Semiconductor Research Corporation

JUMP 2.0 Overview

Dr. Todd Younkin
SRC, President and CEO
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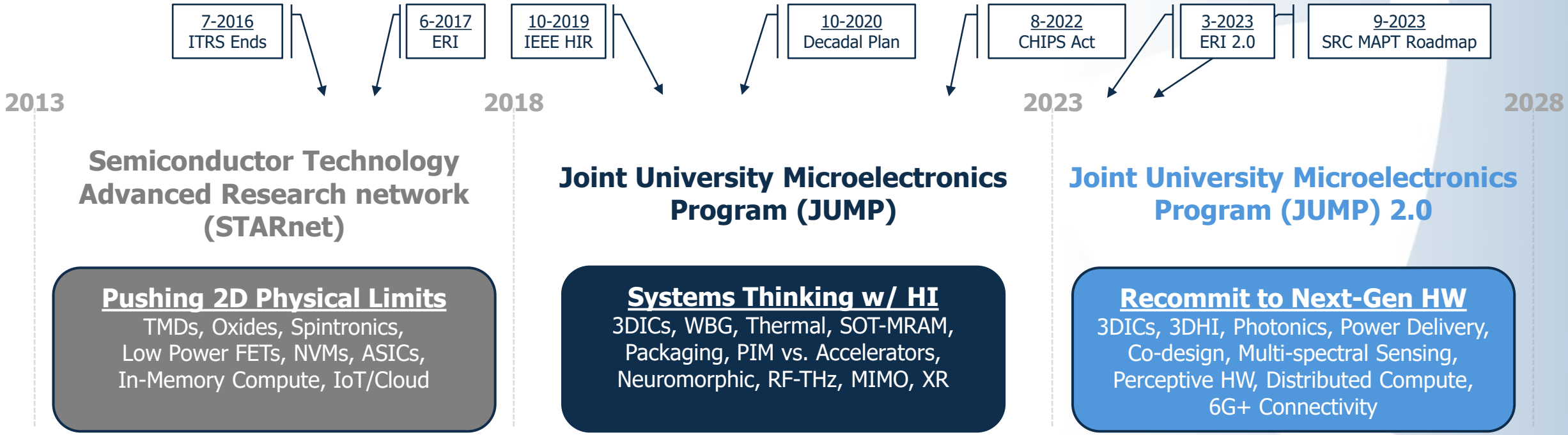
Mission
Driving Semiconductor Innovation

Vision
Neutral, Trusted, and Science-Driven

Values
Prosperity, People, and the Planet

Foundational Microelectronics Research that Benefits both Economic and National Security



2013 2018 2023 2028

Semiconductor Technology Advanced Research network (STARnet)

Pushing 2D Physical Limits

6	Research Centers
51	Universities
223	Faculty
1218	Students
157	Liaisons
6808	Publications
180	Patent Applications
90	Patents Issued

$202M

Joint University Microelectronics Program (JUMP)

Systems Thinking w/ HI

6	Research Centers
35	Universities
163	Faculty
1593	Students
542	Liaisons
6224	Publications*
122	Patent Applications*
20	Patents Issued*

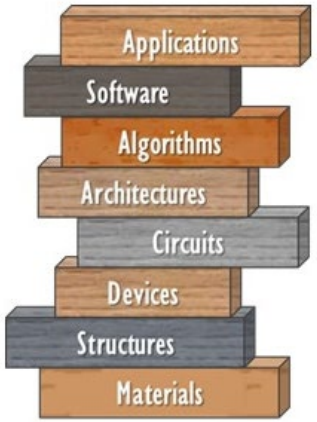
$208M

*To date

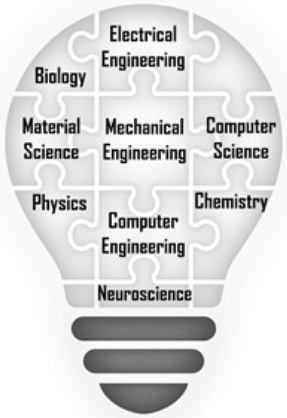
Systems Thinking w/ HI in an Academic Setting?

Holistic Optimal Solutions

Driven by Hardware/Software Co-Optimization

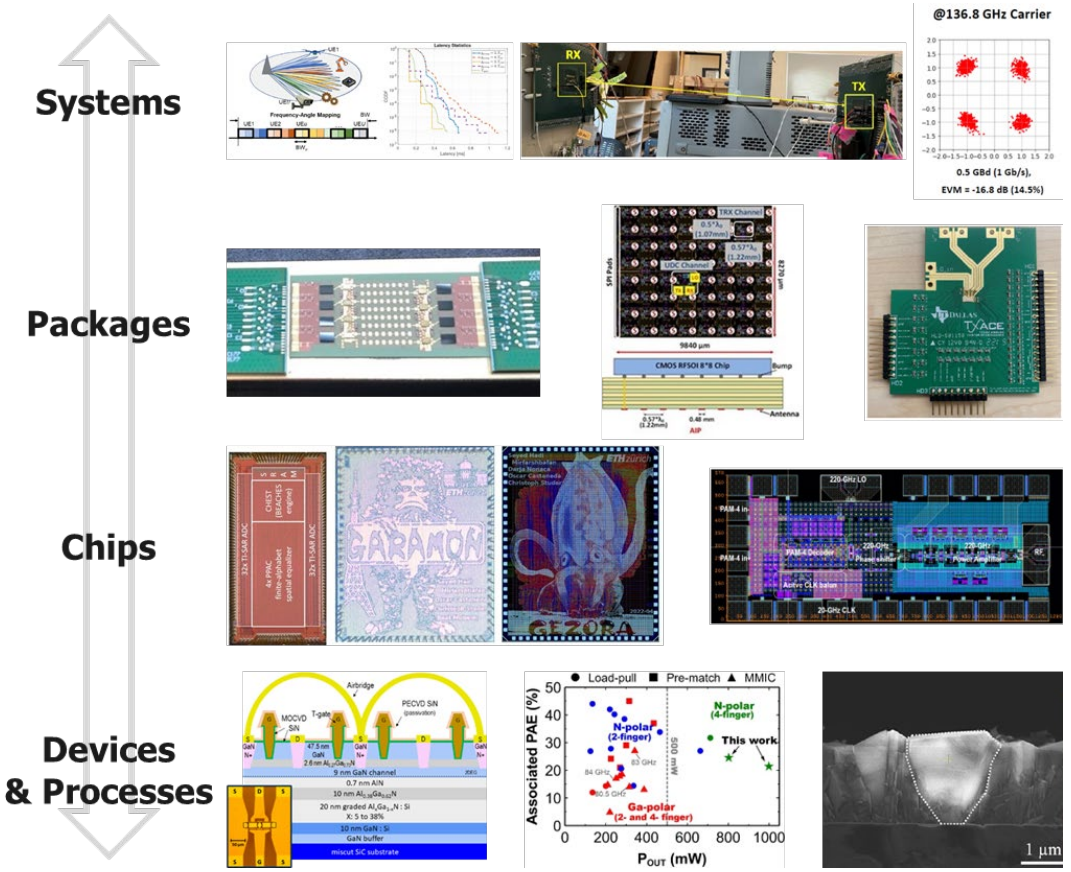


Interlocked Multidisciplinary Research



2030 Decadal Plan for Semiconductors

https://www.src.org/about/decadal-plan/

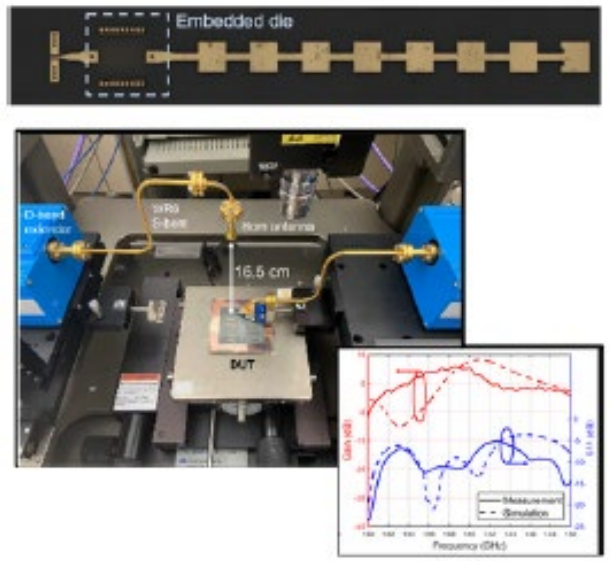


JUMP's ComSenTer

Wireless systems providing extremely high aggregate data transmission capacities

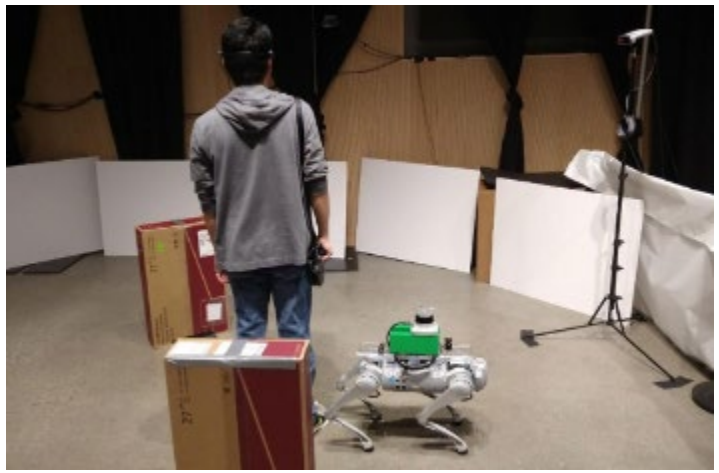
Examples of Additional JUMP Highlights

ASCENT: Worlds 1st Embedded Die with D-Band Integrated Antenna in a Glass Interposer Transferred DoD's SHIP program



www.src.org/newsroom/newsletter/srcconnectionsfeb2023.pdf

CONIX: XR Telepresence Platform Technology Enabled an Immersive Multi-user Video Conference



http://eepurl.com/isSLvI

CRISP: JUMP and Intel Labs Success Story: UCSD Professor Leads HD Computing Research Efforts

https://community.intel.com/t5/Blogs/Tech-Innovation/Artificial-Intelligence-AI/JUMP-and-Intel-Labs-Success-Story-UCSD-Professor-Leads-HD/post/1503321

2013 2018 2023 2028

Semiconductor Technology Advanced Research network (STARnet)

3DSoC
CHIPS
CRAFT
DREaM
FRANC
HIVE
L2M
M3IC
SSITH

https://www.src.org/program/starnet/

Joint University Microelectronics Program (JUMP)

DPRIVE
DSSOC
HyDDENN
IDEA
PAPPA
POSH
T-MUSIC
DARPA-Sponsored Special Projects…

https://www.src.org/program/jump/

Joint University Microelectronics Program (JUMP) 2.0

??
…

https://www.src.org/program/jump2/

Long-range Innovation That Drives New DARPA Programs

The JUMP Community Thanks You, DARPA!

Dev Palmer

Tim Hancock

Tom Rondeau

John Davies

Ali Keshavarzi

Serge Leef

Jason Woo

Y.K. Chen

Jay Lewis

Hava Siegelmann

Andreas Olofsson

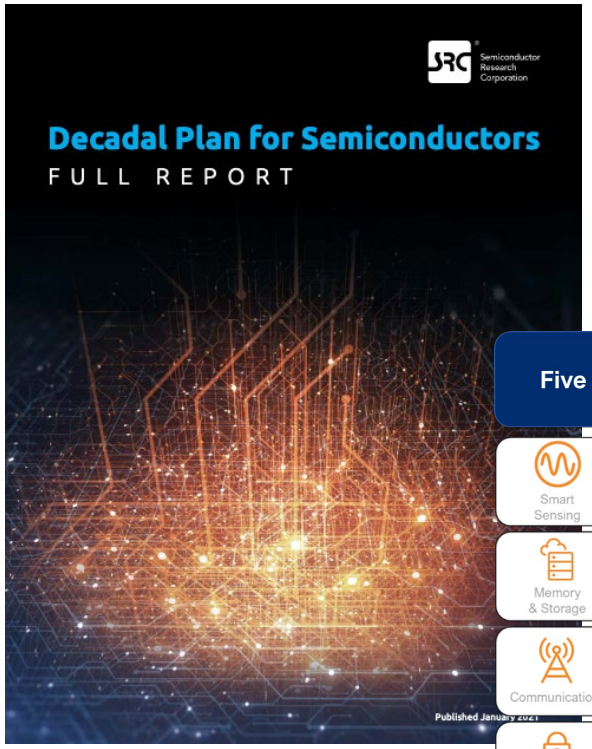
Linton Salmon

SRC's NEW Challenge Coins

Leaders

Learners

SRC's 2030 Decadal Plan for Semiconductors

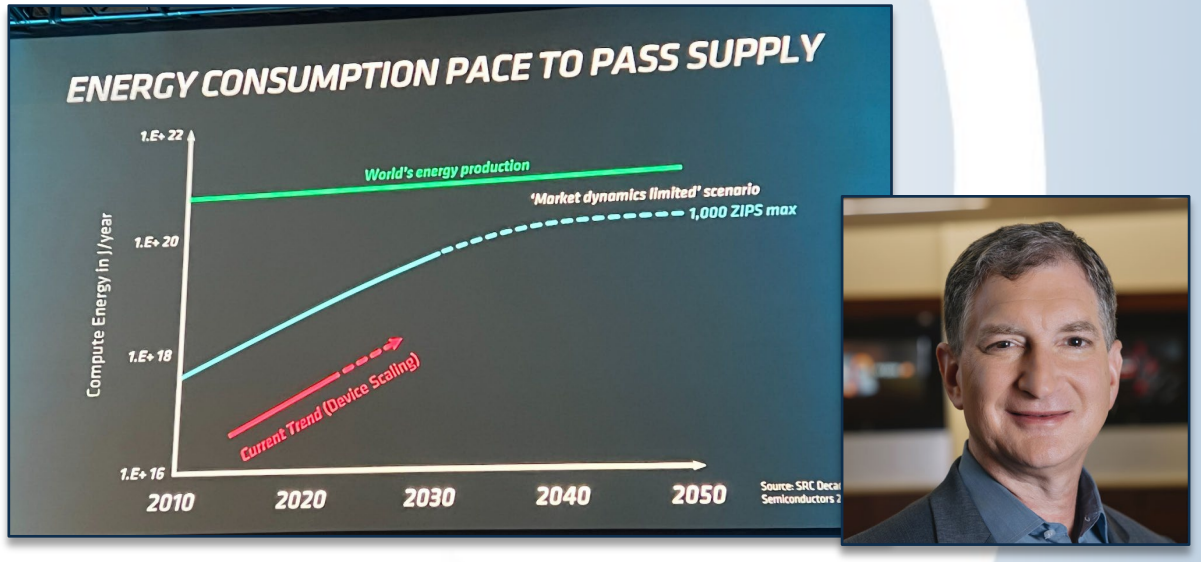


Five "Seismic Shift" Research Priorities

- Smart Sensing — **The Analog Data Deluge**
- Memory & Storage — **The Growth of Memory and Storage Demands**
- Communication — **Communication Capacity vs. Data Generation**
- Security — **ICT Security Challenges**
- Energy Efficiency — **Compute Energy vs. Global Energy Production**

https://www.src.org/about/decadal-plan/

https://www.nextplatform.com/2022/01/04/the-five-horsemen-of-the-data-apocalypse/



Mark Papermaster, AMD CTO

Semi Engineering - What Future Processors Will Look Like

"SRC has done a great job with their Decadal Plan to highlight this issue ....of course it's not just the energy used, it's the impact on Planet Earth."

2013 2018 2023 2028

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Joint University Microelectronics Program (JUMP) 2.0

Recommit to Next-Gen HW

7	Research Centers
42	Universities ↑
141	Faculty ↓
603	Students ↓*
251	Liaisons ↓
179	Publications*
11	Patent Applications*
0	Patents Issued*

$245M

*To date

JUMP 2.0 – Selected Centers & Directors

	#	Theme	Center's Full Name	Acronym	Prime University
System Centers	1	Cognition	Center for the Co-Design of Cognitive Systems	**COCOSYS**	Georgia Tech
	2	Communications and Connectivity	Center for Ubiquitous Connectivity	**CUbiC**	Columbia
	3	Intelligent Sensing to Action	Center on Cognitive Multispectral Sensors	**CogniSense**	Georgia Tech
	4	Systems and Architectures for Distributed Compute	Evolvable Computing for Next Generation Distributed Computer Systems	**ACE**	UIUC
Technology Centers	5	Intelligent Memory and Storage	Center for PRocessing with Intelligent Storage and Memory	**PRISM**	UCSD
	6	Advanced Monolithic and Heterogeneous Integration	Center for Heterogeneous Integration of Micro Electronic Systems	**CHIMES**	Penn State
	7	High-Performance Energy-Efficient Devices for Digital and Analog Applications	SUPeRior Energy-efficient Materials and dEvices	**SUPREME**	Cornell

Arijit Raychowdhury
GaTech

Saibal Mukhopadhyay
GaTech

Tajana Rosing
UC/San Diego

Huili (Grace) Xing
Cornell

Keren Bergman
Columbia

Josep Torrellas
UIUC

Madhavan Swaminathan
Penn State

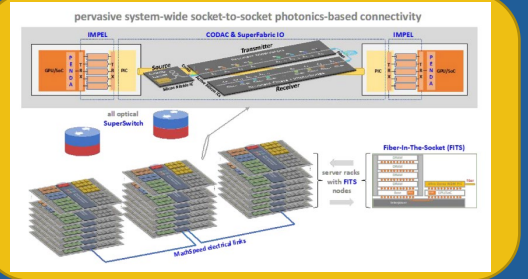
JUMP 2.0 Center Goals – System Centers

Grand Challenges

COCOSYS

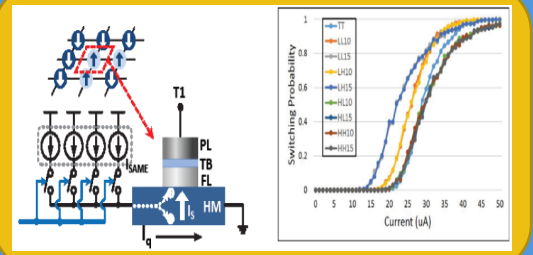
- Secure, robust, and seamless human-AI collaboration
- Synthesize neural, symbolic, and probabilistic approaches for efficient, robust, and explainable algorithms
- Co-design heterogeneous systems that bridge current accelerators to future cognitive architectures
- Leverage CMOS and emerging tech for cognitive hardware

CUbiC



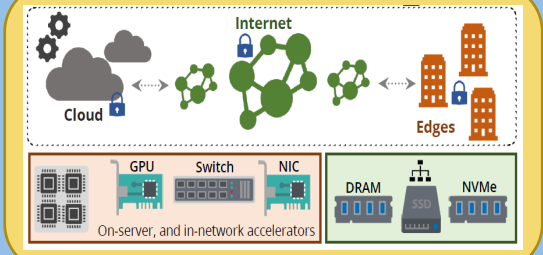
- Close computation-communication gap with vast reduction in global system energy consumption
- Grand Challenge: Robust, scalable edge-to-cloud wireless with >10 Tbps with sub-pJ/bit efficiencies
- While enhancing bandwidth densities by >100X over capacity-constrained channels

CogniSense



- Power and data-efficient wideband sensing arrays
- Eliminate obstructions of machine perception and address analog 'data deluge'
- Create adaptive front-end
- Reduce digital data generated by dynamically adapting the power and perception quality in a multi-spectral sensor
- Design CogniSense sensor with a compact form factor

ACE

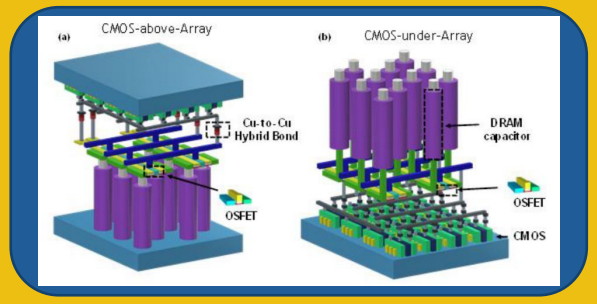


- Devise scalable computing technologies for improved performance and energy efficiency of diverse applications by 100x over 2030 compute systems
- Evolvable computing framework with accelerators, memory, and communication stack plus security mechanics
- Designed for extensibility and composability

JUMP 2.0 Center Goals – Technology Centers

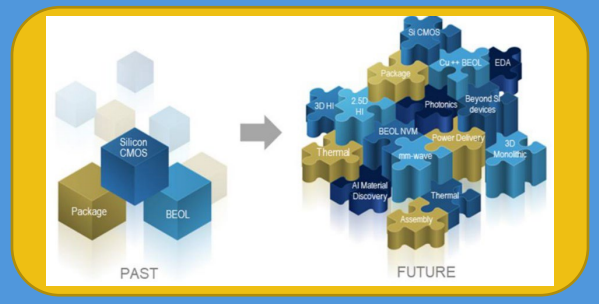
Benchmarking

PRISM



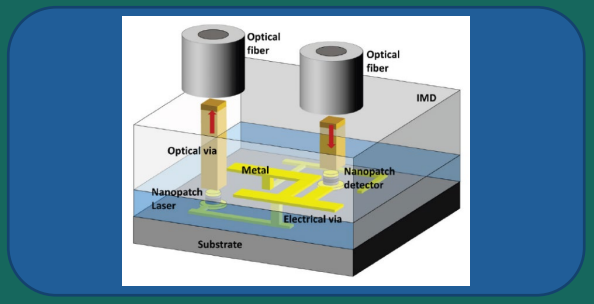
- Intelligent Memory & Storage (IMS)
- Showcasing (1) Personalized & Secure Drug Discovery, (2) Deep Insights
- Software layer adapts to existing framework for compatibility and distributes work throughout system for max performance and efficiency; security, reliability, & availability
- Will develop a novel compute engine in 3D V-NAND to accelerate ultra-large-scale AI models and data-intensive workloads

CHIMES



- HI nearing monolithic integration
- Reconfigurable photonic connectivity with 100x enhancement vs SOTA
- Generalized framework for materials synthesis and implementation
- Power delivery solutions at 50 kW and >80% efficiency
- Thermal management for dense electronic, photonic, and sub-THz that achieves >1kW/cm2 heat flux
- Fully-integrated design automation
- Portability and scalability of components across diverse platforms

SUPREME



- Develop new materials, technologies and devices for 10–100x system-level performance improvement
- Accelerate the pace of discovery and lab-to-fab transition in microelectronics using physics-guided down-selection of computational materials discovery then prototyped into devices at SOTA 8" fabs at MIT and Cornell
- Seeks close collaboration with the systems-level JUMP 2.0 centers to develop prototype devices based on the new materials and technologies from SUPREME

DARPA PM Mentors Will Engage JUMP 2.0 Centers

Attend yearly center reviews and caucus discussions
Interact with center researchers and industry liaisons
Identify breakthrough ideas to seed new DARPA programs

COCOSYS

John Davies
EW/Adv. Processing

CUbiC

James Wilson
Integration

CogniSense

Thomas Ehrenreich
Directed Energy

ACE

Lok Yan
Hardware Emulation

PRISM

Matt Wilding
Software Engineering

CHIMES

Todd Bauer
MEMS/Rad-Hard

SUPREME

Jason Woo
CMOS/Processing

JUMP 2.0 PM

Dev Palmer
MTO Deputy Director

PM	DARPA Web Bio
John Davies	https://www.darpa.mil/staff/mr-john-davies
James Wilson	https://www.darpa.mil/staff/dr-james-wilson
Thomas Ehrenreich	https://www.darpa.mil/staff/dr-thomas-ehrenreich
Lok Yan	https://www.darpa.mil/staff/dr-lok-yan

PM	DARPA Web Bio
Matt Wilding (I2O)	https://www.darpa.mil/staff/dr-matthew-wilding
Todd Bauer	https://www.darpa.mil/staff/dr-todd-bauer
Jason Woo	https://www.darpa.mil/staff/dr-jason-woo
Dev Palmer	**https://www.darpa.mil/staff/dr-dev-palmer**

SRC's Broadening Participation Pledge

https://www.src.org/about/broadening-participation/

2030 Broadening Participation Pledge

"Throughout the decade, as SRC defines, selects, and manages its research and education programs, we will look to grow our student base, establish a balanced mix of bachelors, masters, and Ph.D.-level initiatives, and create a more diverse and inclusive community."

Each JUMP 2.0 Center has:

- Proposed Center commitments
- A public Center pledge
- Committed Center BP champion(s)
- The support of SRC, DARPA, and Industry

Increase the Participation of US Citizens in Adv. Degrees

Workforce Development: NSF REU* Collaboration

*Research Experiences for Undergraduates

- Must be US citizens or permanent residents
- Enrolled in four-year colleges or community colleges
- Women and underrepresented minorities are strongly encouraged
- Veterans of the U.S. Armed Services are strongly encouraged

https://www.nsf.gov/news/news_summ.jsp?cntn_id=307335

A 5-year, $9.9M MOU between SRC and NSF will provide **24 cohorts** mapped to the 7 JUMP 2.0 technology themes. Expected to fund **>600 students**.

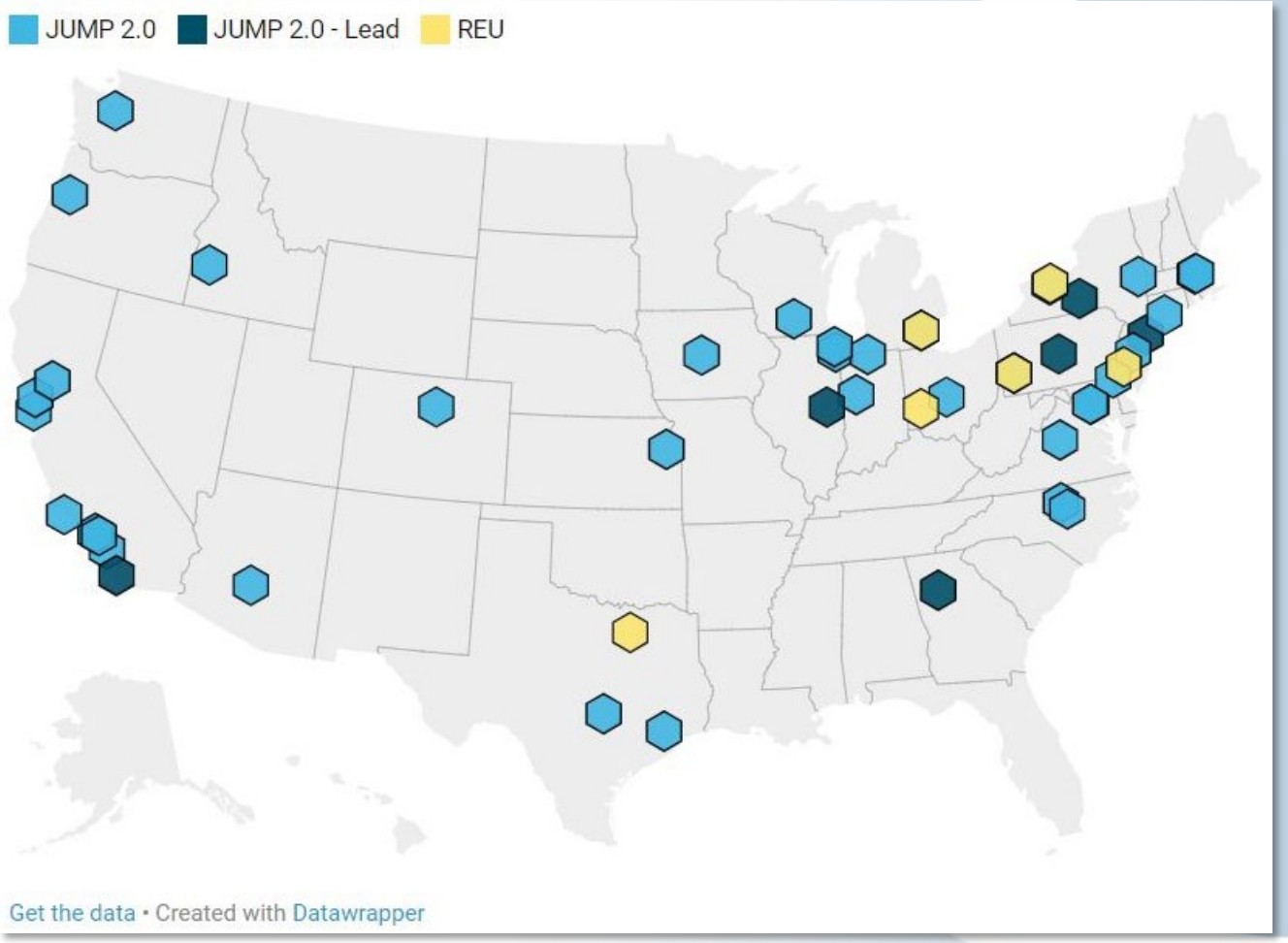
Six cohorts selected in the first round (2023):
UT/Dallas, CMU, U/Rochester, Penn, U/Dayton, U/Michigan

Summary

- SRC is committed to the advancement of semiconductor technologies and technologists
- We serve the U.S. and like-minded nations

- Thanks to DARPA, JUMP 2.0 is a national innovation network driving fundamental microelectronics research. It looks beyond the CHIPS + Science Act
- Our strong partnership with DARPA delivers results

- NSF, SRC, and its member companies have partnered to support the REU program, moving undergraduates into advanced degrees in semiconductor manufacturing
- With more U.S. citizens, our REU will be beneficial to our DIB partners or critical technologies.



An Unprecedented Time for Semiconductor R&D and WFD!

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Adam Knapp
JUMP 2.0 Program Manager
Adam.Knapp@src.org

Tameka Bell
JUMP 2.0 Program Coordinator
Tameka.Bell@src.org