paper narrative, does not contribute to page limit
E	**Concept Paper Narrative**	A 10-page limit description of project impact statement, project plan, project team, planned role for additional team members, team capabilities, budget estimate, and letters of commitment and interest.

Eligibility, PC, and Oversubscription

Eligible Applicants Section 3.1

- ☐ Domestic for-profit organizations
- ☐ Domestic non-profit organizations
- ☐ Accredited institutions of higher education including community and technical colleges
- ☐ State, local, territorial, and Indian tribal governments

Eligible Participants Section 3.1

- ☐ FFRDC as subrecipients or contractors with additional justifications
- ☐ Federal Entities as Subrecipients or contractors
- ☐ Foreign Organizations as members of project team, subrecipients or contractors, CHIPS R&D Approval with written justification.

Lead Applicant Requirements Section 4.5.1.e

- ☐ Lead Institution is applicant entity for full application: ***substrate prototyping capabilities (PC) or plan to achieve in 3 months***
- ☐ Entities may only apply as **Lead Institution** on 1 full application

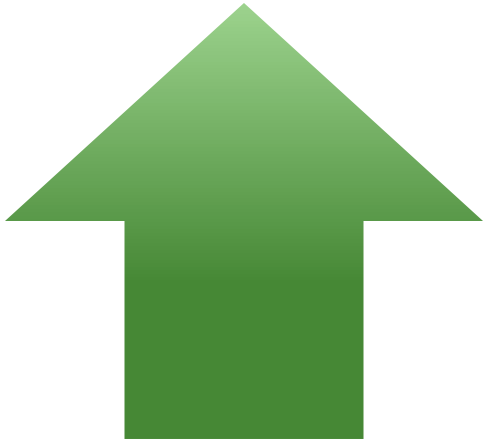
and

- ☐ Entities may be included as subrecipients on no more than 2 applications

Outcomes

- ☐ Entities identified with potential oversubscription and/or prototype capability

Concept Paper Admin Review Trends



Eligibility and Completeness Information

- No concept papers failed this check

Prototype Capability and Oversubscription

- Concept papers clearly identified prototype capability of lead applicant or pathway to prototyping
- Concept papers clearly identified roles of team members and supported those with letters of commitment that supported described roles

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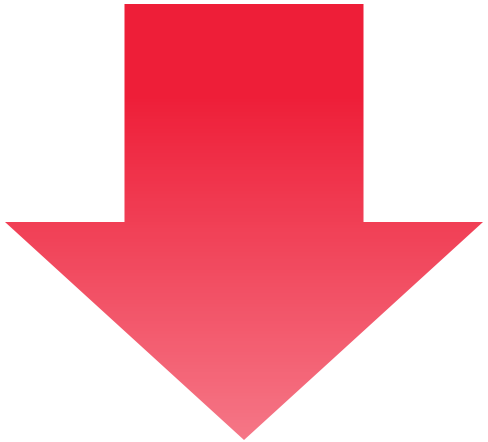
Eligibility and Completeness Information

- Lead applicants were located outside the U.S.

Prototype Capability and Oversubscription

- Concept papers **did not** identify prototype capability of either lead applicant or a plan to acquire prototype capability
- Concept papers **did not** clearly identify roles of team members or support team partnerships with letters of commitment



Concept Paper Review Process

Concept Paper

1. **Scan for Eligibility, Prototype Capability, and Oversubscription**
2. **Merit Review**
   - Primarily experts from DOC, DoD, and DOE.
   - Reviewers received training session and supported by office hours
3. **Evaluation Panel**
4. **Selection Official**

Independent Merit Review

- At least three (3) independent, objective reviewers, with appropriate professional and technical expertise relating to the topics covered in this NOFO.
- Reviewers provide a written evaluation and adjectival ratings (see Section 5.5.2.3) based on the evaluation criteria (see Section 5.1).
- During the review process, the reviewers may discuss concept papers with each other, but ratings will be determined on an individual basis.
- Adjectival ratings: Outstanding, Very Good, Average, Deficient

Merit Review Evaluation Criteria

Concept Paper Merit Review Evaluation Criteria (EC), NOFO Section 5.1

EC1 **Relevance to Economic and National Security**

- This criterion addresses relevance of the proposal to enhancing U.S. economic or national security competitiveness and to achieving the CHIPS R&D mission and goals, as expressed in Section 1.1.1.

Reviewers will consider the extent to which the project is likely to:

1. Advance domestic semiconductor development capabilities;
2. Generate substantial economic benefits to the Nation that extend beyond the direct return to participants in the program;
3. Support the development of semiconductors necessary to the U.S. Department of Defense, other government systems, or critical infrastructure.

Concept Paper Merit Review Evaluation Criteria (EC), NOFO Section 5.1

EC2 **Overall Scientific and Technical Merit**

- This criterion addresses the quality, innovativeness, and feasibility of the proposed Concept Paper Narrative and the potential for meeting the objectives of this NOFO, as expressed in Section 1.1.3.

Reviewers will consider the extent to which:

1. The proposed activities are innovative, original, or potentially transformative;
2. The proposal demonstrates knowledge of the current state of the art in relevant fields and the feasibility of the proposed technologies to be advanced, including gaps, constraints, and significant challenges that must be addressed;
3. The plans for Project-Level Technical Targets, including any Embedded Substrate Features, represent a significant advance relative to the state of the art globally.

Concept Paper Merit Review Evaluation Criteria (EC), NOFO Section 5.1

EC3 **Project Management**

- This criterion addresses the degree to which applicants demonstrate that they have the appropriate personnel and access to required equipment and facilities

Reviewers will consider the extent to which the concept paper:

1. Identifies key staff, leadership, and technical experts with qualifications and experience appropriate to the proposed work, including prior experience and results in efforts similar in nature, purpose, or scope of proposed activities;
2. Identifies equipment and facilities required to support the project and demonstrates either access to or a clean plan to obtain access to such equipment and facilities;
3. Convincingly demonstrates existing or planned substrate manufacturing capability by the applicant and component integration and workforce capabilities by the applicant and/or other committed project participants.

Concept Paper Merit Review Evaluation Criteria (EC), NOFO Section 5.1

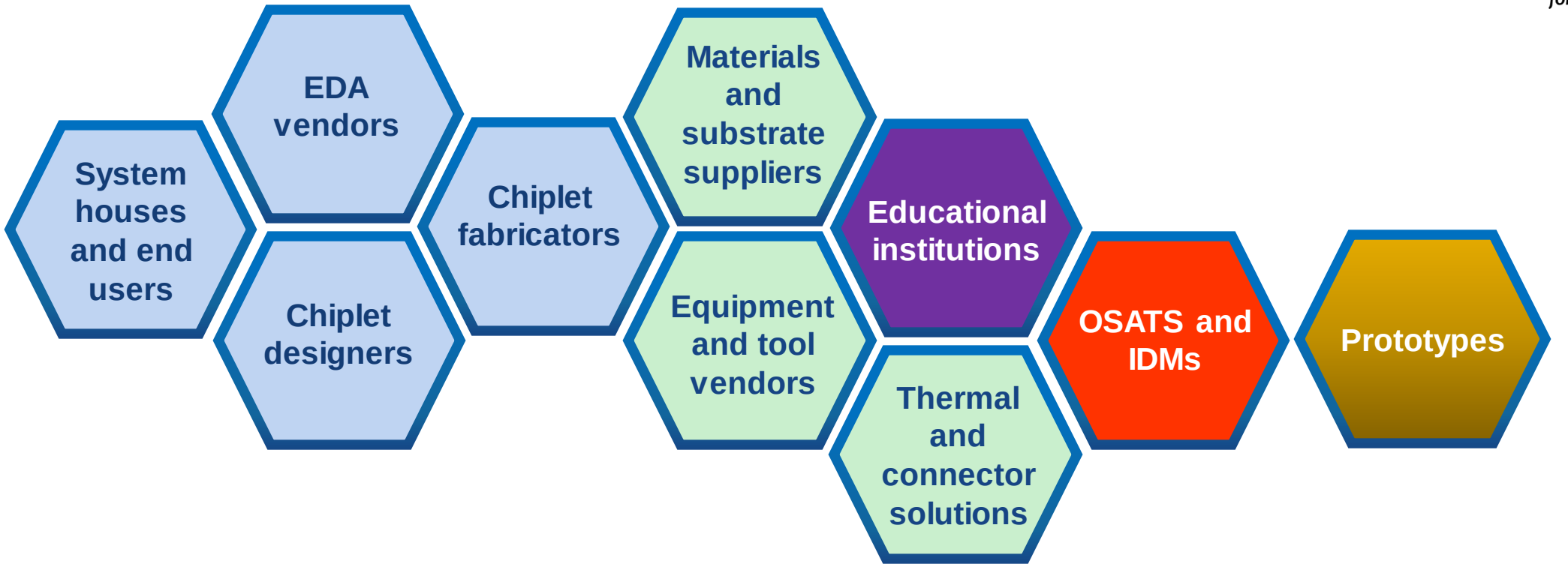
EC4 **Transition and Impact Strategy**

- This criterion addresses the project's potential for supporting the commercialization and domestic production of funded semiconductor innovations, as well as beneficial impacts to workforce development and the broader domestic research, development, and innovation ecosystem.

Reviewers will consider the extent to which the proposal provides:

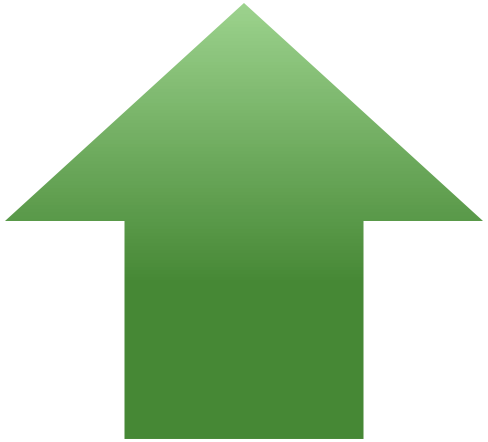
1. A reasonable approach for transitioning the proposed technology to commercial deployment;
2. Outlines an education and workforce development plan appropriate to developing a workforce relevant to domestic advanced substrate manufacturing capabilities. The evaluation may also consider the applicant's history of transitioning (or plans to transition) technologies to foreign governments or to companies that are foreign owned, controlled, or influenced.

Collaboration was an important factor



The list above is an example of the different potential members of a team. In general, concept papers with team members across the ecosystem and with clearly defined roles received higher adjectival ratings

Concept Paper Merit Review Trends

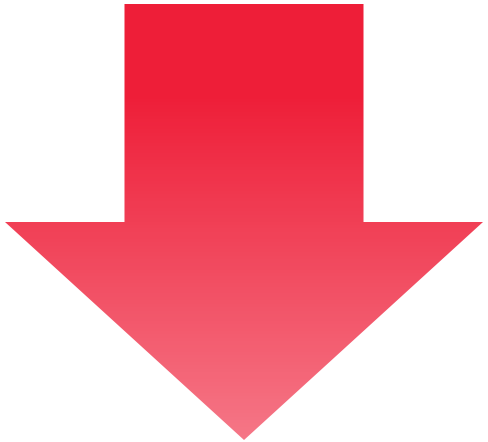


Merit Review

- Concept Paper **clearly ties to U.S. economic or national security competitiveness** with **innovative research and development** and **scaling into manufacturing**
- Concept paper **advances substrate technology targets**, **embedded features**, and **delivers additional supply chain resilience** across packaging ecosystem
- Concept paper with **clear plan and team for Education and Workforce Development (EWD)**
- Concept paper with team for **scaling to appropriate volume manufacturing within timeframe of program**

Merit Review

- **Niche or narrow-focus on** applications, equipment, business model, or commercial market
- Concept paper **was not responsive** to NAPMP goals, NOFO targets, embedded features, EWD, or scaling to manufacturing
- Concept paper team **missing key partnerships or team members** – often missing connection to appropriate volume manufacturer or EWD partner
- Concept papers **had key weaknesses or gaps in an evaluation criteria that was not addressed by the team** – supply chain gaps, unclear phased milestone path defined for a technical target, large and broad diverse team but a lack of focus on technology, innovations unclear, funding facility construction, or commercial market



Concept Paper Review Process

Concept Paper

1. **Scan for Eligibility, Prototype Capability, and Oversubscription**
2. **Merit Review**
3. **Evaluation Panel**
   - Selection factors used for final recommendations
4. **Selection Official**

Evaluation Panel

- Discuss Merit Review assessment based on knowledge of concept paper
- Provide programmatic context and discussion of concept paper.

Evaluation Panel Overview

Resources

The evaluation panel had access to the following information for deliberation:

- All concept paper materials.
- Results of the merit reviewers' evaluations, including written assessments.
- Any relevant publicly available information.
- Any clarifying information obtained from the applicants.

Tasks

Following the merit review, an evaluation panel conducted a panel review of the concept papers.

- The evaluation panel discussed each concept paper including: merit review adjectival ratings and rationale, relevance to NOFO requirements, and programmatic selection factors.
- The evaluation panel **provided a final adjectival rating and written evaluation of <u>each concept paper.</u>**
- A recommendation for invitation to submit a full application.

Evaluation Panel Selection Factors

Selection Factors

Merit Review

Results of the merit reviewers' evaluations, including technical comments, and the evaluation panel's evaluations and adjectival rankings.

Relevance to Program and Mission

Alignment with the objectives of the NOFO as well as the objectives and priorities of the NAPMP program and the mission, goals, and priorities of the CHIPS Research and Development Office, which may include considerations related to research security, domestic production, and domestic control of intellectual property.

Funding and Non-Duplication

The availability of funding.
The degree to which the proposed project duplicates other projects funded by NIST or other Federal sources.

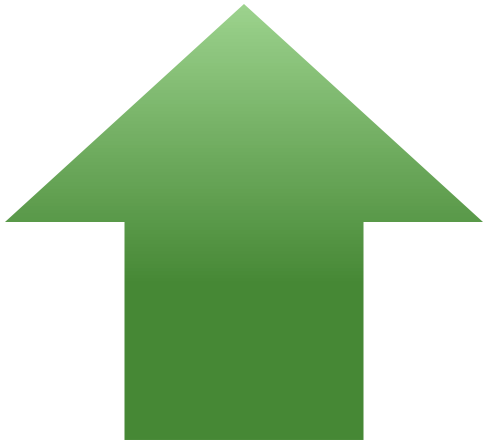
Diversity of Projects and Participants

The degree to which the proposed team and project provides for a diversity of proposed project topics, regional diversity, and institutional diversity (including small and medium enterprises, universities, non-profit research organizations, etc.) in the overall NAPMP materials and substrates projects portfolio.

Broader Impacts and Workforce Development

The potential for the proposed project to contribute to broader U.S. research, development, innovation, manufacturing, education, workforce development, environmental responsibility, and regional economic development goals — including plans for broader impact consistent with Sections 1.6.1 and 1.9 of this NOFO — in addition to any commitment to co-investment from specific, known and anticipated non-Federal sources.

Concept Paper Review Trends

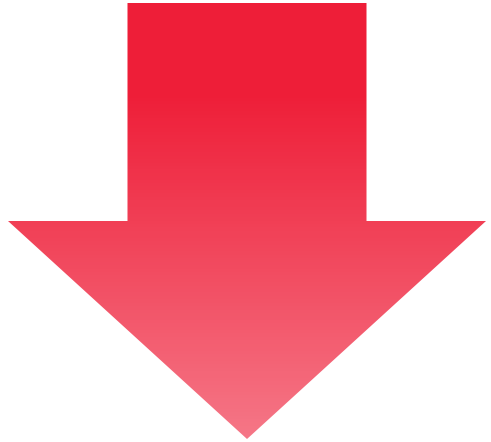


Evaluation Panel

- Concept Paper **clearly ties to U.S. economic or national security competitiveness** with **innovative research and development** and **scaling into manufacturing**
- Concept paper **advances technical area, substrate technology targets**, **embedded features**, and **delivers additional supply chain resilience** across packaging ecosystem
- Concept paper with **clear plan and a diverse, team for Education and Workforce Development (EWD)**
- Concept paper that aimed for **appropriate volume manufacturing of largest formats within timeframe of program**

Evaluation Panel

- Concept papers offered limited broader impacts, scaled current technology or products (not innovative), or included requests to build a facility.
- **Niche or narrow-focus on** application, equipment, or commercial market. Better suited to another NAPMP focus area
- Concept paper was responsive to a limited **NOFO targets or embedded features**
- Concept paper team **missing key partnerships or team members** – often connection to appropriate volume manufacturer, EWD partner, equipment supplier, or materials supplier
- Concept papers **had key weaknesses or gaps in an evaluation criteria that was not addressed by the team** – supply chain gaps, unclear phased milestone path defined for a technical target, large and broad diverse team but a lack of focus on technology, innovation, or commercial market



Concept Paper Review Process

Concept Paper

1. **Scan for Eligibility, Prototype Capability, and Oversubscription**
2. **Merit Review**
3. **Evaluation Panel**
4. **Selection Official**

Selection Official

- The Selecting Official made the final determinations regarding which concept papers to invite to submit full application

Selection of CP and Invitation to Submit

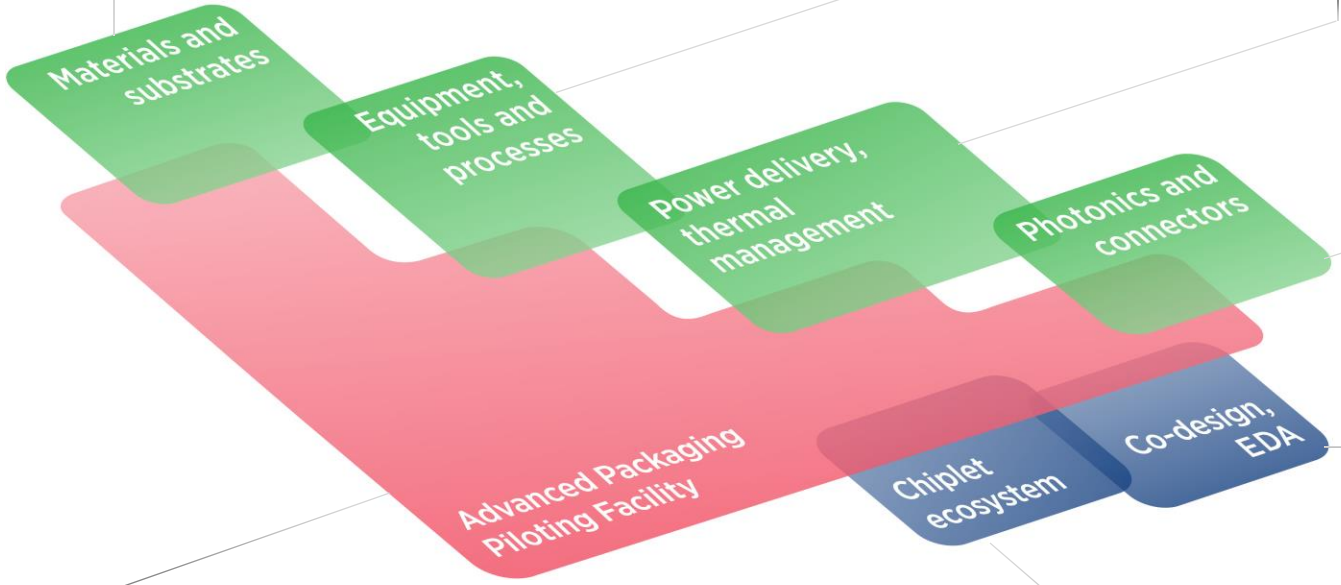
- At the conclusion of the evaluation panel, the panel chair informed the selection official.
- The Selecting Official made the final determinations regarding which concept papers to invite to submit full applications.
- The Selecting Official selected the most meritorious concept papers for invitation **based upon the adjectival ratings and one or more of the Selection Factors**.
- The decisions of the Selecting Official regarding the selection of concept papers are final and may not be appealed.

NAPMP Priority Research Investment Areas

Materials and substrates are the platform for heterogeneous integration of chiplets

Equipment, tools, and processes are needed to pattern substrates and assemble chiplets and passivate assemblies

Thermal management and efficient power delivery are critical needs



Photonics and connectors allow the assembly to interact with the outside world

Automated design for test, repair, security, and reliability; substrate and process dependent

The NAPPF provides a test bed for integration of the different investment areas and also functions as a piloting and prototyping facility

The chiplet ecosystem is crucial for any implementation of advanced packaging

NAPPF: National Advanced Packaging Piloting Facility

Other Current and Upcoming Funding Opportunities

- Visit CHIPS.gov for CHIPS R&D programs, including:
  - CHIPS National Semiconductor Technology Center (NSTC) Program
  - CHIPS National Advanced Packaging Manufacturing Program
  - CHIPS R&D Metrology Program
  - CHIPS Manufacturing USA Program
- Other programs across the administration include:
  - Tech Hubs Program
  - Small Business Innovation Research (SBIR)
  - Small Business Technology Transfer (SBTT)
  - The Microelectronics Commons

Thank You!

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