



DoD's Challenges and Approach to Expanding the National Microelectronics Ecosystem

Shaping the Future of Manufacturing Using High Performance Computing Workshop

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Dr. Dev Shenoy
Principal Director for Microelectronics
Microelectronics Commons Executive Director
OUSD (R&E) Critical Technologies

[HTTPS://WWW.CTO.MIL](https://www.cto.mil)



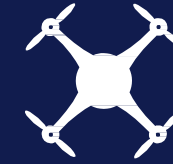
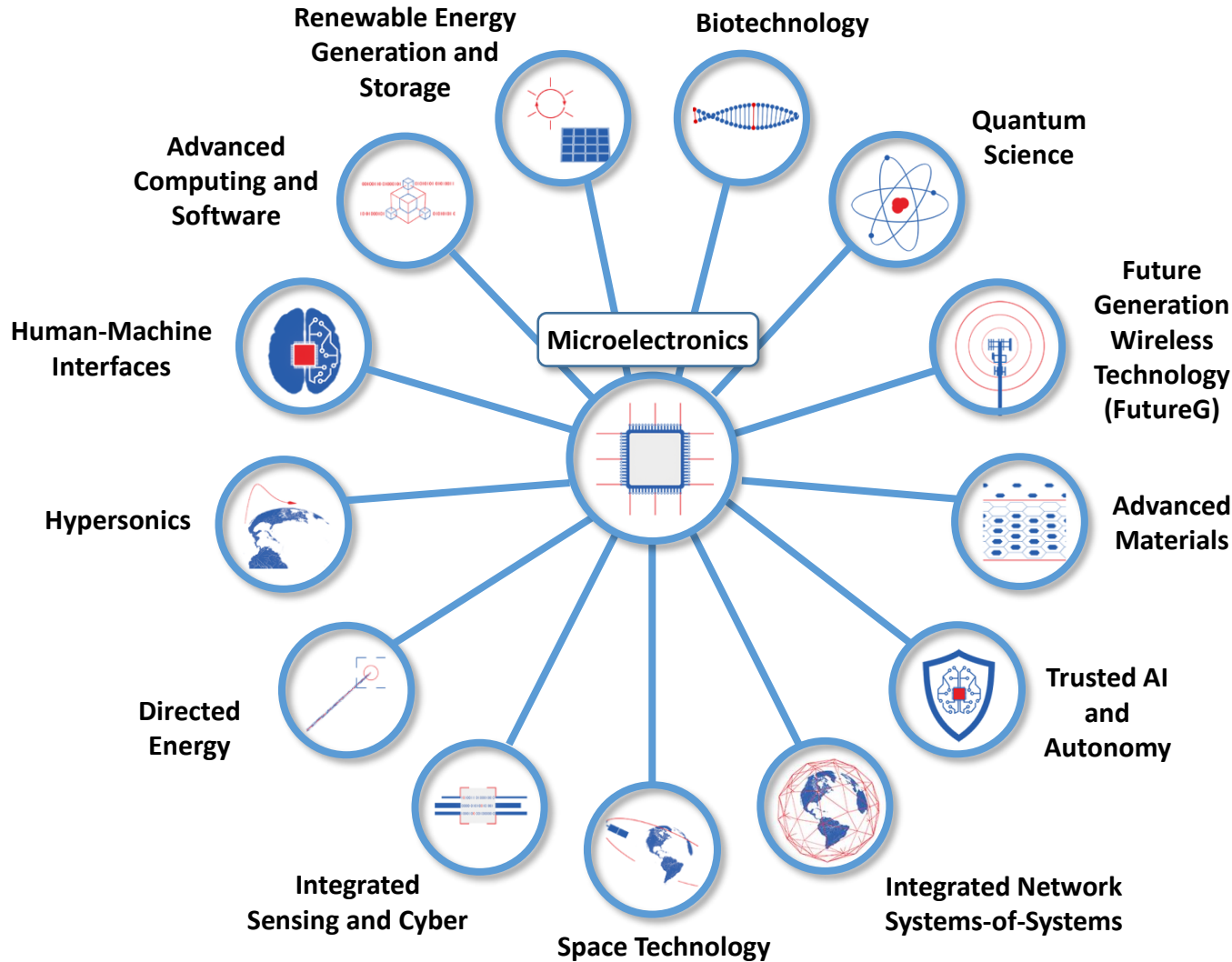
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CRITICAL TECHNOLOGY SYNERGIES: MICROELECTRONICS



Autonomous Drones



AI Chips



Self Driving Vehicles



Energy Efficiency For Edge Computing

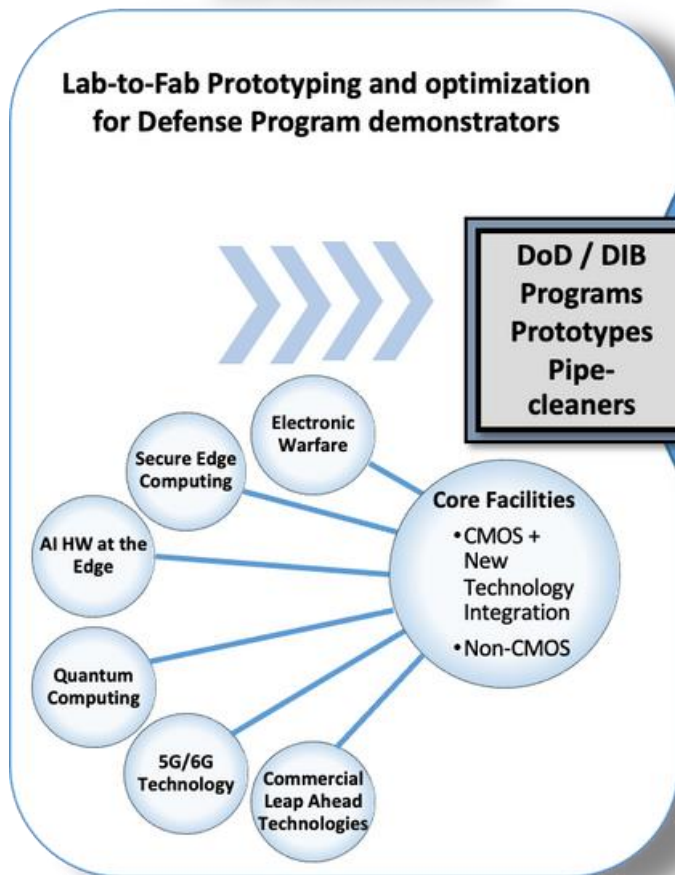


Military Applications

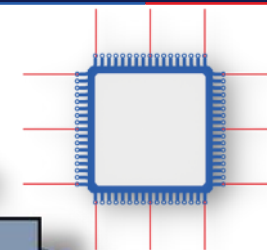
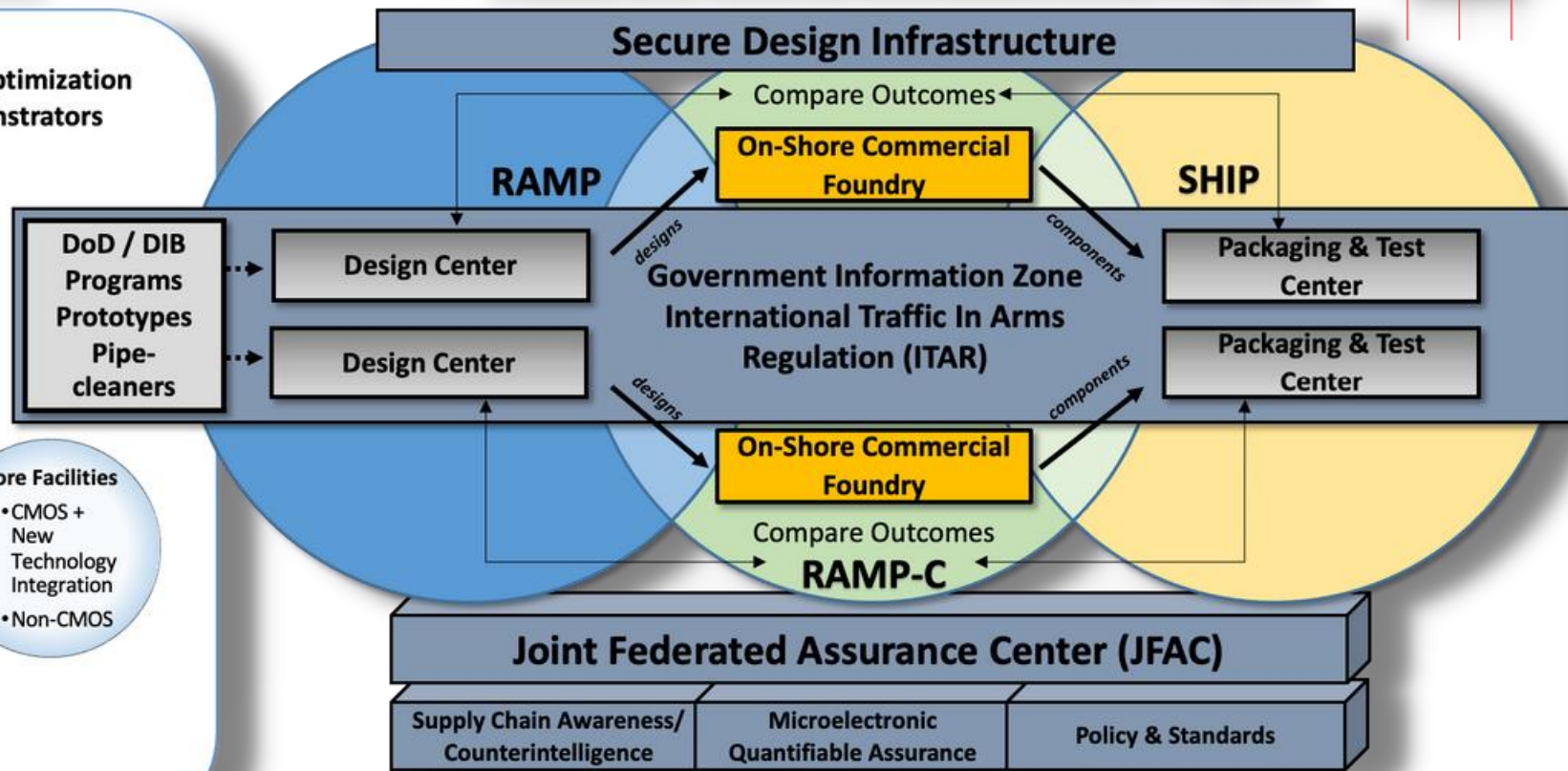


T&AM Program Enabling Access to State of the Art (SOTA)

ME COMMONS

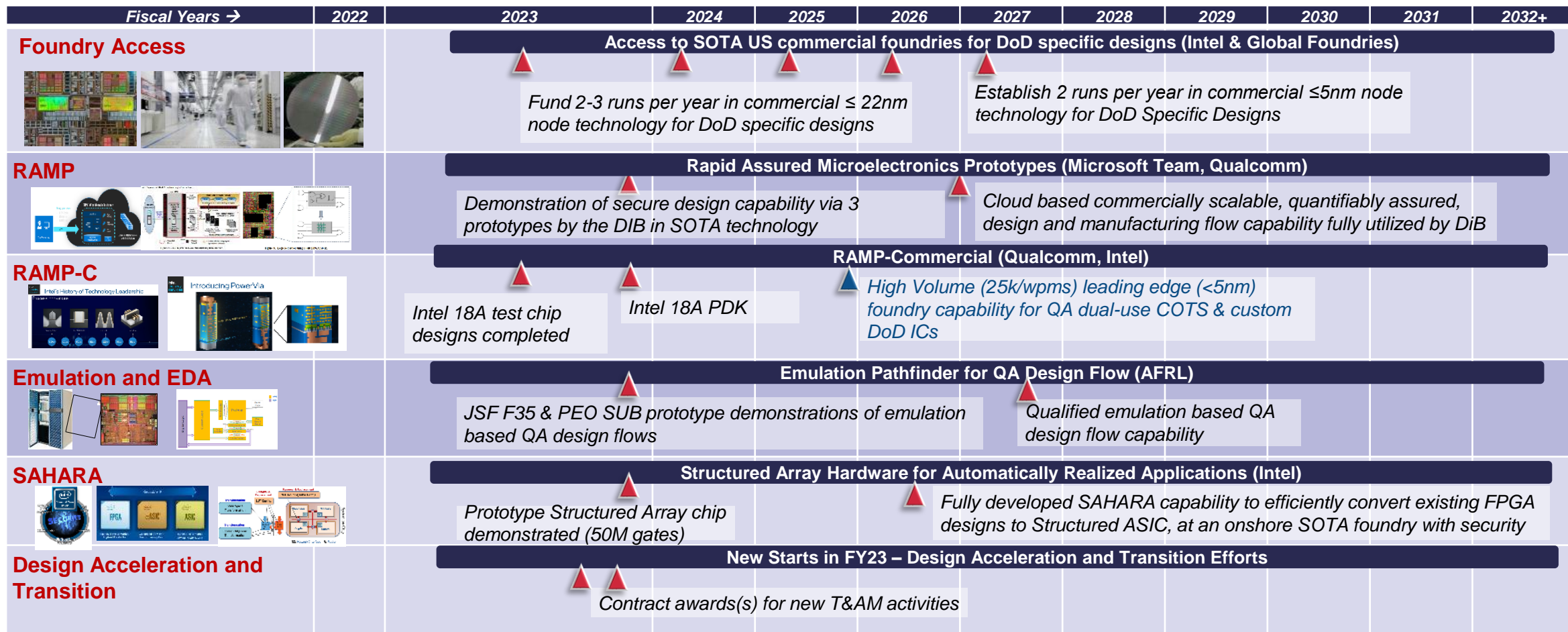


Trusted and Assured Microelectronics Program





Access to State of the Art (SOTA) Roadmap: Microelectronics



LEGEND

Enhanced Capabilities

▲ Key Milestones ▲ Unfunded Option

Major Investments to Mature the Domestic SOTA Microelectronics Ecosystem

- Future SOTA Microelectronics Needs
- Domestic access to mature SOTA materials, foundries, and packaging
 - Ecosystem alignment to DIB and POR



NorthPole Neuromorphic Architecture Advantages

➤ Conventional Von Neumann Processors

- Not capable of achieving the required SWAP parameters due to physically separate memory and computation components
- Processing efficiency limited by data exchange bottlenecks

➤ NorthPole: a Non-Von Neumann Processor

- Incorporates neuromorphic, brain-inspired revolutionary architecture with co-located computation and memory devices
- Dramatically increases SWAP efficiency

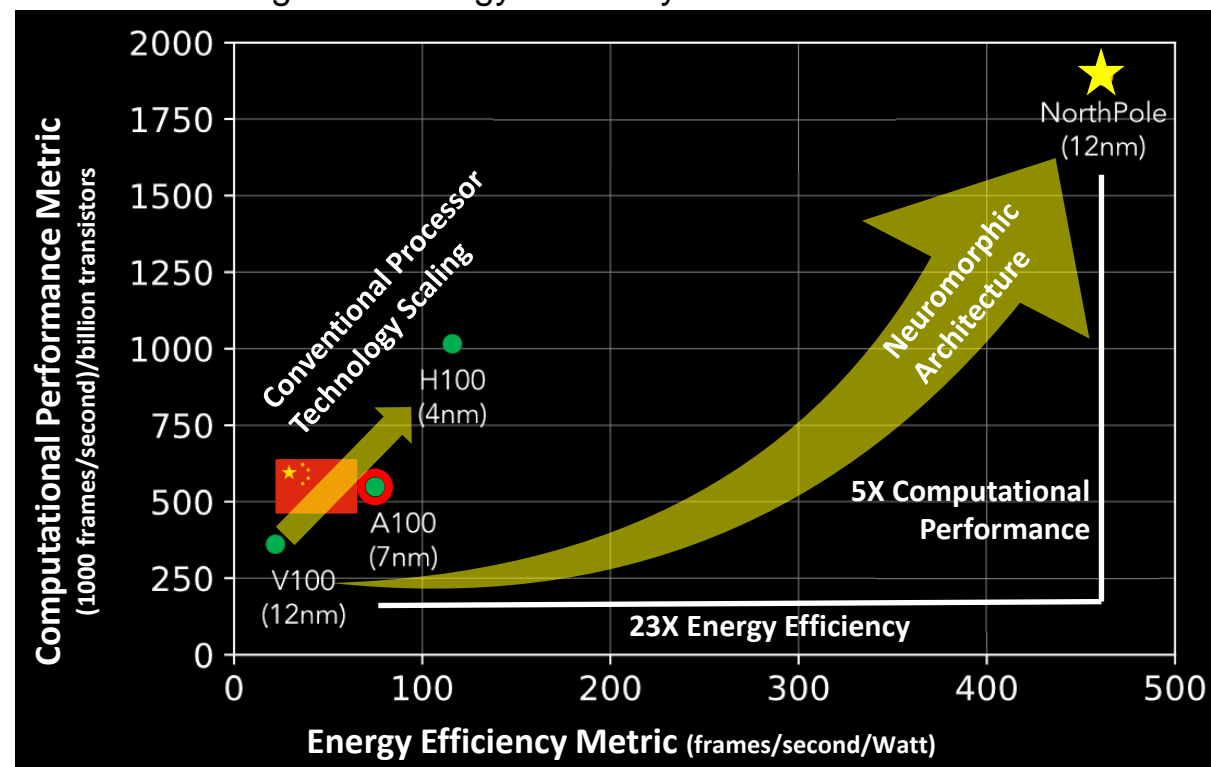
➤ DoD Systems Increasingly Require High-Performance Edge Processing for More Capable Operational Applications

- Adversaries are fully embracing this military enhancing leap ahead technology – one that we cannot afford to let go unanswered
- Commercial microelectronics components are too SWAP-limited to satisfy this need



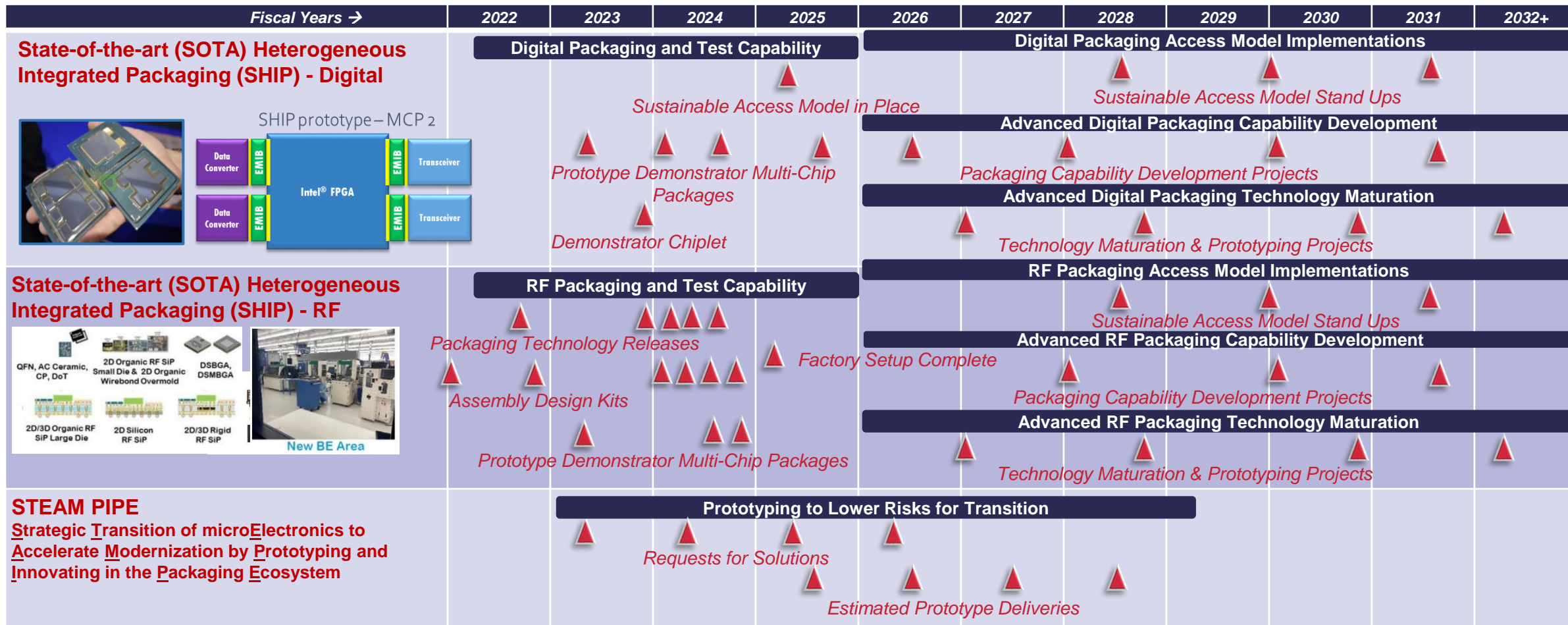
➤ NorthPole Architecture Performance Dominates Competitors

- Conventional Processors provide incremental performance gains through costly microelectronics technology scaling
- NorthPole Vastly Outperforms Conventional (V100) Processor
 - 5x greater computational performance
 - 23x greater energy efficiency





Access to Advanced Packaging Roadmap: Microelectronics



LEGEND

Enhanced Capabilities

Key Milestones

Sustained access to domestic SOTA advanced packaging for DoD system modernization

- Future Advanced Packaging Needs
- A self-sustaining model for DoD and the DIB to procure cutting edge microelectronics in a high mix – low volume environment.

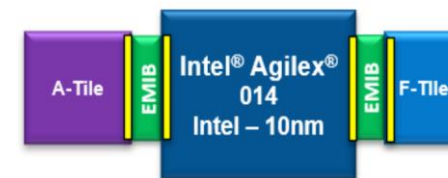


Heterogeneous Integration (HI) and SWAP Benefits

Why HI?

- Modular approach vs. Monolithic approach
- Not every logic function (IP) needs to be designed in the same process node (HI)
- Leveraging IP in the form of chipllets
- Current industry trend has led to chipllets on silicon interposers
- Includes latest IC packaging 2.5D, 3D, FOWLP technologies
- Optimize nodes required for ideal performance and cost

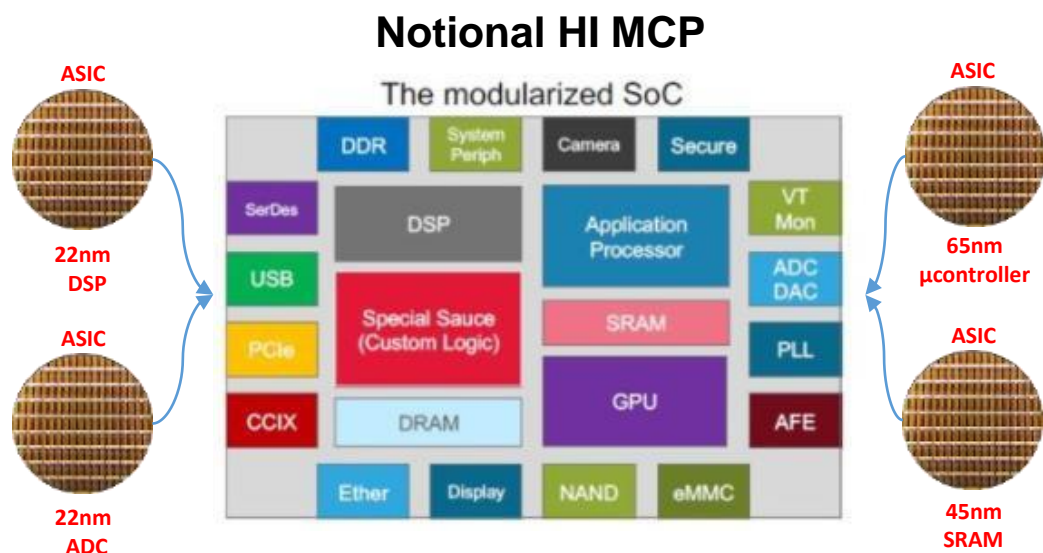
SHIP is leveraging commercial HI solutions to improve SWAP savings and system performance



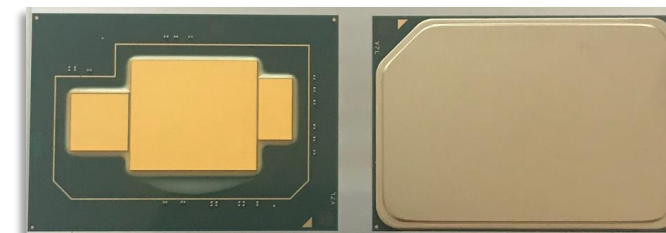
Expected SWAP Savings:
8x relative to current solution

Through HI enabled SWAP savings, MCP-1 will deliver:

- ✓ Unprecedented spectral agility
- ✓ Enhanced signal processing
- ✓ Lower power consumption
- ✓ Improved thermal management



SHIP-D functional parts have been delivered to lead DIB partner to prove SWAP benefits



MCP-1 consisting of two chiplets integrated with an FPGA

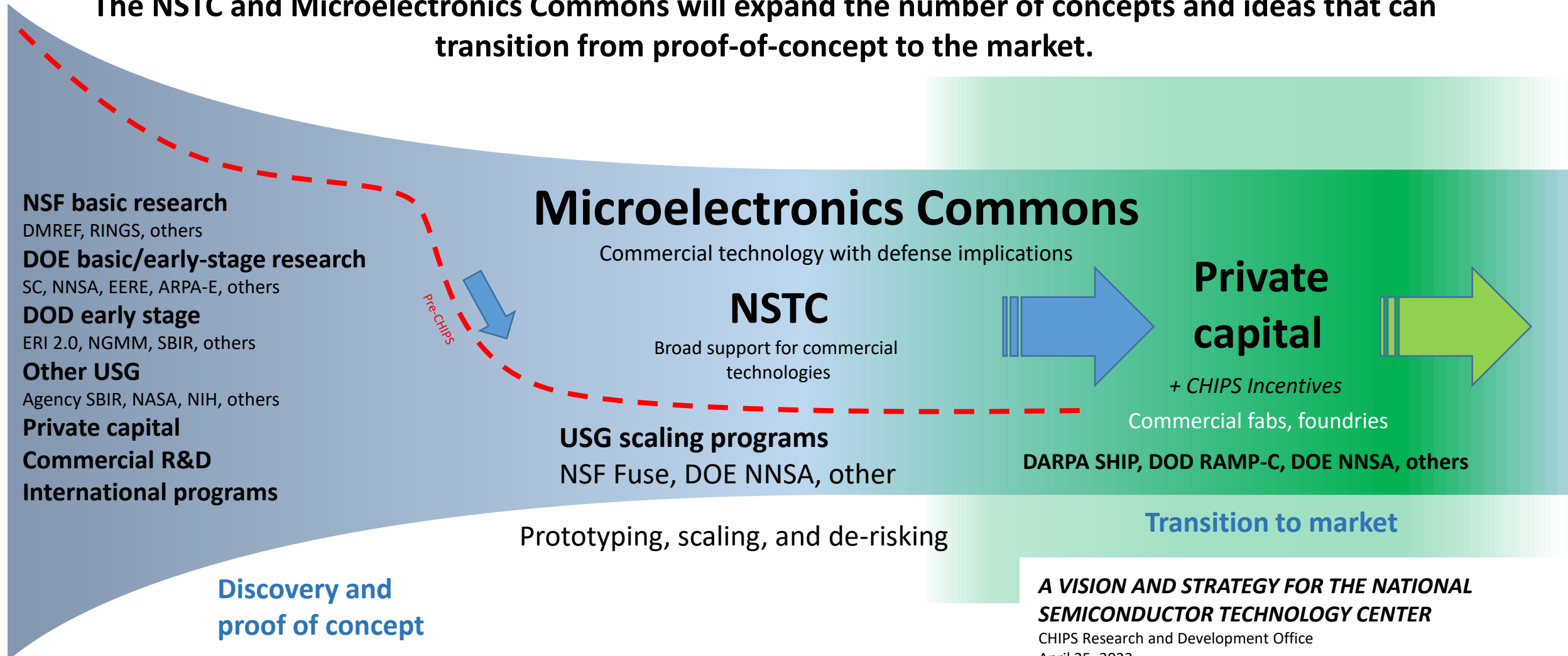
MCP-1 finished package



CHIPS Offers a Whole of Government Approach

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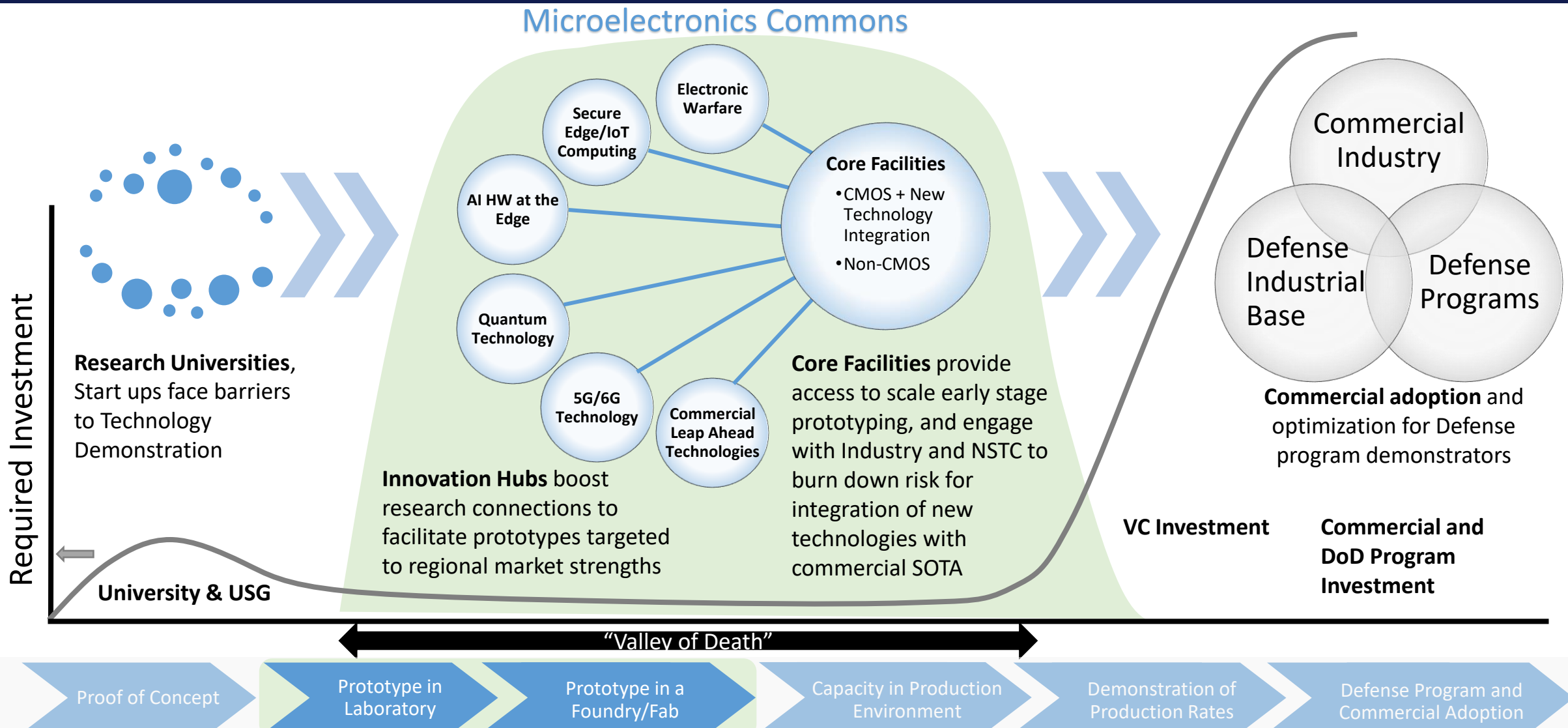
The NSTC and Microelectronics Commons will expand the number of concepts and ideas that can transition from proof-of-concept to the market.





Microelectronics Commons Addresses the Valley of Death

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Microelectronics Commons Accomplishments

<https://microelectronicscommons.org>



Establishment of Microelectronics Commons Program

(U) Microelectronics Commons Request for Solution (RFS)

- The Microelectronics Commons RFS was released on November 30, 2022. Solutions were received and the RFS was closed on February 28, 2023
- Source Selection Determination Completed

(U) Industry Days and Upcoming Commons Meeting

- Industry Days were successfully conducted on December 7 - 8, 2022. The event saw both senior leadership and significant interagency participation. There were **more than 900 participants in attendance** at this hybrid event held at the Ronald Reagan Building and International Trade Center in Washington, D.C.
- The **Inaugural Microelectronics Commons Meeting** is being held on 17-18 October 2023 in Washington, DC

The Microelectronics Commons is Now a Reality

(U) The Deputy Secretary of Defense announced 8 Hub Award Winners on 20 September 2023

- Arizona State University led Southwest Advanced Prototyping or SWAP Hub – \$39.8 million
- Midwest Microelectronics Consortium (MMEC) Hub – \$24.3 million
- North Carolina State University led Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Hub – \$39.4 million
- The Applied Research Institute led Silicon Crossroads Microelectronics Commons Hub – \$32.9 million
- Stanford University led California-Pacific-Northwest AI Hardware or Northwest AI Hub – \$15.3 million
- The Massachusetts Technology Collaborative led Northeast Microelectronics Coalition Hub – \$19.7 million
- The State University of New York led Northeast Regional Defense Technology or NORDTECH Hub – \$40 million
- The University of Southern California led California Defense Ready Electronics and Microdevices Superhub (DREAMS) Hub – \$26.9 million



Progression from Concept to Capabilities

OUSD (R&E)'S MICROELECTRONICS PROGRAMS ARE ALIGNED TO DEVELOP AND DELIVER NEW DEFENSE CAPABILITIES.

Microelectronics Commons

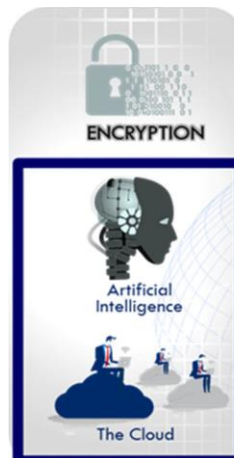
- Electronic Warfare
- Secure Edge/IoT Computing
- AI HW at the Edge
- Quantum Technology
- 5G/6G Technology
- Commercial Leap Ahead Technologies

Technology Maturation

- RAMP
- RAMP-C
- SHIP
- T&AM Prototypes

Application Platforms

- Aircraft
- Submarines
- Ships
- Space Systems
- Ground Systems
- Missile Defense
- C4ISR



POSITIONING, NAVIGATION, AND TIMING



Lab-to-fab prototyping bridges valley of death from laboratory research to foundry/fab prototyping